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Book of Abstracts

Prince Sultan Bin Abdulaziz International Prize for Water

Recognizing Innovation

Winners for the 10th Award (2022)

Creativity Prize

Creativity Prize

1) The team led by Thalappil Pradeep (Indian Institute of Technology, Madras, India)
for the creation and successful deployment of environmentally friendly "water positive" nanoscale materials for the affordable, sustainable and rapid removal of arsenic from drinking water. Team members include Avula Anil Kumar, Chennu Sudhakar, Sritama Mukherjee, Anshup, and Mohan Udhaya Sankar.


Dr. Thalappil Pradeep

2) The team led by Dionysios D. Dionysiou (University of Cincinnati, USA)
for the development of innovative advanced oxidation technologies and nanotechnologies for environmental applications, particularly in the removal and monitoring of emerging contaminants. Team members include Wael H.M. Abdelraheem, Abdulaziz Al-Anazi, Jiong Gao, Ying Huang, and Vasileia Vogiazi.


Dr. Dionysios D. Dionysiou

Surface Water Prize

Surface Water Prize

Dennis D. Baldocchi (University of California Berkeley, USA)
for the development and implementation of effective models to understand, evaluate and predict evapotranspiration and water-use efficiency in various environments under climate change conditions.


Dr. Dennis D. Baldocchi

Groundwater Prize

Groundwater Prize

Linda M. Abriola (Brown University, USA)
for pioneering research on toxic Dense Non-Aqueous Phase Liquids (DNAPLs) in groundwater, ranging from the simulation of their fate to effective methods for cleaning contaminated sites.


Dr. Linda M. Abriola

Alternative Water Resources Prize

Alternative Water Resources Prize

The team of Menachem Elimelech (Yale University, USA) and Chinedum Osuji (University of Pennsylvania, USA)
for wide-ranging advances in nanostructured materials for next-generation water purification, focusing on implementation issues like manufacturing, sustainability, self-assembly, and biofouling.


Dr. Menachem Elimelech


Dr. Chinedum Osuji

Water Management and Protection Prize

Water Management & Protection Prize

The team led by Matthew McCabe (KAUST, Thuwal, Saudi Arabia)
for employing CubeSat constellations in the sustainable management and security of linked water-food systems, along with estimates of agricultural water use at unprecedented spatial and temporal resolutions and with global coverage. Team members include Bruno Aragon (KAUST) and Rasmus Houborg (Planet Labs, USA).


Dr. Matthew McCabe

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PART A – ORAL PRESENTATIONS

SESSION 2 - WATER AND WASTEWATER TREATMENT AND REUSE

Thursday 31 August – morning

An easy numerical evaluation of the DM growth in Self-Forming Dynamic Membrane Bioreactors (SFD MBR) for Wastewater Treatment

Castrogiovanni F. [1], Salerno C. [1,*], Berardi G. [1], Tumolo M. [1], Pollice A. 1

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ABSTRACT

In the last years, self-forming dynamic membranes (SFD MBR) revealed as one of the most innovative technological solutions for wastewater treatment. In these systems, filtration takes place through a cake layer (Dynamic Membrane, DM) supported by a 10-200 µm filter mesh.

Filtration efficiency may decrease when the DM becomes too thick or its composition changes, and this can be measured under constant flux through the increase of TMP (TransMembrane Pressure).

In this study, three different DM maintenance strategies have been adopted to limit the loss of performance caused by excessive cake layer growth. A 4h filtration cycle was applied ending with a filtration break of 11' with different mesh cleaning strategies. The cake growth on the support mesh was analyzed evaluating the TMP increase rate. TMP peaks in the range 20-200 mbar were observed during the 4h filtration cycles. These data were interpreted with second order interpolations and linear trends.

Here, the slopes of the trend lines are used to evaluate the performance of the different DM maintenance strategies considered. These lines provide a simplified representation of the speed at which the pressure of 200 mbar is reached, once the DM thickness starts to increase (lower TMP instability threshold of 20 mbar). These slopes allow to estimate cake layer accumulation: the lower the slope value, the longer the time to reach the critical TMP value.

KEYWORDS: SFD MBR; wastewater treatment; cake layer; TMP increase rate

PAPER ID: cest2023_00522

One-stage and multistage anoxic/oxic systems based on continuous plug-flow anammox process for mature landfill leachate treatment

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ABSTRACT

As a promising biotechnology, the anammox process has been increasingly investigated for landfill leachate treatment. However, its application has been limited by the long generation time of anammox bacteria (AnAOB) and insufficient nitrite supply in actual projects. To overcome these obstacles, this study innovatively established one-stage and multistage anoxic/oxic systems (S1 and S2) based on the continuous plug-flow anammox process to treat mature landfill leachate. Ultra-efficient nitrogen removal was achieved through the partial nitrification coupled anammox (PNA) and the partial denitrification coupled anammox (PDA) pathways. Over 97.0% of nitrogen was removed from the leachate (1800-2000 mg NH4+-N/L). Stable isotope tracing tests demonstrated that 89.8%-92.4% and 90.3%-95.0% of the nitrogen loss were contributed by the anammox pathway in S1 and S2, respectively. 16S rRNA sequencing revealed that the oxic zone, especially the oxic biofilm was the hotspot for AnAOB enrichment. Candidatus_Kuenenia with higher nitrite affinity and stronger tolerance to free ammonia (FA) and salinity stress outcompeted Candidatus_Brocadia and became the dominant anammox genus. Multiple bacteria capable of hydrolysis and acidogenesis were enriched under the in-situ FA anoxic treatment, facilitating complex organic matters degradation and volatile fatty acids production, which could be used as the carbon source during the PDA process.

KEYWORDS: Anammox; Continuous plug-flow system; Combined process; In-situ free ammonia treatment; Landfill leachate

PAPER ID: cest2023_00385

Retention potential of contaminants by (nano)magnetite in batch and microfluidic systems

Papaslioti, E.M.[1,2]*, Tabuteau H.[3], Vantelon D.[4], Le Bouteiller P.[5], Greneche J.M.[6], Fernández-Martínez A.[1], Charlet, L.[1]

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ABSTRACT

(Nano)magnetite (Fe_3O_4) has been suggested to be a significant reductant for contaminants due to its great adsorption capacity and ability to retain metals on its high specific surface. Its use has become an emerging technology for the treatment of contaminated land and water with a great potential to become an effective and low-cost alternative to conventional remediation techniques. We have taken advantage of a concept of the circular economy, exploiting an existing waste from the steel industry that HYMAG'IN company has transformed into magnetite, to study the immobilisation of As, Sb, and U in batch sorption systems and provide new insights into a new 'green' route for the decontamination of water. Moreover, given that polymeric coatings can maximize the adsorption capacity, we additionally, mimic those systems in a micro-scale format via the use of bionanocomposite and microfluidics to study time-dependent Sb reduction by nanomagnetite aggregates. Synchrotron X-ray Absorption Spectroscopy (XAS) is applied for the first time to such experimental systems to shed light into the role of nanomagnetite aggregates into the immobilization of Sb, as a novel remediation strategy.

KEYWORDS: (Nano)magnetite; Redox sensitive contaminants; Microfluidics; Polymer aggregates; Remediation technique

PAPER ID: cest2023_00035

Concomitant phosphorus and nitrogen removal from agro-industrial wastewater through Partial Nitritation/Anammox process

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ABSTRACT

Sustainable phosphorus (P) management is crucial for safeguarding global food security and preventing soil and water bodies' quality deterioration. Recently, the Anammox process was proven to be feasible for P recovery as hydroxyapatite from urban wastewater (1). This work firstly assessed the feasibility of P recovery by treating supernatant from agro-waste anaerobic digestion. Such wastewater was characterized by ammonium nitrogen (N) and P content of 743±17 mgNH4+-N/L and 29±1 mgPO42--P/L, respectively, and a Ca/P molar ratio of 1.64±0.09. The Partial Nitritation/Anammox (PN/A) process was operated according to a single-stage configuration in a 2L sequencing batch reactor (SBR). The bioreactor was inoculated by ANAMMOX© granulated biocatalyst, and run with 6-hour working cycles (i.e., 4 cycles per day). The process temperature was controlled at 35ºC, and the dissolved oxygen concentration was maintained below 0.2 mgO2/L to preserve anammox from oxygen inhibition. The Nitrogen Loading Rate (NLR) was increased throughout the experimental period from 0.20 to 0.33 kgN/m3·d by lengthening the feeding phase, taking into account the nitrite and ammonium accumulation. Moreover, a set of experiments was performed to pave the way for a novel non-damaging separation protocol to recover active biomass and mineral P from the sludge. Granules sampled from the bioreactor were exposed to 37 kHz sonication frequency for different periods (i.e., 60, 30, 15 min) and the effect of ultrasonication on biomass was investigated by measuring the Specific Anammox Activity (SAA) through the manometric method (2). As a result of the increasing NLR strategy, biomass showed significant growth and SAA improvement during the 6 months of the bioreactor operation. Mixed Liquor Volatile Suspended Solids (MLVSS) increased from 4.80 up to 6.77 g/L, while SAA's final value was 0.39 gN2/gMLVSS·d. In the absence of an external calcium source, simultaneous nutrient removal consisting of ammonium conversion rate up to 0.28 kgNH4+-N/m3·d and P removal efficiency of ca. 34% were achieved. As P concentration started lowering in the bulk liquid, the MLVSS to Mixed Liquor Suspended Solids (MLSS) ratio decreased over time from 95% reaching a final value of 75%. This reduction is suggesting probable precipitation of inorganic compounds inside the granules. The resulting Ca/P ratio in the liquid phase varied from 1.47 to 1.61. Thus, Amorphous Calcium Phosphate (ACP) and/or Tricalcium Phosphate (TCP) have been identified as possible deriving precipitates since their constituent molar ratio (1.5) falls within the Ca/P range. Regarding the ultrasonication tests, the SAA resulted in being negatively affected when extending the treatment duration. Nevertheless, after 15 min of granules sonication, the SAA showed a limited reduction, up to 15%, compared with untreated granules collected from the bioreactor. In conclusion, the PN/A was confirmed to be a promising process to achieve a sustainable and simultaneous removal of ammonium nitrogen and phosphorous from digested agro-industrial wastewater. Higher P removal may be achieved by increasing the Ca/P ratio with an external calcium source. Moreover, this work represents a first attempt for unveiling an efficient and non-damaging biomass-to-mineral separation. Re-inoculating microorganisms to the bioreactor would be a key driver for evaluating the effective P recovery potential, and eventually for considering the future scaling up of the technique.

KEYWORDS: agro-industrial wastewater, anammox, circular economy, phosphorus recovery.

PAPER ID: cest2023_00091

LCA of wastewater treatment plant for energy valorization of primary solids

Papamıchael I.[1*], Tsangas M.[1], Economou F.[1], Bandı D.[2], Samaras P.[2], Zorpas A.A.[1]

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ABSTRACT

Throughout history, wastewater management and treatment have been critical sectors of society and civilization. The last century's rising urbanization and industrialization increased the volume of municipal wastewater generation globally, and by 2050, 62% of the global population is predicted to reside in cities (Voukkali and Zorpas, 2022). The global wastewater treatment industry is anticipated to reach 490 billion USD by 2029, up from 281 billion USD in 2021 (Statista, 2022). In recent years, efforts to enhance wastewater treatment plant performance have evolved from generating acceptable effluent to assuring sustainability and economic viability. The current work aims to determine the environmental footprint of an activated sludge process that includes appropriate measures for the energy valorization of primary solids received from raw wastewater, as well as the additional benefits expected by implementing these measures in comparison to a conventional system. Towards that objective, the assessment of the environmental impact was carried out by utilizing the Life Cycle Assessment (LCA) approach.

Throughout the life cycle of a product, service or entire set of processes, from raw materials to production, use, end-of-life treatment, recycling, and final disposal (i.e., cradle-to-grave), LCA is a standard procedure that addresses the environmental aspects and potential environmental impacts of processes or services (i.e. use of resources, carbon footprint, eutrophication etc.). Over the past thirty years, it has rapidly advanced from a basic energy analysis to a full life cycle impact assessment, life cycle costing, and social-LCA, and most recently to a more thorough life cycle sustainability analysis, which broadens the scope of the conventional environmental evaluation (Dimitra C Banti et al., 2020; Tsangas et al., 2020). It is directly applicable to the creation and enhancement of products, strategic planning, the assessment of environmental performance, the formulation of public policy, and other activities. LCA has been used in the past for the improvement of the environmental performance of specific production processes and services (Dimitra C Banti et al., 2020; Hashemi et al., 2022; Litskas et al., 2022), the monitoring and assessment of CO2 emissions (Iannone, R.; Miranda, S.; Riemma, S.; De Marco, 2016), the estimation of the impact of climate change on wastewater treatment as well as strategic development planning in different sectors of interest (Dimitra C. Banti et al., 2020; Christoforou et al., 2016).

Therefore, LCA was used for the representative system of an activated sludge unit, including pretreatment and primary treatment stages consisting in coarse screens and grit removal, secondary treatment involving an aeration tank followed by sedimentation, while anaerobic digestion is applied for the stabilization of excess sludge. The main environmental impact categories chosen for analysis for the three scenarios employed were the eutrophication potential (EP) (kg PO4-eq_FU−1), the acidification potential (AP) (kg SO2-eq_FU−1), the global warming potential (GWP) (kg CO2-eq_FU-1) over a 100 years period, the ozone depletion potential (ODP) (kg CFC-11-eq_FU−1) and the photochemical ozone creation potential (POCP) (kg C2H4-eq_FU−1).

KEYWORDS: Wastewater Treatment, Activated Sludge, Lca, Impact Assessment, Environmental Impact Evaluation

PAPER ID: cest2023_00412

Development of pH-Responsive Adsorptive Ultrafiltration Membrane for the treatment of Heavy Metals from Aqueous Solution

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ABSTRACT

This research presents a new amino-modified activated carbon (MAC) nanohybrid and its use in polylactic acid (PLA) ultrafiltration (UF) membranes for treating wastewater. The MAC composite was produced through three steps: activated carbon pretreatment, modification, and heat-induced cross-linking. The composite membranes were made using the phase inversion technique and optimized by varying the concentration of the MAC nanohybrid. The synthesis was confirmed through several methods, and the membranes were characterized using different techniques, such as SEM, surface zeta potential, water flux, and pore-size/porosity. Static adsorption and dynamic filtration experiments were conducted to investigate the membrane's flux-rejection performance and pH-responsiveness. The results showed that the MAC nanohybrid significantly improved the properties of the PLA membrane, such as increasing the pure water flux and enhancing heavy metal ions rejection, among others. The composite membranes also exhibited improved adsorption and desorption behavior. The study suggests that adding the MAC nanohybrid has promising potential for these composite membranes in the wastewater treatment industry.

KEYWORDS: pH responsive, heavy metals, MXene, graphene oxide, two-dimensional materials

PAPER ID: cest2023_00096

SESSION 3 - RECYCLING OF MATERIALS TO NEW PRODUCTS

Thursday 31 August – morning

Degradation assessment of high-density polyethylene (HDPE) debris after long exposure to marine conditions

Lourmpas N.[1,*], Efthimiadou E.[2], Fillipidis A.[3], Papanikos P.[4], Lekkas D.[5], And Alexopoulos N.D.[1]

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ABSTRACT

In the present investigation, the degradation of high-density polyethylene (HDPE) in marine environments, under ultraviolet (UV) radiation and saltwater conditions, was examined. HDPE debris were collected from the coastal areas nearby Korinthos, encompassing a wide range of exposure durations, from relatively intact to several decades of exposure in the marine environment. The debris were examined via several microstructural examinations and additionally tensile specimens were extracted to evaluate the weathering effects on the mechanical properties. The experimental test results revealed a significant decrease in the mechanical properties that ranged according to the estimated exposure of the debris to the environmental exposure. The debris were classified into three different groups, based on the decrease of their mechanical properties, to be used for recycling. This high-end discrimination of the induced damage to the material properties will probably allow for the appropriate recycling of such debris without essential decrease in the mechanical properties, as currently a small portion of the damaged debris are being used during recycling of such materials.

KEYWORDS: High-density polyethylene; Marine environment; Degradation rate; Natural weathering

ACKNOWLEDGEMENTS

This research has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, for the implementation of Action 5 with Code 5045851 and title Center for Sustainable and Circular Bioeconomy [Aegean_BIOECONOMY] within the framework of Call with Code 111 (A/A OPS NSPA 3525) and title "Support of Regional Excellence".

PAPER ID: cest2023_00248

Chemical properties of plant-based biochar to be used as soil fertiliser in Galicia (NW Spain)

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ABSTRACT

The excessive use of chemical fertilisers can cause soil acidification, depletion of soil quality, and biodiversity loss. Alternatively, biochar can improve crop productivity due to its ability to bind macronutrients and micronutrients and also adsorb various contaminants. However, the properties of the biochar depend among other factors on the material used to produce the biochar and the pyrolysis process. This study aims to evaluate the total nitrogen concentration of different types of biochar produced from forest plants to be used as fertiliser and amendment in acidic soils of Galicia (NW Spain). In this experiment, the biochar was produced from different tree fractions (branches, dry leaves, green leaves) of six tree species (Pinus radiata D. Don, Pinus sylvestris L., Pinus pinaster Aiton, Betula alba L., Quercus robur L., Castanea sativa Mill.) under different pyrolysis times (30, 60 and 120 minutes) at a temperature of 300°C. The results obtained showed that Betula alba L. and Pinus sylvestris L. increased the total nitrogen concentration in the biochar, independently of the tree faction. The same result was observed for Quercus robur L. when the branches and green leaves were used to produce biochar. Moreover, a pyrolysis time of 60 minutes increased the total nitrogen in the biochar, mainly in the case of Pinus radiata D. Don and Pinus pinaster Aiton. Therefore, the biochar produced from these tree species and fractions with a pyrolysis time of 60 minutes could be used as amendment and fertiliser in the Galician soils.

KEYWORDS: conifers, broadleaves, soil amendment, pyrolysis, forest trees waste

PAPER ID: cest2023_00329

Coffee ground biosorbent for nitrite and nitrate recovery and soil nutrient

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ABSTRACT

Nitrate (NO3-) and nitrite (NO2-) are two forms of nitrogen that contribute to the occurrence of eutrophication if found in excess concentrations. Conversely, nitrogen is one of the major macronutrients required for healthy plant growth. The purpose of this work is to evaluate the recovery of NO3- and NO2- from aquaculture wastewater (AW) by adsorption using coffee grounds (CG) as a biosorbent. The influence of carbonization temperatures (200 – 700 °C) was studied. The result postulates that CG carbonized at 200 °C was the most effective in NO3- and NO2- recovery from AW, having more than 80 and 70 %, respectively. The potential of the spent CG for soil conditioning was also investigated by evaluating the germination index (GI). The findings showed that spent CG from AW resulted in high GI with 105.6 % after 72 h of incubation. CG biosorbent is a potential sorbent to recover nitrate and nitrite from wastewater. The spent or nitrate and nitrite recovered biosorbent can be reutilized as soil nutrient.

KEYWORDS: Coffee grounds, Biosorbent, Nitrate, Nitrite, Recovery, Aquaculture wastewater, Plant growth

ACKNOWLEDGEMENT

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PAPER ID: cest2023_00456

Towards sustainable plastics recycling: assessing the integrity status of polypropylene (PP) debris to recycle marine-degraded materials

Lourmpas N.[1], Kyriakakhs E.[2], Efthimiadou E.[3], Papanikos P.[4], Lekkas D.[5], And Alexopoulos N.[1*]

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ABSTRACT

Polypropylene (PP) is a widely used polymer with significant environmental implications when improperly disposed. Effective recycling strategies for PP are crucial for mitigating plastic pollution and achieving sustainability goals. This investigation focuses on classifying PP debris based on their integrity status using, microscopy, Fourier Transform Infrared (FTIR) spectroscopy, and tensile testing. The debris are classified based on the above analyses in three different groups, based on the induced damage due to environmental exposure. In the present work, the classified PP debris samples are then blended with virgin PP to produce recycled specimens, aiming to enhance their properties and their overall quality. The recycled specimens undergo further evaluation through the same mechanical, chemical and morphological analysis. This assessment helps identify the integrity status group(s) with desirable properties and determines the optimal percentage of virgin PP incorporation. The research findings contribute to the development of sustainable and cost-effective recycled PP specimens, promoting circularity in PP plastics.

KEYWORDS: Marine pollution; Plastic debris; Polypropylene; Injection moulding; Recycling

ACKNOWLEDGEMENTS

This research has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, for the implementation of Action 5 with Code 5045851 and title Center for Sustainable and Circular Bioeconomy [Aegean_BIOECONOMY] within the framework of Call with Code 111 (A/A OPS NSPA 3525) and title "Support of Regional Excellence".

The authors acknowledge the help of "OZON" Non-Governmental Organization by providing the plastic debris to support the present investigation.

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EPS waste management from coastal cleaning actions: identification of contamination sources, collection, treatment, and re-use in cement-based materials

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ABSTRACT

Finding sustainable solutions to reduce plastic waste in response to today's global environmental challenges is a high priority for the scientific community. Collaboration among many scientists with diverse research interests is the key to success for integrated proposals for the collection, treatment, and reuse of recyclable waste. This study presents proposals for integrated EPS waste management, from identifying pollution hotspots to collection routes, especially on the coast where waste is more abundant and leaves a larger footprint, to reuse in cement-based materials. This paper discusses the various options for recycling low-grade EPS and the potential applications of mortar or concrete containing EPS collected on the coast. The multiple benefits are not limited to reducing EPS waste, but benefit the entire planet, from reducing aggregate consumption to improving building insulation.

KEYWORDS: EPS, cement, circular economy, waste management, reclaiming, retrieval, recovering, recapturing

ACKNOWLEDGEMENTS

This research has been financed by the Greek Green Fund, under the «NATURAL ENVIRONMENT & INNOVATIVE ACTIONS 2022» Call (Proposal ID: 555/2022, MIS Acronym: COAST-EPS, Title: Recycling and reuse of polystyrene foams waste in cement-based materials.

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Recycling Approaches Of Marine Plastic Litter

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ABSTRACT

Plastic and microplastic pollution in the marine environment is a global issue. Plastic production has increased substantially over the years, to around 280 million tons per year [1]. Plastics are widely used because of their properties and versatility, making them suitable materials for numerous applications. Improper disposal of plastic waste results in large quantities of this material entering marine ecosystems [2]. The most common plastics in the ocean include polyethylene, polypropylene, polystyrene and polyethylene terephthalate, materials commonly used in packaging [2]. The fishing industry is also responsible for part of ocean plastic pollution [3]–[7]. The lost or abandoned fishing gear, like fishing nets, is very harmful to marine organisms due to microplastics release and ghost fishing [4], [5], [8]. Finding recovery and recycling strategies (mechanical, chemical or thermal) for marine plastic waste is a challenge and an opportunity to contribute to the reduction of plastic waste within the framework of a circular economy. In order to develop effective recycling strategies for these complex types of waste, some important aspects have to be considered: the heterogeneous composition of the polymer fraction recovered from the sea, the difficulty of the sorting process, the pollution and degradation status of the waste due to the material life cycle and its persistence in the ocean.

KEYWORDS: recycling, marine plastic waste, microplastic pollution

PAPER ID: cest2023_00108

Valorization of poultry manure extract enriched with sodium acetate in mixotrophic cultivation of Auxenochlorella protothecoides

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ABSTRACT

Poultry manure (PM) is byproduct of intensive agricultural production and can be used as a low-cost microalgae growth substrate due to its nutrient and protein-rich content. Microalgae are capable to grow rapidly and thrive in different substrates, thus serving as a valuable source of biomass. In this study, Auxenochlorella protothecoides was cultivated in PM extract supplemented with sodium acetate in order to simulate a volatile fatty acid (VFA) rich substrate after PM thermophilic acetogenic fermentation. The effect of different VFA concentrations (0-30g/L) in the substrate on biomass growth and biochemical composition under mixotrophic conditions was evaluated. A. protothecoides was capable to acclimatize and multiplied in the PM substrate, ultimately achieving the highest biomass concentration at 20 g/L VFA. Proteins were the most abundant component accounting for 38.1-43.9% w/w in the dry biomass, while carbohydrates and lipids followed, comprising 31.5-36.3% and 10.9-14.1%, respectively. The addition of VFA enhanced the protein, carbohydrate and lipid productivity achieving the maximum values 43.9%, 36.3%, 14.1% respectively at 20 g/L VFA. The results indicate that VFA-enriched PM extract can potentially be used as a sustainable and cost-effective growth medium for microalgal cultivation, while the biochemical composition of algal biomass makes it a promising animal feed supplement.

KEYWORDS: poultry manure, mixotrophy, volatile fatty acids, microalgae, Auxenochlorella protothecoides

PAPER ID: cest2023_00113

Reimbursement of aluminum and PET packaging project at a University Campus: a case study

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ABSTRACT

Deposit Return Systems were created to increase the recycling rate of single-use beverage containers and meet the recycling targets in European Union. REAP - Recycling and Reimbursement of Aluminum and PET Packaging is an initiative that took place within the scope of the sustainability policies created at the University of Aveiro, Portugal, allowing students and staff to be reimbursed for each PET beverage bottle/ aluminum can returned after consumption. This selective collection reduces the degree of contamination of the waste and increases the quality of the waste to be incorporated into the recycling industry and in the PET packaging production chain. This paper aims to promote reimbursement systems and bottle-to-bottle mechanisms as a measure for sustainability and circular economy. This article analyses the REAP case study monitoring results during the first year. The results indicate an increase in the number of returned packages during the year and return rates of 41% for PET bottles and 26% for aluminum cans in the first year of implementation. The increase in the number of users shows that the project has been a good instrument in raising environmental awareness among the academic community for the importance of packaging separation for subsequent recycling.

KEYWORDS: Single-use Beverage Containers; Recycled PET; Bottle-to-Bottle; DRS

ACKNOWLEDGMENTS

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Microbial inoculum production for bioleaching of critical metals from tailings

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ABSTRACT

In this paper, research is presented regarding the development and testing of strategies to identify the optimal solutions for the production of microbial inoculum for the bio-recovery of critical metals from tailings. The versatility and diversity of biotechnologies available offer the opportunity for an economically viable solution for treating ores with complex mineralogy and those not suitable for processing by traditional methods. Bioleaching is a real economic alternative for the treatment of mine tailings, which allows, depending on the chosen strategy, two possible outcomes: (i) a leachate enriched in target metals or (ii) a tailings enriched in target metals by leaching interfering components. Continued population growth, ever-increasing levels of economic activity and technological innovation lead to a rapid increase in resource consumption, making the sustainable use of resources an imperative issue for humanity. Therefore, in recent years, new ideas regarding the use of materials and circularization have emerged. On the one hand, traditional mining activity produced tailings that were deposited in tailings ponds, containing metals as by-products of the extraction processes. On the other hand, as we aim to expand human presence in space, we need to find viable approaches to achieve independence from terrestrial resources and space biomining becomes of great interest.

KEYWORDS: critical metals, bio-recovery, microbial consortium, biomining

ACKNOWLEDGEMENTS

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PAPER ID: cest2023_00218

SESSION 4 - SUSTAINABLE DEVELOPMENT IN INSULAR REGIONS UNDER TOURISM PRESSURES: AN INTEGRATED APPROACH

Thursday 31 August – morning

Carrying capacity in islands. The case of Mykonos

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ABSTRACT

The discussion on the assessment of the Carrying Capacity came back to timeliness at a time when planetary boundaries are being exceeded at a global level due to the production and consumption pattern that exhausts resources and produces waste that the environment cannot absorb. This happened not by chance, since serious objections have been registered for some years about: - residential expansion changing land uses and irreparably degrading biodiversity and the landscape, - depletion of water resources that are no longer sufficient even for human needs, while based on management requirements 20% of resources should be directed to nature for its own needs, - plastics everywhere on land and in the sea, - congestion and traffic jams. When do we consider an island to have exceeded its carrying capacity? Along with the stress on nature, there is also the stress on permanent residents who see their quality of life being degraded, while the tourists themselves are uncomfortable since their travel experience is being also degraded, especially in relation to what they have paid. Is hypertourism here to stay? And will tourism last? Is it sustainable? With what financial performance, as until now has been the only goal? Finally, the carrying capacity (resilience) of the local economic system to withstand external shocks such as the pandemic and the climate change. Moreover, the strong tourism development - which has led to monoculture - did not even solve the problem of the demographic sustainability of most of the "aging" islands. This work concerns the development of a methodology and the measurement of the pressure exerted on tourist islands and its effects on the carrying capacity. The research was done through the collection and analysis of the available and most up-to-date secondary data as well as expert judgments. In this way the pressures and their causes were detected, analyzed in a DPS(I)R system, examining, and evaluating, at the same time, the existing policies in terms of their implementation and effectiveness. The analysis of the data for Mykonos shows that on the one hand there are very high incomes, while on the other the pressure on society and the environment has exceeded the limits of carrying capacity.

KEYWORDS: islands, carrying capacity, sustainability, tourism

PAPER ID: cest2023_00561

Integrated approach for Sustainable Development in islands under tourism pressure: First findings Serifos and Tinos

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ABSTRACT

This work is based on the approach of the Global Network of Sustainable Tourism Observatories which considers as necessary the decisions made at the destination level are based on quantitative data but also on the perceptions of tourists, businessmen and residents regarding the sustainability of destinations. In order to implement this approach, the Observatory of Sustainable Tourism of the Aegean proceeded to develop a methodology based on the mapping of the local system which includes on the one hand the anthropogenic activities (D) as recorded on the island and on the other hand the state of the island (S) in the three dimensions of sustainablility (economic efficiency, social justice and environmental conservation) as affected by the results of these activities (P). The effort for the best possible quantitative recording of the activities (primary sector, manufacturing, tourism, trade, construction, etc.) and their results is a prerequisite for creating a clearer picture of the current situation through the collection of existing secondary data as well as primary data through surveys of tourists and businessmen of the islands. At the same time, in order to capture the perception of all interested parties of the local society, it is planned to organize meetings with representatives of local society bodies with the aim of recording their opinions on the state of the island and its degree of attractiveness and sustainability, as well as the distribution of questionnaires to the whole population in the same direction.

KEYWORDS: islands, carrying capacity, sustainability, tourism

PAPER ID: cest2023_00564

Sustainable mobility on insular regions with significant tourism pressures

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ABSTRACT

This presentation explores the challenges surrounding sustainable mobility in insular regions that face significant tourism pressures, with a specific focus on the Greek islands. By examining their distinctive characteristics, such as their geographical distribution, diverse sizes, high dependence on tourism, and pronounced seasonality, we gain valuable insights into the development of mobility solutions in tourism destinations. The analysis is supported by pertinent data and statistics on tourism numbers, population demographics, and transportation usage, offering a comprehensive understanding of the scale and impact of the challenges faced in achieving sustainable mobility. To provide practical examples and inspiration, the presentation incorporates various case studies of Greek islands that have successfully implemented sustainable mobility solutions. These case studies highlight the strategies, initiatives, and outcomes that have yielded positive results. This work also presents the concept of Sustainable Island Mobility Plans (SIMP) as a customized adaptation of the Sustainable Urban Mobility Plan (SUMP) methodology tailored specifically for islands with a permanent population of less than 50,000 inhabitants. This framework has been introduced by CIVINET Greece-Cyprus and serves as a blueprint for devising effective and context-specific mobility plans in insular regions. Lastly, the presentation offers a review of innovative and sustainable urban mobility solutions, including sharing schemes, car-free concepts, and active mobility, which can be implemented in island destinations. The objective of this research is to provide valuable insights for policymakers and transport operators aiming to offer intelligent and sustainable mobility options for tourists.

KEYWORDS: sustainable mobility, islands, mobility plans, active mobility

PAPER ID: cest2023_00560

Conflicts between development patterns, hydrological resilience and water justice in insular tourism destinations – the necessity for water governance.

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ABSTRACT

Tourism has become the premeditated path to development that all islands are inclined to follow. This has resulted in a redefinition of water from a finite resource used thriftily, to an intermediate commercial and technologically produced commodity that serves the aspirations of insular societies. This redefinition is accompanied by significant dilemmas, conflicts and inequalities between the various social groups, thus emphasizing the political dimension of sustainability and resilience problems: large versus small water consumers, holidaymakers versus permanent residents, farmers and touristic facilities versus residential users, public versus private water providers, local management authorities versus regional and central government authorities, borehole drilling versus desalination and eventually local development that undermines the sustainability of local aquifers. In this conflicting context, what is the meaning of "water justice" (as part of the wider environmental justice)? Who is responsible to decide, with what principles and criteria? Moreover, an overarching question arises: What comes by priority? Water justice, local development regardless of the potential inequalities it encompasses, or the sustainability of the islands' hydrological systems accompanied by perpetuated hydrological self-sustenance while embracing restrictions to local development? This paper attempts to map out some initial responses to those questions based on insights from theoretical approaches and empirical data from the Aegean islands. Responses to those questions cannot be simply technical and managerial. Rather they have a colorful political background and entail the information of local societies (and others with which they interact hydrologically) regarding problems of sustainability and resilience with respect to water resources. The end-goal is a process of deliberation regarding the necessity for water governance, so that the responsibility for political choices is distributed among the members of the society.

KEYWORDS: development, hydrological resilience, water justice, insular sustainability, tourism destinations

PAPER ID: cest2023_00541

Environmental monitoring and sustainable planning for tourism in Balos lagoon in Western Crete

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ABSTRACT

Balos lagoon was used as the case study to test a new methodology developed under the CROSS-COASTAL-NET initiative, Development of a Cross-Border Network for the Promotion of Sustainable Coastal Tourism, which is underneath the Interreg Greece–Cyprus program. The project examines the regions of Balos and Akamas in an attempt to settle any concerns raised in such sensitive coastal ecosystems, due to the issue of over tourism. Thus, environmental impact assessments and planning processes are considered essential to define an area's carrying capacity (CC), so that the foundations for its sustainable touristic growth, can be built.

In the current study, aiming to perform a holistic approach -investigation of all the aspects of sustainability, i.e., environment, society, and economy-, the methodology proposed for the carrying capacity identification is three-levelled: 1) calculation of the physical, real, and efficient carrying capacity, 2) quantification of the ecosystem's biological quality, 3) definition of the stakeholders' view, through ranking of proposed solutions derived from thorough research. Eventually, an integral strategy is being applied to capture a spherical view of the existing condition in Balos, as also to provide tailored made solutions.

KEYWORDS: Sustainable Tourism; Ecosystems monitoring and management; NATURA 2000; Carrying Capacity; environmental quality

AKNOWLEDGEMENTS

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Tourism Carrying Capacity in Natural Protected Areas. The case of Voidokilia Beach - Messinia, Greece

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ABSTRACT

Estimating the ecotourism carrying capacity (ETCC) in protected areas (PAs) is essential to mitigate negative impacts of ecotourism on the natural environment and to achieve sustainable environmental management. Carrying capacity for tourists is the number of people that may visit a protected area during any given period, which: (i) maximizes long-term protection of the area's objective, and (ii) does not cause irreversible depletion of provisioning ecosystem services that may affect of visitor's satisfaction. This paper focuses on the estimation of tourism carrying capacity of a natural protected area, such as the one of lagoon, Divari beach and Voidokilia in the wider area of Gialova in the Region of Messinia, Greece. The method of assessing the carrying capacity is based on the environmental indicators and specifically on the corresponding indicators proposed by the European program ESPON 2020. The identification and estimation of the appropriate indicators for the area under study is carried out computationally and/or through data-driven by the bibliography and structure questionnaire answered by local residents and entrepreneurs. The final indicators' results determine the overall condition of the area while several measures are proposed in order to achieve a further sustainable and within permissible limits development of the studied area. Therefore, since similar areas have, also, a limited ability to attract visitors and develop ecotourism, the protection of these areas requires immediate action including the implementation of sustainable management so that to mitigate the negative impacts of ecotourism and, finally, estimate the allowed number of visitors.

KEYWORDS: Ecosystems, sustainable tourism, Environmental Indicators

PAPER ID: cest2023_00585

SESSION 5 - SUSTAINABLE PRODUCTION AND MANAGEMENT OF BIOMASS

Thursday 31 August – morning

Mapping of available biological feedstock streams: The case of agro-industrial waste and by-products in the Region of Central Macedonia - Greece

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ABSTRACT

The European Union's Bioeconomy Strategy aims to the transition to a circular, sustainable bio-based economy. It should be highlighted that bio-based production systems face significant challenges concerning the sustainable availability of the biological materials that are used as feedstocks for bio-based products. The development of sustainable value chains of biological feedstocks is a challenging prerequisite for the implementation of the Bioeconomy Strategy and Green Deal priorities. An important step towards this goal is to develop a methodological approach for mapping the current European biological feedstocks by identifying their source, trade, and fate. In the material to follow, a general, comprehensive methodology for carrying out a Material Flow Analysis (MFA) of the main biological feedstocks that can be used by the bio-based industries is presented. The MFA methodology is implemented for the main agro-industrial waste and by-product streams in the Region of Central Macedonia (RCM) in Greece, identifying the most promising locally available biological feedstocks. Approximately 1.4 million tons (dry matter) residual biomass per year are harvested in the RCM mainly from cereals and industrial crops. The majority of this biological feedstock is valorized in conventional uses for bioenergy and for feed. Constrains regarding their use (e.g. legal, social, technical etc.) are also discussed. The outcomes of this study are expected to contribute to the development of the local circular bio-based economy and to act as a paradigm for other national (Greek) and European regions.

KEYWORDS: Biological feedstocks, Agro-industrial waste and by-products, Material Flow Analysis, Circular economy, Bio-based products

ACKNOWLEDGMENT:

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PAPER ID: cest2023_00294

Towards bioeconomy implementation – hotel's biomass potential and the use of it

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ABSTRACT

European Green Deal's most significant component is the new circular economy action plan (CEAP). A circular economy will help decrease the strain on natural resources and lead to sustainability. Exploiting the potential of biomass can cause the transformation of a linear economy into a circular one. An interesting area to explore is biomass from the hotel's waste management. Regarding this, one of the goals of the Greek government for municipal waste management in the Greek islands is the cooperation between local authorities and the largest hotels, for the separation and collection of organic waste. The objective of this research is to state the amount and bring into use the biomass residues of Lesvos hotels by applying the IZES model. The first step is to track and cluster the largest hotels and their biomass residues on Lesvos Island and map them by using QGIS. In addition, a material flow analysis will be detecting the recent usage and possible future usage of the organic waste from the hotels. This will help to find a hotel's decision with the aim of transitioning towards a circular economy.

KEYWORDS: biomass, hotels, circular economy

PAPER ID: cest2023_00372

Paradigm Shift Towards Integrated Sustainability and High Performance Machining

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ABSTRACT

The environmental impact of machining is presented in terms of the damage to human health, ecosystem quality, and resources. To reconcile the conflicting requirements of economic growth and environmental protection, a paradigm shift towards integrated sustainability and high performance machining is discussed in the light of the new industrial revolution I5.0. Implementation of the sustainability strategy showed that the use of innovative and eco-friendly cooling/ lubrication methods in machining can significantly reduce the environmental impact and improve productivity, part quality, and process economics at the same time. Implementation of the resilience strategy, through a cyber-physical adaptive control system, showed up to 50% and 35% of combined reduction in the production cycle time and cost, respectively, as well as extending the tool life and eliminating the part damage.

KEYWORDS: paradigm shift, sustainability, machining, cyber-physical system, adaptive control

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Preparation, Characterization And Utilization Of Biosourced Nickel And Iron-Based Catalysts For Hydrogen Production

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ABSTRACT

The Paris Agreement (2015) engaged the 195 signatory nations to reduce greenhouse gas emissions. The valorization of biomass and biowaste into hydrogen and biofuels may play a significant role in reaching this objective, due to the carbon neutrality and high availability of these bioresources. The Water Gas Shift reaction (WGS), which allows enhancing the conversion of syngas into hydrogen, is involved in many thermochemical conversion processes such as gasification, Fisher-Tropsch Synthesis, and biogas reforming. It typically occurs between 180 and 400°C in the presence of noble or transition metal-based catalysts, including iron (Fe) and nickel (Ni) (Ghogia, 2021). Commercial catalysts present a high environmental impact and a high dependence on critical or precious metals (Said, 2017). To overcome this problem, catalysts may be produced from bioresources with a high metal content, which requires a deep knowledge on the complex and heterogeneous structure of bioresources and on metal catalytic activity. The objective of this work is to prepare, characterize and utilize biosourced catalysts from bioresources rich in catalytic elements for enhancing hydrogen production through WGS reaction.

In a first approach, raw fern and willow were selected due to their ability to cumulate heavy metals from soil by phytoremediation. For catalysts preparation, a part of raw biomass was pyrolyzed under N2 from 25°C to 800°C at 2°C/min, followed by an isothermal step at 800°C for an hour. Impregnation was carried out by Wetness impregnation (WI) method for biomass samples and Incipient Wetness impregnation (IWI) for biochar samples, in both cases with an objective of 3 wt%biochar of Ni or Fe. Catalysts were then characterized in terms of organic element content (CHNS analysis), inorganic element content (ICP-AES) and its dispersion on the carbonaceous matrix (SEM, TEM), thermal stability (TGA-DSC), surface area (BET, N2), textural properties and surface chemical groups (TPD, TPR, XRD).

Catalysts were then tested in WGS reaction. A fixed bed reactor (8 mm diameter, 25 cm long) was filled with 1.00±0.01 g of each biosourced catalyst and an inert bed of α-Al2O3 (Ghogia, 2021). Permanent gases were analyzed using an in-line µ-GC/TCD device. A first screening of the catalysts was carried out in Reverse WGS conditions (RWGS) to facilitate reactant introduction in gas phase, at 400°C, 3 bar and a ratio of reactants equal to 1:1 (CO2:H2). In a second step, the best catalysts were tested in WGS reaction conditions (220°C, 3 bar, 1:5.5 CO:H2O). Biosourced catalyst structure was compared before and after the chemical reaction.

The produced biosourced catalysts showed their thermal stability in TGA up to 500°C. Concerning the impregnation method, WI required 2 to 4 times less time and up to 3 times less metal nitrate than IWI catalysts and therefore biomass impregnation was facilitated. This may be explained by the aromatic nature of biochar leading to formation of Van der Waals bonds between the metals introduced by impregnation and the carbonaceous structure (Said, 2017). In the case of biomass, metals make covalent bonds with biomass structure during impregnation, which results in a strong retention of metals by the carbonaceous structure after pyrolysis.

Fern biochar IWI impregnated with Ni showed promising activity in RWGS with an initial CO2 conversion of 20% (~35% at equilibrium) and an average selectivity for CO compared to CH4 of 88%. Willow biochar WI impregnated with Fe catalysts lower CO2 conversion, but a higher selectivity to CO (>98%). Non impregnated fern and willow biochars showed lower CO2 conversion with no CH4 production.

Future work will test the selected biosourced catalysts in WGS conditions, to identify the key parameters of the biosourced catalysts leading to the maximum syngas conversion rate, as well as H2 productivity and selectivity, as a function of WGS operating conditions.

KEYWORDS: Biochar, Hydrogen, Water Gas Shift Reaction, Biosourced Catalyst, Iron, Nickel.

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Assessment of water reuse potential for the cultivation of the red microalga *Galdieria sulphuraria*

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ABSTRACT

The red microalga Galdieria sulphuraria has emerged as a promising biotechnological platform for large-scale cultivation and production of high-value compounds, such as the blue pigment phycocyanin. However, its extremophilic nature requires cultivation in an appropriately acidified culture medium, resulting in strongly acidic wastewater exceeding legal limits for industrial wastewater release. Additionally, the high freshwater usage, together with the supply of the necessary nutrients, is among the main costs associated with large-scale algae cultivation. This study investigates the possibility of recycling water and metals for multiple G. sulphuraria's cultivation cycles to reduce costs and make microalgae cultivation more sustainable. Firstly, 25% water recycling showed no significant differences in consecutive cycles compared to the control, reaching the same final biomass concentration. Further, recycling the whole permeate derived from the harvesting process with the only re-integration of nitrogen and phosphate sources, did not affect G. sulphuraria growth in a first cycle of water recycling. Finally, the study evaluated the potential of G. sulphuraria's phycocyanin (C-PC) accumulation achievable at high cells densities within the flat panel PBR, with values between the highest reported in the literature (10.8 % w/w). No negative effects of the recycled water on the C-PC accumulation were observed, suggesting that this approach could lead to a more sustainable and cost-effective strategy for large-scale G. sulphuraria cultivation and production of high-value compounds..

KEYWORDS: *Galdieria sulphuraria,* Water Recycling, Phycocyanin, Closed Flat-panel Photobioreactor

PAPER ID: cest2023_00481

Evaluation of microalgae CO_2 bio-fixation efficiencies under controlled growth conditions in a closed pilot-scale planar photobioreactor

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ABSTRACT

Microalgae cultivation for direct carbon dioxide fixation and production of high-quality biomass and energy feedstock is gaining particular attention as potential Carbon Capture and Utilization (CCU) biotechnological tool. However, despite the many technological advances in photobioreactor designs and operations, microalgae CCU systems are still far from being implemented, mainly due to the high investment and operation costs of closed photobioreactors, as well as low CO2 fixation yields achieved with most diffuse PBRs technologies. This work aims to assess an experimental evaluation of CO2 bio-fixation efficiencies of two different microalgae strains, Acutodesmus obliquus, and Galdieria sulphuraria, grown under optimized and controlled conditions in a novel completely closed pilot-scale flat-panel PBR. The CO2 injection system was designed to precisely calibrate CO2 in-flow and its quantification, and the evaluation of CO2 bio-fixation efficiencies was performed by measuring the elemental composition of microalgae biomass. The results obtained show that the two microalgae species were able to reach relevant biomass concentrations displaying both CO2 bio-fixation efficiencies above 90% of the total injected CO2. The data suggest that, by employing optimal growth conditions and finely controlling CO2 injection, microalgae cultivation may constitute a relevant CCU tool for CO2 mitigation while producing high-quality biomass for multifaceted applications.

KEYWORDS: Acutodesmus obliquus, Galdieria sulphuraria, Carbon Capture and Utilization, Closed Flat-panel Photobioreactor

PAPER ID: cest2023_00482

Valorisation of biomass waste into bioproduct: Potential use of cannabis extracts for bacterial inhibition activity

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ABSTRACT

Cannabis Sativa is a plant containing two main active components; tetrahydrocannabinol and cannabidiol that can be widely used in pharmacological and medical benefits. Main parts such as seeds, flowers, and leaves are mostly used in several applications; medicines, beverages and foods. While other parts such as stems and incomplete leaves (withered-, dried, and spotted-) were removed to disposal. In this research, cannabis leaves were extracted using 3 solvents namely deionized water, ethanol, and hexane.The extracts were determined to inhibit two pathogenic bacteria (Escherichia coli and Staphylococcus aureus). Some parameters; ratios of extracts: solvents (1:5, 1:7 and 1:10) and temperatures (30 °C, 35 °C and 40 °C) were also considered. The results revealed that extracts yield and total phenolic compound (TPC) content slightly increased as all parameters increased. The maximum yield and TPC content were 16.46% and 64.14 mg GAE/g DW when hexane was applied under ratio of 1:10 at 35°C. The extracts obtained from all conditions could inhibit bacterial inoculation. Furthermore, the use of hexane yielded more effective inhibitor than the cases of water and ethanol. Moreover, extracts were also able to inhibit both bacteria at the lowest concentration for tests of minimum inhibition concentration and minimum bactericidal concentration.

KEYWORDS: *Cannabis Sativa; Escherichia coli; Staphylo- coccus aureus;* Minimum inhibition concentration (MIC); minimum bactericidal concentration (MBC)

ACKNOWLEDGEMENT

All authors would like to acknowleadge for all sponsors; Khon Kaen University for travel busary while Faculty of Technology, Department of Biotechnology for cofunding. We also would like to thanks Ms. Promma, C., and Kanaenork, N. for their experiments and data collection.

PAPER ID: cest2023_00510

SESSION 6 - ESG (ENVIRONMENTAL, SOCIAL AND GOVERNANCE) AND CIRCULAR ECONOMY

Thursday 31 August – morning

Water-wise approaches for circular cities – lessons learned from Amsterdam.

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ABSTRACT

Under a constantly changing world, the environmental costs of increasing urbanization and associated water challenges, prioritized the circular economy on political agendas. Simultaneously, water-wise-cities initiatives, seeking sustainable and resilient communities, started to emerge. Synergies between these two concepts are, however, poorly explored in the literature. They can be influenced by legislation, stakeholders' perceptions and associated networks, among others. Driven by the work of the project Water-wise Cities from the International Water Association, this article builds a conceptual model merging the principles of circular cities and the principles of water-wise cities. This model is then applied in the case of Amsterdam, by assessing current circular economy strategies and related municipal policies to understand how cities are adopting circularity while becoming water-wise. The assessment used a brief content analysis of the current circular initiatives and how these can be part of a transition into a water-wise city. The developed conceptual model has proven to be able to identify the key areas where further intervention is needed to attain a circular and water wise city. The study displayed a water-wise community where many collaborative networks between public administration entities, entrepreneurs and citizens are in place, which create a robust potential for synergetic urban initiatives. Within the water sphere, their focus is mainly on flood risk management and resilient infrastructures, while lesser attention is given to circularity concerns. However, a few circular actions are identified in the water-sensitive design and the regenerative water approaches dimensions, such as the decentralization of wastewater treatment systems, the reuse and recovery of organic residues and the integration of water-sensitive nature-based solutions. Legislation and project upscaling constrains were identified as barriers hindering opportunities to mainstream circular solutions. Overall, there is still room for developments in the basin connected cities' dimension.

KEYWORDS: circular city, conceptual model, policy, water-wise city

PAPER ID: cest2023_00095

The Phenomenon of Greenwashing In The Fashion Industry: A Conceptual Framework

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ABSTRACT

The fashion industry has one of the highest environmental, economic, and social impacts in the world. In recent times, awareness of sustainability issues has certainly increased, with companies making a real effort to reduce their impact. On the other hand, consumer awareness has also increased, with companies seeing sustainability as an element of competitive advantage. However, to achieve these advantages some companies taint themselves with the phenomenon of greenwashing, creating a disparity between the sustainability commitments actually made and those advertised. This paper aims to analyse the phenomenon of greenwashing in the fashion industry at a literature level with the objective of creating a conceptual framework to analyse and recognise elements of greenwashing in the companies studied.

KEYWORDS: Greenwashing, Fashion industry, Environmental Sustainability, Framework, SPAR-4-SLR

PAPER ID: cest2023_00363

Circular Cities: Challenges and Opportunities towards their transition to a green, smart and circular economy.

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ABSTRACT

Cities cover 3% of the land on Earth, however with more than 70% of the population expected to live in urban areas by 2050 they drive almost three-quarters of GHG emissions. They account for two-thirds of global energy demand, consume 60-80% of natural resources and generate 50% of waste.

Urban metabolism is becoming the most important indicator of measuring the sustainability of cities.

Cities are on the front lines combatting major challenges, notably climate change, pandemics, integration of refugees, decarbonisation, air pollution, food security, energy poverty, waste/water management and putting in place circular economy. Cities are hubs of sustainable economic activity, community engagement, innovation.

The policy choices local governments make today will determine the successful transition to greener, cleaner, smarter way of living and will offer new economic opportunities. Cities and regions can act as enablers of the transition, providing the conditions for the circular economy to happen in practice.

This paper/presentation explores major urban challenges driven by climate change. It observes new human-centric urban trends and technologies shaping circular urban planning. It draws the main axes of integrated policies, collaborative governance and technology-powered solutions that cities can deploy to speed-up their transition to a green, smart and circular economy.

KEYWORDS: governance; innovation; sustainability; technology; urban-metabolism.

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Volatilities and returns of selected ESG ETFs and SRI ETFs

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ABSTRACT

In the last couple of years investors and companies are more aware of the impact of investments on the environment and society as a whole. Climate changes, polluted air, the harmful impact of plastic, pesticides and other polluter on health and the environment, are just some of the reasons why socially responsible investing (SRI) and environmental, social and governance (ESG) investing are rapidly growing investment classes. Therefore, responsible and sustainable corporate governance is inevitable. Although the application of ESG investment criteria has its roots in the traditional concept of socially responsible investment (SRI), it is considered a more modern and advanced approach to investment.

This paper investigates linkages among selected ESG ETFs and SRI ETFs returns and volatility. Different GARCH methodologies are applied to daily data on ESG and SRI exchange traded funds (ETF) based on the MSCI indices. The ETFs that cover the most important geographic areas were selected for analysis: iShares MSCI World, iShares MSCI USA, iShares MSCI Europe and iShares MSCI Emerging Markets. The listed ETFs are traded on the London Stock Exchange, so there are no differences in trading days. In order to get a better insight into the performance of ETFs that apply ESG criteria, they are compared with those that apply the SRI approach. In some segments, they were also compared with the basic ETF (iShares ETF Core) in each group. The analysis of the observed ETFs was made for the period from October 22, 2018. to 28.04.2023. (a total of 1144 daily returns), because for the specified period data are available for all ETFs that are the subject of this analysis.

The preliminary results show that ETFs with socially responsible investing (SRI) strategy performed better. Results of GARCH (1,1) show that the USA ETF ESG (.2001) exhibits the highest α value, meaning that volatility reacts intensely to market movements and Emerging Markets ETF ESG has the lowest Arch coefficient (.1216) indicating stable short term volatility. On the other hand, Emerging Markets ETF ESG has the highest Garch parameter ß (0.8343). Looking at both Arch and Garch effects, USA ETF ESG has the highest value of α + ß (0.9860) suggesting that the effects of the volatility shocks fade away slowly. Finally, we found that EGARCH (1,1) provides a better fit for selected ETFs because AIC criterion and SIC criterion are slightly lower for all ETFs.

These findings should be useful to portfolio managers for better risk assessment and portfolio selection and diversification, as well as to international investors interested in the emerging markets. The presented findings should be useful to policymakers concerned about sudden and harmful movements of assets.

KEYWORDS: ESG ETFs, SRI ETFs, Volatility, GARCH, EGARCH

PAPER ID: cest2023_00494

Collective Action for Sustainable Water Resource Management: Analytical Framework and Company Initiatives

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ABSTRACT

The water resource management is an important area for accomplishing the sustainability. During last one to two decades, there have been many innovations in managing the water resources at different levels and across different contexts. The present paper examines the innovation in sustainable water resource management at company or firm level. Based on the case-study analysis method, the paper examines the key learning from each of the selected ten (10) recent case-studies, selected from the different secondary open access sources. The findings offer a fresh perspective on the critical issues in identifying and managing the water resources sustainably

KEYWORDS: Sustainability; Water Resource Management; Collective Action

PAPER ID: cest2023_00519

SESSION 7 - WATER AND WASTEWATER TREATMENT AND REUSE

Thursday 31 August – morning

Optimization of wastewater treatment by integration of artificial intelligence techniques: recent progress and future perspectives

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ABSTRACT

Artificial intelligence (AI) is proving useful in optimizing the process efficiency in many sectors, including wastewater treatment. The complexity of wastewater characteristics and treatment technologies leads to uncertainties and variability in the efficiency of the processes in wastewater treatment plants (WWTPs), resulting in environmental risks and increased operating costs. Many studies have shown that AI could be applied to achieve better performance in WWTPs, minimizing potential negative environmental impacts, enhancing the quality of treated wastewater, and reducing costs through efficient, innovative, and smart solutions.

This article provides a review of recent progress in the implementation of AI in wastewater treatment, giving an overview of the state of the art in this field. The analysis conducted in this review demonstrates the enormous potential of implementing AI technologies in wastewater treatment applications, obtaining technologically advanced systems that simultaneously provide high purification performance, simplified process management and reduced operating costs. Furthermore, automation of processes and improved monitoring activities can be fostered by applying AI. Finally, the future potential of the integration of AI techniques in wastewater treatment is discussed and the long-term prospects in this field are presented. Research can make great strides by addressing the challenges and overcoming the limitations that hinder their implementation in full-scale plants.

KEYWORDS: Machine learning, Wastewater treatment automation, Wastewater data analysis, Advanced algorithms, Advanced treatment

PAPER ID: cest2023_00353

Understanding the alteration of organic pollutants and microbiome profiles in a petrochemical wastewater biotreatment process

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ABSTRACT

A better understanding of the alteration of organic pollutants and microorganisms in wastewater biotreatment processes is essential for the elucidation of pollutant removal mechanisms. This study investigated the alteration of organic pollutants, microbial communities and functional genes in a petrochemical wastewater treatment plant in China. Results show that the dominant organic components are phenols and aromatic amines in the influent of the biotreatment process, while linear hydrocarbons remained in the effluent. Microorganisms in the activated sludge samples were mainly bacteria, with Rhodocyclales and Burkholderiales dominating in the biotreatment process, but their relative abundances decreased dramatically during the biotreatment process, along with the removal of organic compounds. Based on functional gene annotations from the eggNOG database, the microbial community possessed high numbers of genes associated with amino acid transport and metabolism, energy production and conversion, replication, recombination and repair, and cell wall/membrane/envelope biogenesis. Generally, the relative abundances of KEGG orthologous genes involved in alkane and aromatic degradation initially increased, then dropped during the biotreatment process. This study gives insights into the mechanisms of petrochemical biodegradation processes in wastewater treatment plants.

KEYWORDS: activated sludge; microbial community; organic compounds; functional metagenomics

PAPER ID: cest2023_00357

Oxic-Settling-Anaerobic under intermittent aeration: effect on system performance, sludge minimization and greenhouse gas emissions

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ABSTRACT

The paper presents the results of an experimental study carried out on a pilot scale activated sludge system operated under intermittent aeration and fed with real wastewater at the Water Resource Recovery Facility of Palermo University (Italy). The experimental campaign was divided into two periods: in Period I, the pilot plant was operated as a conventional activated sludge system under intermittent aeration with fixed duration of aerated and non-aerated phases. In Period II, the plant layout was modified according to the Oxic-Settling-Anaerobic (OSA) configuration, by adding one anaerobic reactor in the recycling line from the final settler to the biological reactor. The final aim was to assess the reduction of excess sludge production while monitoring both system performance and N2O emissions. The results highlighted that the implementation of OSA configuration lead to a decrease of the sludge yield from 0.45 to 0.35 mgVSS/mgCOD. The COD efficiency remained quite stable and close to 90%. Conversely, OSA configuration negatively affected the pilot plant nitrification, with a significant decrease of NH4-N removal from 91% to 79%. Such reduction was also confirmed by respirometric analysis which showed a change in kinetic behavior from Period I to Period II.

KEYWORDS: sludge minimization; resource recovery from wastewater; advanced wastewater treatment; intermittent aeration; GHG

ACKNOWLEDGEMENTS

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PAPER ID: cest2023_00422

Settling and filtration experiments for the removal of flocs produced by a hybrid sono-electrochemical process

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ABSTRACT

Choosing the right method for floc separation after electrochemical treatment seemed to be a problem in a number of previous research papers. Therefore, ultrasonic and electrochemical (sono-EC) processes in circulating flow mode were combined with settling and filtration to treat the oily wastewater and to remove the produced flocs. Experimental results showed that the inclined settling, which represented lamellar settling, was not recommended for the low-density flocs, as it did not accelerate the settling process. Overall settling time was 45 min with the final mineral oil concentrations up to 25 mg/l. On the other hand, mineral oil removal efficiency was about 57 % using the combination of settling and filtration. Achieved mineral oil concentrations (8.76 mg/l and 28.63 mg/l) were in accordance with the European standards for discharge into the sewerage system or direct discharge into the water body. It was recommended that all three filter pore sizes are used together to achieve the complete removal of mineral oil, turbidity and safety, as the filter with the smallest pores would often clog due to the floc residue in the treated wastewater.

KEYWORDS: electrochemistry; filtration; flocs; settling

PAPER ID: cest2023_00439

Investigative Study on the Effectivity of Plant-Based Coagulants for the Siltation Pond of an Aggregate Crushing Plant in Southern Luzon, Philippines

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ABSTRACT

Water quality and treatment are becoming of increasing concern. It is important to develop renewable bio-coagulants to treat turbid water. This study suggests plant-based coagulants as substitute for chemical coagulants. The plants used were Moringa oleifera (MO), Carica papaya (CP) seeds, and aloe vera (AV) rind which are readily available in most communities. These contain water-soluble substances that have coagulation activity in water. The coagulation efficiency of these plants, at different dose were studied and compared with aluminum sulfate (AS), the most used chemical coagulant.

All coagulants were most effective at 0.40 g/L dose. Among the coagulants used, MO outstands in interface height variation, settling rate and TSS removal of 71.79%. With 98.00%, it also has the highest color removal together with alum. The latter also has the highest turbidity removal with 96.40% and contributed to greater rise in DO levels. However, using alum turned the water acidic. The pH exhibited variations through coagulation, Moringa oleifera yielded to smallest pH variation.

KEYWORDS: water treatment, coagulation, bio-coagulant

PAPER ID: cest2023_00139

Selection of bacterial strains to bioaugment granular sludge and improve the removal of recalcitrant pollutants

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ABSTRACT

Several advantages are gained by the use of granular sludge in wastewater treatment plants (WWTP), such as higher biomass retention, faster settling properties, lower energy costs and smaller operational land space. However, relatively few studies have been carried out on the biodegradation of recalcitrant pollutants in these systems, compared to research performed on conventional WWTP with floccular sludge. For instance, bioaugmentation of bacterial strains with metabolic abilities of interest in biological reactors for wastewater treatment has been intensively studied in conventional WWTP systems, but not in systems with granular sludge. In the project "Bioaugmentation and conjugative plasmid transference using bacteria from extreme environments to enhance biodegradation of recalcitrant pollutants in WWTP granular sludge", funded by the Portuguese Foundation for Science and Technology, a group of bacterial strains showing potential capacity to metabolize recalcitrant pollutants (paracetamol, ibuprofen, fluoxetine and polyethylene terephthalate) was isolated and their genomes are being sequenced with the aim of identifying genes putatively involved in the metabolic pathways of interest. In addition, biodegradation experiments are being performed in laboratory-scale granular sludge bioreactors bioaugmented with selected isolates.

KEYWORDS: Bioaugmentation, Bioremediation, Pharmaceuticals removal, Microplastics removal.

ACKNOWLEDGMENTS

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Modelling Closed-Water Loops in the Process Industries

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ABSTRACT

Global water scarcity poses a significant challenge for the process industry, especially in water-stressed areas. Population growth and rapid industrialization make evident the necessity to incorporate sustainable and efficient water management strategies in the industrial sector. This study aims to point out the complex industrial systems at different levels presenting the modelling of them. Overall, three modelling levels are identified, i.e., in-process, in-factory, and systemic modelling based on the system's characteristics, requirements, and prospects. Individual process units, a series of water and wastewater treatment processes, a whole industrial plant and synergistic collaborations are modelled. In this regard, a generic methodology was developed in order to be applied in six discrete use cases, recommending the most appropriate model to be applied.

KEYWORDS: wastewater treatment, process industry, modelling, sustainability

ACKNOWLEDGMENTS

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Use of residues from Eucalyptus Globulus as biosorbents for cadmium removal

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ABSTRACT

The present work studied the removal of cadmium from aqueous solutions by a series of batch sorption experiments using Eucalyptus Globulus bark and seeds as biosorbents. Both biosorbents showed good results in cadmium removal. The best results were obtained when working with a particle size < 75 µm, initial pH solution between 7.5 and 8.0, a mass-to-volume ratio of 18 and 12 g L-1 for the bark and seeds respectively. The Ho and McKay model explained well the biosorption kinetic results for both biosorbents. It was found that cadmium sorption on seeds was faster than that obtained on bark, with maximum cadmium capacity of 8.54 and 5.62 mg L-1 for the seeds ant bark respectively which indicates that the seeds presented better results. The experimental equilibrium data could be fitted well with both the Langmuir and Freundlich isotherm models.

KEYWORDS: Cadmium removal, adsorption, wastewater, biosorbents

PAPER ID: cest2023_00153

Application of electrochemical peroxidation with nanoscale zero-valent iron particles (nZVI) for selenium removal from oil refinery wastewater

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ABSTRACT

This study uses the electrochemical peroxidation process to remove selenium in combination with nanoscale zero-valent iron particles (nZVI) as the iron source. Also, experiments with just the addition of the nZVI doses without current application were carried out. The nanoparticles were synthesized by the chemical reduction of iron chloride hexahydrate with sodium borohydride obtaining particles with an average size of 78 nm. The initial percentage of oxygen was in the range of 4.57% - 6.25% with no measurable increase after 15 days. 1 L of oil refinery wastewater was used in each experiment and the treatment time for all of them was 1 hour. The nZVI doses were: 950, 3800 and 11400 molFe/MolSe and the current density values were: 100 and 200 A/m2, all combinations were tested. The initial concentration of total Se in the wastewater was 0.16 mg/L. After the treatment, in the case of electrochemical peroxidation, a removal of 21.4 to 28.4% was achieved, depending on the nZVI dose and current density. In the case of treatment with just nZVI and no application of current, a removal of 54.1 to 94.5% was obtained, with the highest removal efficiency reached at a nanoparticle dose of 11400 molFe/MolSe.

KEYWORDS: Selenium removal, electrochemical peroxidation, nanoparticles

PAPER ID: cest2023_00271

SESSION 8 - BEACH EROSION OF ISLAND BEACHES IN EASTERN MEDITERRANEAN (GREECE AND CYPRUS): ASSESSMENT, MONITORING AND MANAGEMENT

Thursday 31 August – morning

Drivers and impacts of beach erosion in Eastern Mediterranean Islands

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ABSTRACT

This short contribution provides a brief overview of the drivers and impacts of beach erosion at the Greek islands and Cyprus, which are under an increasing risk of erosion. The most significant beach erosion drivers have been found to be the mean and extreme sea level rise, as well as various geological (e.g., the geological setting and the diminishing beach sediment supply) and anthropogenic factors (e.g. river dams that starve beaches of their terrestrial sediment supply, degradation of wave-attenuating coastal ecosystems and badly designed/implemented coastal works). Under climate change, beach erosion is projected to have very significant (even devastating) impacts on the populations, assets/infrastructure and socio-economic activities of the islands' beaches, the exposure of which is already very significant and increasing

KEYWORDS: Beach erosion, Climate change, Eastern Mediterranean, Sea level rise

ACKNOWLEDGEMENTS

This work was supported by the research project BEACHTECH, co-funded by the European Union (ERDF) and national funds of Greece and Cyprus.

PAPER ID: cest2023_00490

Coastal flood and erosion risk under climate change: An overview of policies and legislation in Greece and Cyprus

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ABSTRACT

This short contribution provides a brief overview of the most relevant policies and legislation for the prevention and management of the coastal flood risk under climate change in Greece and Cyprus, following the 'hierarchy of norms': the most relevant International policy and legals instruments to which Greece and Cyprus, are Contracting Parties (CPs) are considered first, followed by the EU and National policies and legislation. Their review has shown that there are several challenges in the existing regulatory regimes, with the most important of which associated with the lack of consideration of the effect of coastline change (retreat/erosion) under climate change on the shoreline and beach legal demarcations.

KEYWORDS: Coastal flood risk, Coastal erosion, Shoreline demarcation, Set back zones

ACKNOWLEDGEMENTS

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PAPER ID: cest2023_00477

Beach erosion due to climate change: evaluation and best mitigation practices in touristic beaches of North Aegean Islands and Cyprus – The methodological structure of BEACHTECH project

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ABSTRACT

The expected relative sea level rise (RSLR) and changes in the intensity/ frequency of extreme sea levels pose a growing erosion threat to beaches, the most important natural resources of touristic islands. In the framework of the BEACHTECH project, the beaches of Lesvos and Chios Islands (NE Aegean) and Cyprus have been digitized and modeled under different scenarios of sea level rise to assess their erosion. Four pilot beaches were selected for further study aiming to determine the present and model the future erosion risk and design effective technical adaptation measures. The results are envisaged to advance knowledge on the assessment of the anticipated coastal erosion and flood risk at island settings, offer options of technical measures (involving prospection for potential marine aggregate deposits) to the partner regional authorities, advance our understanding of the interactions between beaches and their backshore hydrological basins, and promote our capability to observe beach erosion using high frequency coastal monitoring systems

KEYWORDS: beach erosion, coastal protection measures, sea level rise, eastern Mediterranean

ACKNOWLEDGMENTS

This work was mainly supported by the research project BEACHTECH, co-funded by the European Union (ERDF) and national funds of Greece and Cyprus under the Cooperation Programme "INTERREG V-A Greece-Cyprus 2014-2020"

PAPER ID: cest2023_00295

Morphological changes recorded from an automated beach optical monitoring system in a highly touristic pocket beach, Coral Bay, Pegeia, Cyprus

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ABSTRACT

This paper demonstrates preliminary results of a Beach Optical Monitoring System (BOMS) installed in Coral Bay Beach (Pegeia, Cyprus) in the framework of BEACHTECH project. The BOMS is deployed at the southern sector of Coral Bay, a pocket sandy beach of high touristic and economic importance for the region that also faces considerable erosion problems. Shoreline and wave run-up positions are recorded from specialized georectified coastal images following automatic procedures and with fine spatio-temporal resolution. Wind speed and direction data were logged from a meteorological station deployed at the same area and used to access the wind climate. For the examined period, it became evident that beach response to the wind climate is irregular, driven by the hydrodynamic action with different shoreline erosion/accretion and recovery patterns. The research demonstrates that such types of coastal monitoring systems are able to provide a powerful, automatic and efficient tool for coastal engineering, management and planning.

KEYWORDS: Beach Morphodynamics, Shoreline Detection, Wave Run-up, Coastal Video Monitoring, Image Processing

ACKNOWLEDGEMENTS

This work was supported by the research project BEACHTECH, co-funded by the European Union (ERDF) and national funds of Greece and Cyprus under the Cooperation Program "INTERREG V-A Greece-Cyprus 2014-2020".

PAPER ID: cest2023_00298

Coastal Zone Vulnerability Analysis in East Mediterranean Basin: Greece, Cyprus and Montenegro

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ABSTRACT

The coastal zone is a vital natural resource extensively used by the population for various activities. Given the human pressures and climate change, it is crucial to comprehend the modifications occurring in the coastal environment and its exposure to erosion. The InVEST Coastal Vulnerability Model is employed to qualitatively assess vulnerability based on an erosion exposure index, which combines information from the physical environment and population. The methodology for calculating the index is developed holistically, considering technical data, climate parameters and theoretical background. Geographic information software is used to apply the methodology to specific parts of the coastal zone in Lesvos, Cyprus and Montenegro. These regions share common vulnerability issues but also exhibit differences in coastal management approaches, socio-economic characteristics, geological features and potential impacts. The study emphasizes the need to understand biological and geophysical factors influencing coastal erosion and flooding to facilitate effective future planning and management. By assessing coastal vulnerability and considering the impact of tourism, this study can provide insights for sustainable coastal zone management and informe decision-making tools regarding protection and development.

KEYWORDS: Coastal Vulnerability, InVEST model, Lesvos, Cyprus, Montenegro

ACKNOWLEDGMENTS

This work was mainly supported by the research project BEACHTECH, co-funded by the European Union (ERDF) and national funds of Greece and Cyprus under the Cooperation Programme “INTERREG V-A Greece-Cyprus 2014-2020”. S. Papasarafianou is funded by the Ph.D. program “Phenomena and Environmental Risk” of the University of Naples, Parthenope, and A. Gkaifyllia’s research is part of ERASMUS Plus.

PAPER ID: cest2023_00511

Exploring beach visitors' willingness to pay for protecting island beaches from erosion: The case of Marmari beach in Kos, Greece

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ABSTRACT

This contribution aims at exploring beach visitors' perceptions regarding the impacts of beach erosion on their recreational activities and their willingness to pay in order to protect the beaches from erosion and preserve them in their current state. Towards this aim, a contingent valuation study was implemented, through the construction and distribution of a short and "user-friendly" questionnaire, among domestic and incoming tourist, residents and local businessmen in Marmari beach on the island of Kos (Greece). By presenting a scenario and asking respondents if they would voluntarily contribute a certain amount of money, the survey sought to understand their willingness to financially support the cause. Additionally, the questionnaire included questions about visit preferences, factors influencing their payment response, and socio-demographic information, allowing for the examination of correlations between willingness to pay and various factors. The results showed that 52% of the respondents are willing to pay for the protection of Marmari beach, and the average amount they are willing to contribute annually was estimated to be 33€. The data collected provide insights into the factors that influence beach users' willingness to financially support beach conservation and management efforts, which can inform decision-making regarding funding and resource allocation for these initiatives.

KEYWORDS: Willingness to pay, Contingent valuation, Beach erosion, Island beach, Questionnaire

ACKNOWLEDGMENTS

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CEST 2023

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Application of a Bioclimatic Index for Evaluating the Attractiveness of Two Highly Touristic Beaches in Santorini and Kos

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ABSTRACT

Beaches have a high hedonic value and economic potential; they are pillars of tourism which has been increasingly associated with vacationing wholly, or partially, at coastal locations and beach recreational activities according to the 3S (Sun, Sea and Sand) touristic model. The visitor's satisfaction and the attractiveness of a beach depends on several climatic factors such as temperature (i.e. thermal sensation index - PET), wind, cloudiness and rain. Future changes in the climatic conditions under Climate Change, such as temperature increases (and corresponding thermal discomfort) can affect the attractiveness of the beaches. A specialized bio-climatic index (the Climate Index for Tourism – CIT) was used in order to: (a) assess the ideal climate conditions for a tourist to visit the beach; and ii) evaluate the present and future attractiveness of the island 3S destinations of Kos and Santorini, as a touristic product..

KEYWORDS: CIT, PET, Tourist Satisfaction, Tourism and Climate Change

ACKNOWLEDGEMENTS

This research was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the "2nd Call for H.F.R.I. Research Projects to support Post-Doctoral Researchers" (Project Number: 211).

PAPER ID: cest2023_00453

An Example of a Detailed Beach Inventory at an Island Scale: The Case of Chios, Greece

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ABSTRACT

This contribution presents an example of a detailed beach inventory that can provide a comprehensive understanding of beach characteristics, using as a case study the island of Chios. The inventory was assembled using various sources, such as satellite imagery, optical information/tools provided by the Google Earth Pro application, online resources, and local information sources, including interviews with locals. The ‘dry’ beaches were digitized as polygons on the satellite imagery. Metadata production from the digitized polygons was carried out in GIS. Geospatial information (e.g., width, area, orientation), environmental characteristics (e.g. sediment texture, coastal dunes, cliffs, rivers), socio-economic parameters (e.g. beach development, touristic activity) and human intervention features (e.g. coastal defenses, port facilities) were included in the database. The spatial characteristics and other attributes of the island beaches stored in the database were statistically analyzed, to identify underlying relationships. The geographical distribution of the beach characteristics along the coastline of Chios was also analyzed. This database serves as a vital management tool, facilitating the fulfilment of relevant legal obligations of Greece regarding coastal management. Its comprehensive and detailed information supports effective decision-making and aids in the sustainable management of the island's beaches.

KEYWORDS: Beach inventory, Chios, Geo-spatial characteristics, Statistical analyses

ACKNOWLEDGEMENTS

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Uncovering the Hidden Treasures: A Meta-Analysis and Map of the Monetary Value of Mediterranean Seagrass Ecosystem Services

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ABSTRACT

Seagrass meadows provide valuable services for human well-being and the economy. However, the importance of these services is often underestimated by decision-makers due to limited accessibility. To assess the value of Mediterranean seagrasses, we reviewed 386 publications, but only 13 met the criteria for statistical meta-analysis. These publications provided 74 unique observations on 8 ecosystem services. The majority of these observations focused on specific types of ecosystem services in the northwestern Mediterranean, utilizing similar methodologies. Our analysis concentrated on the economic value of seagrass ecosystem services, using standardized International dollars (Int$) per hectare in 2020 as the dependent variable in our meta-regression. The results revealed that the Gross Domestic Product per capita and the type of ecosystem service significantly influenced the variation in seagrass values. Moreover, we utilized the meta-analysis model to extrapolate the findings spatially and estimate the ecosystem services provided by seagrass meadows in the Mediterranean region. Our findings demonstrated that Italy, with a seagrass meadow surface area of 461,028 ha, possessed the highest total value of seagrass meadows in the study region, amounting to 3.4 billion Int$/2020. Conversely, Libya, with a seagrass meadow surface area of 852 hectares, had the lowest value at 2.5 million Int$/2020. When considering the cumulative value of the eight ecosystem services per unit area, Monaco had the highest value per hectare with 241,631 Int$/ha/2020, while Tunisia had the lowest with 3,298 Int$/ha/2020.Meta-analysis and benefit transfer techniques serve as valuable tools in decision-making, particularly when no existing valuation studies are available for a specific region of interest. In conclusion, our study highlights the urgent need for more rigorous research on seagrass valuation in the Mediterranean region, with a focus on the southeast areas and ecosystem services where data availability is limited.

KEYWORDS: Seagrass, Mediterranean, Meta-Analysis, Ecosystem Services, Monetary

PAPER ID: cest2023_00454

SESSION 9 - SUSTAINABLE DEVELOPMENT IN INSULAR REGIONS UNDER TOURISM PRESSURES: AN INTEGRATED APPROACH

Thursday 31 August – morning

Food loss and food waste in hotel sector: Insights from empirical data and strategies for reduction

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ABSTRACT

Food waste is a multidimensional problem and reducing it is the means to achieve other goals, such as improving food security for all, reducing greenhouse gas emissions, reducing the overexploitation of natural resources and increasing production and economic development at the global level and at the country level.

The purpose of this specific study is to develop and test a methodology for the qualitative and quantitative analysis of food loss and waste in the context of the circular economy in the hotel sector. The study is based on the investigation and mapping of the food waste generation system with an analysis of the processes, composition and management thereof. Data were collected from three 5-star hotels. On-site measurements were combined with interviews and questionnaires to enable us to understand the hotel operation and the material flows without affecting the smooth operation of the hotel. The indicator that was chosen according to the bibliography to describe the current situation is "food waste per guest per day" and the values vary from 0.3 gr to 1.3 kg/person day. The need for a more specific indicator was noted. "Food waste per person" gives a clearer picture due to the fact that most five-star hotels have restaurants accessible to non-residents as well.

Measuring the current situation of food waste will give a general overview of the food waste produced by the hotel as well as the activities that cause this production. In this way the processes with the greatest loss and opportunities for change can be identified.

KEYWORDS: Food loss / food waste / hotel unit / circular economy / sustainable development

PAPER ID: cest2023_00418

Ecotourism; a tool to achieve sustainable Ecosystems

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ABSTRACT

"Ecotourism" is a rapidly grown sector in the tourism industry, particularly after COVID-19. It is very promising in enhancing economic development at rural areas by actions such as businesses initiation and promotion of local products, while providing the opportunity to the visitors to experience unique ecosystems. However, the uncontrolled practice of Ecotourism, especially at highly venerable areas like the designated protected sites, create many irreversible problems both for the environment and humans, such as increased problems with invasive species and reduced biodiversity levels. In order to alleviate those problems, it is essential to properly inform both locals and tourists through education and awareness actions. These are key factors that promote the responsible practice of Ecotourism and achieve long-term sustainable ecosystems, particularly for the protected areas while enhancing the economic growth. Consequently, Ecotourism can be used as a tool to educate and inform locals, tourists and stakeholders on long-term sustainable friendly practices to the environment and humans while enhancing economic development, increase tourism 24/7 throughout the year and create new jobs.

KEYWORDS: Biodiversity, Climate Change, Conservation, human inclusivity, SDGs, Tourism

PAPER ID: cest2023_00548

SESSION 10 - CIRCULAR ECONOMY AND BIOECONOMY

Thursday 31 August – morning

Environmental and economic assessment integrated into laboratory-based scenario development for the valorization of dredged sediment

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ABSTRACT

This study discusses the potential environmental and economic benefits of dredged sediment valorization in concrete in the framework of the circular economy. The goal is to find a sustainable way to use the sediment in concrete while maintaining its strength and not compromising the economy or environment. The maximum rate of sand substitution in concrete with sediment was found to be 40%, but sustainability was negated for rates above 20%. To optimize sustainability, a compromise between concrete strength and workability, economic and environmental impacts, and sediment transport must be reached. Lack of environmental and economic assessments in valorization scenarios may lead to non-sustainable practices.

KEYWORDS: life cycle assessment, dredged sediment, valorization, concrete

PAPER ID: cest2023_00020

Polyhydroxyalkanoates (PHAs) Production from the Liquid Fraction of dried/shredded Food Waste

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ABSTRACT

An enriched culture of Polyhydroxyalkanoates (PHAs)-forming bacteria was developed using the liquid fraction (condensate) which is generated during drying and shredding of food waste. A mixed enriched culture was used for the production of PHAs, in two Draw-Fill Reactors (DFRs). The culture was developed using cyclic limitation by carbon and nitrogen. Urea was used as nitrogen source and a mixture of volatile fatty acids (VFAs), lactic acid, ethanol and glucose, simulating the composition of the condensate as carbon source. Two cycles of experiments were performed aiming to investigate the effect of the organic loading on the yields and composition of the produced PHAs.

The results showed that the organic loading did not significantly affect the accumulation capacity of PHAs, with the average yield for DFR-1 being 16±5% g PHAs/g DCW (dry cell weight) and for DFR-2 19±3% g PHAs/g DCW. The HV:HB ratio in DFR-1 was estimated to be (19±4):(81±4), whereas in DFR-2 (26±2):(74±2) indicating that the availability of more odd-VFAs may lead to the production of copolymers with higher HV content i.e. a bioplastic with improved properties.

KEYWORDS: PHAs, condensate, food waste, Draw-Fill Reactors (DFRs).

ACKNOWLEDGMENT

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PAPER ID: cest2023_00310

Nutrients recovery from liquid anaerobic digestate by combining nanofiltration and struvite precipitation - The case of dairy effluents valorization

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ABSTRACT

Results are reported herein of a study aiming to develop an integrated process for valorizing liquid digestate (LD) from an industrial anaerobic digestion (AD) plant treating dairy-processing effluents. The investigated approach involves LD treatment by nanofiltration (NF) membranes, at pilot-scale on-site, followed by precipitation/recovery of struvite in the retentate stream. The obtained NF permeate, for a typical 60% recovery, meets the required standards for restricted irrigation. The significant concentration of nutrients in the NF-retentate (~500 mg/L NH4-N, ~230 mg/L PO4-P) allowes the investigation of struvite precipitation and the determination of near optimum process conditions, through lab- and pilot-scale testing. The results show that the maximum removal of nutrients and production of struvite-rich precipitate is obtained at molar ratio of N:Mg:P = 1:1.5:1.5 and pH=10 in the retentate stream. Additionally, almost complete struvite precipitation can be achieved within ~30 min, whereas solids drying at modest/ambient temperature is desirable to avoid struvite degradation. Under the aforementioned conditions, a significant amount of dry precipitate (~11 g dry mass/L of treated retentate) including crystalline struvite is obtained. The results of this study warrant further development of this integrated process as well as its overall sustainability assessment in comparison to alternative LD valorization approaches.

KEYWORDS: dairy-industry effluents; anaerobic digestion; liquid digestate; nanofiltration; struvite recovery

ACKNOWLEDGEMENTS

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PAPER ID: cest2023_00314

Exploring awareness and practices of rural firms towards a circular economy: A study in rural areas of Greece and Romania

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ABSTRACT

Circular Economy (CE) has been promoted during the last decade through the mainstream EU policy as the alternative to the unsustainable current economic model. However, the awareness levels and practices of CE in the different sectors of the economy have been reported as lower than expected in the scant published research on the subject. This knowledge gap is even more significant for the rural sector of the economy. The current paper presents the state of awareness levels and practices of CE in rural firms. The study has been conducted in the rural areas of Drama County in Greece and Bacau County in Romania following a survey questionnaire approach. A total of 47 rural firms responded to the questionnaire and given the exploratory nature of the study, the data were analyzed with descriptive statistics and correlation analysis. The findings of the study showed that in consideration of the three pillars of CE, environmental impact, resource scarcity, and economic benefits the rural firms in Greece placed higher emphasis on the environmental and resource scarcity pillars of CE, while in Romania on the economic pillar of CE. The study adds to the limited empirical research on CE awareness and practices of rural firms.

KEYWORDS: Rural firms, Circular Economy, Awareness, Practices

ACKNOWLEDGMENTS

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PAPER ID: cest2023_00525

Green Transformation of Organized Industrial Zones (OIZ) to Eco – Industrial Park (EIP): Experiences from Turkiye

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ABSTRACT

Turkiye has been encouraging the industries with green growth perspective and has supported this strategy towards the implementation of new eco industrial parks (EIP) as well as transform the existing organized industrial zones (OIZ) to green conditions. In order to achieve this strategy, certain national and international projects were conducted. Among the projects "Green OIZ Framework Development for Turkey" has special importance. Because "minimum requirements" and/or "green OIZ performance standards" for industrial parks were identified and released as a guideline for industries in Turkiye. Following the guideline development, several studies, workshops and similar regulatory activities were performed by governmental institutions, and certain revisions were carried out in the certification as well as performance indicators. In addition, the mechanisms that are essential for certification were identified. Recently Turkish Standards Institution were authorized by the Ministry of Industry and Technology (MoIT) of Turkiye to certify the OIZs. In the manuscript, EIP concept and the green transformation rules of OIZs in Turkiye are discussed. Indicators adopted to national conditions and a guideline prepared for supporting the green OIZ facilities are reviewed. The studies on green transformation of Tire Organized Industrial Zone are also presented as case study.

KEYWORDS: Eco-industrial park, organized industrial zones, circular economy, resource efficiency, environmental indicators

PAPER ID: cest2023_00194

Nature-based solutions and policy instruments towards an optimal urban design

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ABSTRACT

Urban planning is crucial to promote resilience and liveability of cities in the face of current urbanization patterns and climate change challenges. Nature-based solutions (NBS) are viable alternatives to grey infrastructure, with multiple environmental, social and economic benefits and co-benefits, comprehensively contributing to the sustainable development goals. Despite their widely recognized importance, socio-economic dynamics are less studied – namely in simulation approaches. Additionally, they are rarely considered alongside policy instruments to either steer or potentiate the NBS socio-economic and urbanization impacts. Hence, the objective of this paper is to assess the effectiveness of several simulated NBS and policy instruments in different case studies with different socio-economic contexts. It aims to provide municipalities and policy-makers evidence to learn from and extrapolate expected outcomes based on urban characteristics. From a participatory approach perspective, the methodology included NBS co-design workshops with municipalities as well as NBS and policy instrument scenario simulations. Regarding NBS impacts, attractiveness has proven to be the most relevant characteristic, in combination with urban pre-greenness, size and/or location. Furthermore, NBS in combination with policy instruments demonstrated the potential to maximize NBS benefits and control urbanization processes, such as gentrification and urban expansion, namely though real-estate taxes, subsidies and zoning.

KEYWORDS: Nature-Based Solutions, Policy Instruments, Simulation modelling, Urban design

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Impact of environmental disclosure on financial health of manufacturing firms

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ABSTRACT

Environmental reporting can help firms stay in compliance with environmental regulations and manage environmental risks. By proactively addressing and disclosing their environmental impact, manufacturing firms can mitigate potential legal and regulatory penalties, fines, and reputation damage, thereby safeguarding their financial performance. In addition to the latter perspective, cost savings and operational efficiency, enhanced reputation and stakeholder engagement, as well as access to capital and investment opportunities, are critical factors to ensure that firms disclose information about their environmental performance, including its impact on the environment, sustainability initiatives, and environmental risks and opportunities to ensure that they maximise their financial performance. Hence, the aim of this study is to explore the relationship between environmental reporting and financial performance of South African listed manufacturing firms. A multiple regression analysis was adopted to achieve the aim by testing the relationship between the variables amongst a sample of 50 manufacturing firms listed on the Johannesburg Stock Exchange (JSE). A content analysis was utilized to attain environmental reporting information themes from the integrated annual reports retrieved from the JSE for the period 2016 to 2020. The results indicate a negative association between environmental reporting responsibility and financial performance, measured by return on equity (ROE) when the components of environmental reporting are tested individually. However, when these components namely: environmental reporting, social reporting and environmental degradation are combined the findings reveal a positive and statistically significant relationship. These results imply that the adoption of environmental reporting, specifically an increase on the quality of environmental reporting results in an increase in the manufacturing firm performance.

KEYWORDS: Environmental reporting, financial performance, sustainability reporting, manufacturing firms

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Treatment of three agro-industrial wastewaters by dried bio-absorbent orange peels and brewery spent grains

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ABSTRACT

This study aims to determine the efficiency of reducing the phenol content (hence BOD/COD) of three agro-industrial wastes: olive mill effluent- olive mill wastewaters- OMW, brewery sludge – BS, and white wine lees – WWL by orange peel (OP) and dried brewer' spent grains (BSG). Orange peels and dried brewer's spent grains are found to have absorbing properties to phenolic compounds. They can be characterized as absorption materials that use the mechanism of absorption (same as activated carbon- sorbent material/precursor mechanism) (Gayatri, 2010)

KEYWORDS: Olive mill wastewaters, brewing sludge, white wine lees, orange peels, brewery spent grains

ACKNOWLEDGMENTS

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The effects of biostimulant application on *Lavandula angustifolia* cultivation under deficit irrigation

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ABSTRACT

Lavender, (Lavandula angustifolia Mill.; Lamiaceae) is a native species of the Mediterranean basin and has a wide range of medicinal uses and biological functions. The aqueous extracts, essential oils, and herbal formulations have long been utilized in traditional medicine, hygiene products, and cosmetics. The present study evaluated the effect of four different biostimulant products (Tr1: vegetable proteins + amino acids + 5% carboxylic acids; Tr2: vegetable proteins + amino acids + seaweed extracts; Tr3: 0,3% Stabilized Orthosilicic Acid; Tr4: 35% CaO and 35% SiO2 + Calcium Mobilization and Translocation Factor + 1% Mo, 15% Bo and 30% Zn; and the control treatment (Tr5: no biostimulants added) on field grown Lavandula angustifolia plants under three irrigation levels (I1: 164 , I2: 219 and I3: 274 mm). Lavender seedlings were transplanted in the field on April 2022, at the experimental farm of University of Thessaly, in Velestino, Greece. Each experimental plot included 15 plants and was replicated three times (n=3; 45 plants per treatment). Harvest took place on September 2022 by removing the antennas from each plant. All the antennas from the same plot were pooled in a batch sample for the quantification of essential oil yield with a Clevenger apparatus after air-drying at 42 °C. Our findings demonstrated that a decrease to the water supply (irrigation + precipitation) up to 16% and 31% resulted in a decrease of the fresh weight by 32% and 72%, respectively. Specifically, the fresh weight decreased from 1220 to 832 and to 338 kg ha-1 in the case of I3 to I2 and I1, respectively. Furthermore, irrigation has a considerable detrimental impact on the content of essential oils. Particularly, the highest irrigation dose (I3) resulted in a decrease in essential oil concentration compared to I1 treatment (from 1.86% to 0.99%). Additionally, a statistically significant difference amongst the tested biostimulants was discovered, with Tr4 emerging as the biostimulant with the higher essential oil yield (1.67%). In conclusion, our results indicate that deficit irrigation combined with biostimulants application is a sustainable tool that can ensure fresh biomass yield and high essential oil yield in lavender plants.

KEYWORDS:

Deficit irrigation; biostimulants; sustainable farming; lavender; essentail oils

ACKNOWLEDGMENTS

This research has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepre-neurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T2EDK-05281).

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Drought stress effect on crop development and chemical composition of field grown Scolymus hispanicus L. plants

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ABSTRACT

Lavender, (Lavandula angustifolia Mill.; Lamiaceae) is a native species of the Mediterranean basin and has a wide range of medicinal uses and biological functions. The aqueous extracts, essential oils, and herbal formulations have long been utilized in traditional medicine, hygiene products, and cosmetics. The present study evaluated the effect of four different biostimulant products (Tr1: vegetable proteins + amino acids + 5% carboxylic acids; Tr2: vegetable proteins + amino acids + seaweed extracts; Tr3: 0,3% Stabilized Orthosilicic Acid; Tr4: 35% CaO and 35% SiO_2 + Calcium Mobilization and Translocation Factor + 1% Mo, 15% Bo and 30% Zn; and the control treatment (Tr5: no biostimulants added) on field grown Lavandula angustifolia plants under three irrigation levels (I1: 164 , I2: 219 and I3: 274 mm). Lavender seedlings were transplanted in the field on April 2022, at the experimental farm of University of Thessaly, in Velestino, Greece. Each experimental plot included 15 plants and was replicated three times (n=3; 45 plants per treatment). Harvest took place on September 2022 by removing the antennas from each plant. All the antennas from the same plot were pooled in a batch sample for the quantification of essential oil yield with a Clevenger apparatus after air-drying at 42 °C. Our findings demonstrated that a decrease to the water supply (irrigation + precipitation) up to 16% and 31% resulted in a decrease of the fresh weight by 32% and 72%, respectively. Specifically, the fresh weight decreased from 1220 to 832 and to 338 kg ha-1 in the case of I3 to I2 and I1, respectively. Furthermore, irrigation has a considerable detrimental impact on the content of essential oils. Particularly, the highest irrigation dose (I3) resulted in a decrease in essential oil concentration compared to I1 treatment (from 1.86% to 0.99%). Additionally, a statistically significant difference amongst the tested biostimulants was discovered, with Tr4 emerging as the biostimulant with the higher essential oil yield (1.67%). In conclusion, our results indicate that deficit irrigation combined with biostimulants application is a sustainable tool that can ensure fresh biomass yield and high essential oil yield in lavender plants.

KEYWORDS: Golden thistle; deficit irrigation; drought stress; nutritional value; wild edible species

ACKNOWLEDGMENTS

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PLA based nanocomposites with Cellulosic and Lignocellulosic nanofibers as a biodegradable solution for green food packaging

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ABSTRACT

The HIPERION project aims at the sustainable production of various types of nanocellulose, such as microfibrillated cellulose (MFC), cellulose nano-fibrils (CNF), nanocrystalline cellulose (NCC) and bacterial nanocellulose (BNC), for the development of high-performance industrial materials for green food packaging, paper packaging, adhesives and wood coatings.

In that manner, different types of cellulosic and lignocellulosic fibers (i.e., CNF and LCNF received from University of Maine and API-Europe respectively), after freeze drying at -50 oC, were incorporated to PLA (grade 3052d from NatureWorks) by melt blending at various concentrations with or without the incorporation of the crosslinking agent Dicumyl Peroxide (1% or 3% wt.). The final films were produced after melt pressing. Thermal treatment on samples containing the peroxide initiator has been shown to crosslink PLA and also graft chains to cellulosic fibers (Wei et al., 2016).

The chemical composition and structure of the produced films were studied via Raman spectroscopy (μRaman T-64000), IR transmission (FTIR/IR) and Reflectance (ATR/IR) measurements (Bruker Alpha II), while their thermal and thermomechanical properties were studied by Differential Scanning Calorimetry (DSC Q100) and Dynamic Mechanical Analysis (DMA 850).

The suitability of the final products is performed by a release study of different molecular entities migrating through the polymer matrices in EU certified food simulants, using certified methodologies (i.e., UV/VIS, Surface Enhanced Raman Spectroscopy SERS, etc.) and specially designed cells/devices.

KEYWORDS: Bioplastics, Food Packaging, Lignin, Nanocellulose, Nanofibers

ACKNOWLEDGEMENTS

This research has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T2EΔK-01394 "High Performance Industrial Materials based on Nanocellulose").

European Union European Regional Development Fund · Hellenic Republic Ministry of Development and Investments Special Secretariat for ERDF & CF Programmes Managing Authority of EPAnEK · EPAnEK 2014-2020 Operational Programme Competitiveness Entrepreneurship Innovation · ΕΣΠΑ 2014-2020 Partnership Agreement 2014 - 2020

Co-financed by Greece and the European Union

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SESSION 11 - ECOLOGY, ENVIRONMENTAL CHANGE AND MANAGEMENT

Thursday 31 August – morning

Paleolimnological approach infers past environmental changes archived in lake sediments of Bukit Merah Reservoir, Malaysia.

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ABSTRACT

Human activities in the watershed of Bukit Merah Reservoir, have significantly increased, placing unprecedented pressure on this important system. However, long-term records of the ecological effects are scarce. Thus, this research aims to examine the impact of human-induced environmental change on the reservoir using a paleolimnological approach. Two 25 cm sediment cores were extracted from the reservoir using a Uwitech corer, and analysed for 210Pb, elemental geochemistry, and diatom remains. Using 210Pb and the Constant rate of Supply Model (CRS) the oldest sediments (22.5-24.5 cm) were dated to AD 1985 ± 34 years. The mean concentration of metals (As, Cd, Cu, Pb, and Zn), total nitrogen (TN), total organic carbon (TOC), and total phosphorus (TP) increased from the bottom of the core and fluctuated to the top. This may be ascribed to increasing usage of agrochemicals, tourism, industry contributions, sand excavation, and inputs from small and medium-scale companies in the catchment area. In this study, the dominance of diatom species (Aulacoseira granulata, Aulacoseira ambigua, Discostella stelligera, and Cyclotella meneghiniana) throughout the length of the core, indicates high productivity of the reservoir due to continuous human impacts. As a result, immediate action is needed to further ameliorate the degradation of the reservoir.

KEYWORDS: Paleolimnology, sediment core, diatom, geochemical, human impact

ACKNOWLEDGMENTS

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Decreased Dissolved Oxygen Affecting Sustainability of Mussel Farming in East Manila Bay, Philippines

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ABSTRACT

Manila Bay is surrounded by industrial, urban and populated cities of the Philippines and exposed to various pollutants. A hydrodynamic model previously simulated with the influence of tides, winds, rivers and pharmaceutical pollutants showed high dissolved organic pollutant concentration near Pasig & Pampanga Rivers and on the eastern side of the bay where mariculture, especially mussels proliferate (Enova et al, in progress). These organic pollutants may contribute to lower dissolved oxygen (DO) and hypoxic conditions (<2 mg/L) deeper than 4 m in Navotas, and 6 meters in Paranaque. Low DO levels at the bottom waters are consistent with anecdotal reports from fisherfolks that mussels survive at the upper 2 meters of the water column in the past few years rather than at the seafloor. Monitoring of dissolved oxygen is vital in this area as it may affect mussel growth and reproduction. Moreover, targeted monitoring and analysis of specific organic pollutants and other factors that may contribute to hypoxia is recommended for a more comprehensive discussion of the health of Manila Bay and sustainability of mariculture.

KEYWORDS: Hypoxia, Manila Bay, Pollutant Transport, Mariculture

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Knowledge Evolution in Agroecology in Mediterranean Areas: A Bibliometric Analysis

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ABSTRACT

The loss of productivity of agri-food systems today is known, partly related to biodiversity loss. To reverse this situation, adopting sustainable agri-environmental practices has been proposed. However, there are not enough studies in the scientific literature to explain why in-depth transformations to sustainable agroecological models are not taking place at all scales and dimensions. Therefore, based on the number of publications and trend topics, this study aims to analyse the evolution of knowledge in "agroecology" and see if its development is linked to climate policies and. agreements. A survey of all the scientific articles collected on the Web of Science (WoS) between 1992 and 2022 by affiliated authors from France, Spain, Italy, Portugal, and Greece is carried out. For the analysis, a bibliometric analysis was performed (with R 3.6.2 (Biblioshiny package)). The first publications were observed in 1992. More than 95% of the publications took place in 2011. French research institutions led this trend, publishing 55% of the articles. The evolution of knowledge observed over the last few years has been linked to the transition towards sustainable agriculture through the study of agroecological practices, e.g., "agroforestry", able to face different challenges related to loss of "biodiversity" and "climate change.

KEYWORDS: sustainable agriculture, agrobiodiversity, agroecology practices, scientometrics analysis, biblioshiny.

PAPER ID: cest2023_00115

Techno-economic, environmental and social assessment of precision agriculture for stone fruit production

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ABSTRACT

Precision agriculture is a powerful solution to mitigate the environmental impact of agricultural systems, optimize crop inputs and cost reduction. The aim of this work is to analyze the benefits of precision farming practices (irrigation, fertilization and phytosanitary treatment) through a life cycle sustainability assessment (environmental, economic and social impacts) using a detailed life cycle inventory for stone fruit production compared to traditional production. The 8-year life cycle inventory was provided by a local producer in southern Spain. The system boundaries include a "gate to farm gate" approach using 1 kg of stone fruit as the functional unit. The streamlined analysis incorporates environmental, life cycle cost and social risk analysis for this crop production. The results show that the reduced input requirements of the precision agriculture scenario led to lower environmental damage, reduced economic costs and lower social risks, with average impact reductions ranging between 20-30% in most sustainability categories.

KEYWORDS: life cycle sustainability assessment; variable application of inputs; nectarine;

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Season Dynamics of Pollution and Changes in Enzymatic Activity in Agricultural Soil near an Industrial Area

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ABSTRACT

The aim of the study was to assess the ecological condition of soils in three regions in Armenia - Hrazdan, Gavar, and Martuni. It was shown that the soil samples from the three regions had low humus content in winter. However, in spring and summer, a significant increase in humus content was observed. The soils had a neutral pH of 7.11 to 7.83. The enzymes studied belong to the class of hydrolases (invertase and urease) and oxidoreductases (catalase). The urease activity was almost 2-3 times lower than invertase activity in all soil samples. During the winter-spring period, high catalase activity was observed in all soil samples. It was found that in Hrazdan and Martuni regions the enzyme activity was on average 62% higher than in soil samples from Gavar regions. The HMs distribution depends on seasonal variations and the wind rose in each region. In order to interpret the results, the given total contamination index (Zc) was compared, taking into account the cloud concentration of chemical elements. The value of the total index of pollution of arable soils by HMs near the Gavar region also had a moderately dangerous value.

KEYWORDS: Soil; humus; pH; enzymes; heavy metals; total contamination index.

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PAPER ID: cest2023_00311

Study Of The Performance Of Ruscus Aculeatus Leaves Alcoholic Extract As Corrosion Inhibitor For Carbon Steel In 1 M HCl Solution

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ABSTRACT

The addition of corrosion inhibitors is one of the most widely used methods for the protection of metals and alloys from corrosion in various environments. Although synthetic organic compounds have been found to be highly effective in mitigating corrosion, they are often toxic, non-biodegradable, and rather expensive. Plant extracts are among the environmentally friendly alternatives to replace organic compounds as corrosion inhibitors. This study aims to investigate the corrosion inhibition efficiency of the Ruscus aculeatus leaves (RAL) alcoholic extract for carbon steel immersed in 1 M HCl solution, using weight loss and potentiodynamic polarization measurements. The optimum concentration of RAL alcoholic extract, i.e. 200 mg/L, gave a corrosion inhibition efficiency of 91.09% at 25 ºC. Potentiodynamic polarization measurements showed that the RAL alcoholic extract acts as a mixed-type inhibitor with a predominant influence on the anodic corrosion reaction. The corrosion inhibition efficiency of the RAL alcoholic extract decreased at an acceptable rate with increasing temperature in the 25–55 ºC range.

KEYWORDS: Ruscus aculeatus, carbon steel, alcoholic plant extract, potentiodynamic polarization, green corrosion inhibitor

PAPER ID: cest2023_00406

Strategies for the implementation of the sustainable development in protected areas: the case study of the Regional Park of Monti Lattari (Italy)

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ABSTRACT

Protected areas today cover about 17% of the territory. They aim to preserving environmental quality, ecosystem balance and biodiversity. Although in Italy protected areas are around 10%, in Campania it's very high and is about 25%. In the last 10 years the number of protected sites has increased by 42% worldwide. Today the general approach to safeguarding is strongly conservative.

Due to phenomena such as climate change, deforestation and urbanization, it has emerged that crystallizing the environmental state is impossible. Targeted and effective policies are necessary from the systemic perspective introduced with the Natura 2000 network. Environmental protection must be active to enable sustainable development, to respect the environment and to enhance strategic sectors such as agriculture, tourism and sport. This paper illustrates the sustainable development strategies for the management of protected areas to control environmental pressures and enhance natural ecosystems and biodiversity. The case study of the Monti Lattari Regional Park in southern Italy will be examined. It is characterized by a vast and complex territory that includes mountain and sea areas of high environmental and landscape value. This protected site is interesting to analyze because recently actions for the environmental safeguard have been taken.

KEYWORDS: Protected area, Natura 2000 Network, Conservation, Ecosystem, Environmental Strategies

PAPER ID: cest2023_00509

Cornus Sanguinea Leaves Alcoholic Extract As Corrosion Inhibitor For Carbon Steel In Acidic Solutions

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ABSTRACT

In recent years finding environmentally friendly and affordable sources to mitigate corrosion has become demanding in many industries due to the increased awareness related to environmental issues. Due to their readily availability, biodegradability, low toxicity and relatively low cost, plant extracts have been shown to be an effective alternative for corrosion protection of different metals in various environments. This work reports on the performance of the alcoholic extract of Cornus sanguinea leaves (CSL) as a green corrosion inhibitor for carbon steel (CS) immersed in 1 M HCl solution. Weight loss and potentiodynamic polarization techniques have been used to investigate the corrosion rate (CR) of the CS samples immersed in the 1 M HCl solution with and without the addition of various concentrations of the CSL alcoholic extract. The addition of 250 mg/L CSL alcoholic extract resulted in the highest corrosion inhibition efficiency (CIE) (i.e. 91.68%) at 25 ºC. The polarization curves showed that the CSL alcoholic extract acts as a mixed-type inhibitor. A significant decrease of the CIE of the CSL alcoholic extract was observed when increasing the temperature in the range 25–55 ºC.

KEYWORDS: Cornus Sanguinea, carbon steel, alcoholic plant extract, potentiodynamic polarization, green corrosion inhibitor

PAPER ID: cest2023_00408

Transforming wild rabbits' overpopulation problem into a local biotic resource of Lemnos island

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ABSTRACT

For more than 20 years, the European Wild Rabbit (WR) (Oryctolagus Cuniculus) is considered a pest in Lemnos island, Greece, due to significant crop damage. Authorities took insufficient actions to control WR overpopulation, resulting only in managing its effect on crop losses with farmers' compensation. The current study aims to redefine the WR problem in Lemnos by transforming the WR population to a local commodity, where hunting could supply the local market (restaurants and butcheries) with WR products. Semi-structured qualitative interviews from local stakeholders were analyzed using content analysis, to identify their priorities on the WR problem. Additionally, relative local press articles (2005-2023) were recorded and analyzed qualitatively. Furthermore, European and National legal framework was studied to understand the implementation of hunting and selling procedures of WR in local markets. The main events' timeline of the WR overpopulation problem was identified and the stakeholders' key points were combined to create a viable solution. These highlights include the affected areas of interest, hunting processes, and local interest in the supply and demand of WR consumption. The national legislation on hunting and selling of WR at the local market was identified, and its activation is proposed for turning the WR into a sustainable product of local gastronomy.

KEYWORDS: Oryctolagus cuniculus, Lemnos, sustainable development, hunting, local gastronomy

FUNDING

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European Regional Development Fund

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MINISTRY OF DEVELOPMENT AND INVESTMENTS
SPECIAL SECRETARIAT FOR ERDF & CF PROGRAMMES
MANAGING AUTHORITY OF "COMPETITIVENESS" PROGRAMME

EPAnEK 2014-2020
OPERATIONAL PROGRAMME
COMPETITIVENESS ENTREPRENEURSHIP INNOVATION

ΕΣΠΑ 2014-2020
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Partnership Agreement 2014 - 2020

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PAPER ID: cest2023_00288

Study of fragmentation and land use changes in the Natural Parks of Galicia

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ABSTRACT

In this study the relationship between land use changes and landscape fragmentation in the Natural Parks of Galicia, Spain, during the period 2000-2018 was studied, using landscape indexes such as effective mesh size, Simpson's index, and the number of patches to measure fragmentation. The results show that unprotected areas have a higher degree of fragmentation than protected areas, a decrease in diversity and an increase in the number of patches in unprotected areas. The results show that most land covers have slightly increased in area, except for land covers related to agriculture, which have decreased significantly. It is concluded that it is necessary to implement measures to reduce landscape fragmentation and preserve biodiversity in these protected areas.

KEYWORDS: Protected areas, Land cover Changes, Fragmentation, Landscape indexes, Unprotected Zones.

PAPER ID: cest2023_00359

The invisible environmental impact of tourism in show caves: microplastic pollution in three Italian show caves

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ABSTRACT

Show caves are the most important geological heritage in the world, a significant economic resource and unique ecosystems characterized by speleothems, particular species and important drinking water reserves, however, microplastic (MP) pollution in caves is poorly studied. The deposits of three NW Italian show caves were investigated: for each cave, six sediment samples were collected along the tourist paths and one in a non-touristic area. MPs were identified and characterized using MUPL automated software, observed with and without UV light under a microscope, and verified under µFTIR-ATR. MPs were present in sediments of all examined caves: an average of 4300 MPs/kg were found along the tourist paths and of 2570 MPs/kg in the speleological zones. MPs less than 1 mm, fibre-shaped, polyesters and polyolefins dominated the samples suggesting that synthetic clothes are the main source of pollution in show caves. Our results highlight a high pollution of MPs in the examined show caves, despite the different touristic and environmental characteristics. The subterranean environment monitoring gives useful information to assess risks posed by MPs in show caves and consequently define strategies for the conservation and management of caves and natural resources.

KEYWORDS: microplastic, show cave, geological heritage, sediment, tourist impact

ACKNOWLEDGMENTS

The authors are grateful to the Toirano, Borgio Verezzi and Bossea caves managers. Funding: This work was realised within the research project "SHOWCAVE: a multidisciplinary research project to study, classify and mitigate the environmental impact in tourist caves", funded by the Italian Ministry of Education, University and Research [PRIN: Progetti di ricerca di rilevante interesse nazionale 2017 - Prot. 2017HTXT2R; PI: Prof. Marco Isaia, University of Torino].

PAPER ID: cest2023_00377

SESSION 12 - ADVANCED OXIDATION PROCESSES AND WATER TREATMENT (V)

Thursday 31 August – morning

Comparison between plasma microbubbles and gas-liquid dielectric barrier discharge (DBD) plasma for pollutants degradation in water

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ABSTRACT

This study's main emphasis is the direct comparison between gas-liquid dielectric barrier discharge (GLDBD) and plasma microbubbles (PMB) concerning the kinetics related to the contaminant's destruction and plasma-activated water composition. As contaminants with different structures, methylene blue (MB), methyl violet (MV), methyl orange MO) and sunset yellow (SY) were investigated. For the PMB system, low concentrations of long-lived plasma species were measured and an almost neutral pH, while on the contrary for the GLDBD high long-lived species concentrations and a significant pH decrease was recorded. This study sheds light on how the GLDBD and PMB systems can be used to expand the use of cold plasma-based wastewater treatment.

KEYWORDS: Plasma bubbles; Dielectric barrier discharge; Plasma-activated water; Wastewater treatment; Reactive oxygen and nitrogen species; Cold atmospheric plasma.

ACKNOWLEDGMENTS

This research has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T1EΔK-02873; project title: "Removal of organic wastes from polluted soils with cold plasma - REMPLASMA").

Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

PAPER ID: cest2023_00070

Destruction of Perfluorooctanoic acid (PFOA) in water by cold atmospheric plasma

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ABSTRACT

Cold atmospheric plasma was investigated as for the remediation of perfluorooctanoic acid (PFOA) contaminated water. The destruction of the highly toxic PFOA is a challenging task since it is a persistent and bioaccumulative chemical causing pollution in waterbodies. In this study, plasma experiments were conducted in a gas-liquid DBD (GLDBD) reactor, driven by high voltage microsecond pulsed generator. The effect of different critical parameters such as the treatment time and the plasma gas were investigated towards the degradation of PFOA in water. It was observed that air has a better performance compared to argon. In particular, a complete degradation of PFOA (>99.9%) was noticed with the air-GLDBD reactor after 30 min of treatment with the corresponding electrical energy per order (EEO) being ~900 kWh/m3.

KEYWORDS: Per- and polyfluoroalkyl substances (PFAS), cold atmospheric plasma (CAP), wastewater treatment, dielectric barrier discharge (DBD), reactive oxygen and nitrogen species (RONS)

PAPER ID: cest2023_00072

Removal Of Ciprofloxacin From Waste Water By Photocatalytic Method With Waste Polystyrene And Tio2 Composites

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ABSTRACT

Ciprofloxacin (CIP) is one of the widely used antibiotics. Since ciprofloxacin in the aquatic ecosystem adversely affects human health as well as other organisms, it must be removed from wastewater.

The aim of this study was to develop polystyrene (PS) and TiO_2 composites that can be used as catalysts in CIP removal by photocatalytic process. Waste PS was used in these composites. This is important in terms of the use of one waste in the removal of another waste.

This process is optimized using Box-Behnken Design. Parameters such as the amount of polymer in the composite, pH and initial CIP concentration were studied and their effects on CIP removal were investigated.

The validity and adequacy of the selected model were evaluated according to the relevant statistical data. These are $R2=0.9751$, adjusted $R2=0.9565$, the model's p-value <0.0001 and the lack of fit-value 0.246. In the process carried out under optimum conditions, the CIP removal was found to be 95.01% at the end of 180 minutes. This value was predicted as 94.37% in the model. According to these results, it was seen that the model represents the real process with high accuracy.

KEYWORDS: Ciprofloxacin, waste polystyrene, TiO2, photocatalyst

PAPER ID: cest2023_00089

Photocatalytic Degradation Of Aldrin Under The Influence Via Ozonation In The Presence Of Ag2o/Smfeo3 Under Visible Light

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ABSTRACT

The photocatalytic degradation of aldrin, a hugely toxic and commonly used pesticide was studied using Ag doped $SmFeO_3$ as a heterogenous catalyst under ozonation reaction. Various photocatalytic nano particles were prepared with varied dopant percentage (1%, 2.5% and 5%) which were characterised using various analytical and morphological techniques. A magnificent degradation of aldrin up to 99.9% was achieved using 50 mg/L of 5% $Ag_2O/SmFeO_3$. It was observed that the degradation was highly efficient at a basic pH of 11 leading to mineralisation of any intermediates produced in the process within 2 h. The extent of degradation was monitored by GC-MS and TLC. Overall mineralisation was tracked using TOC value. The catalyst was easily separated from the reaction mixture using simple ultra filtration method. The separated catalyst was again washed and dried to be used for the next 7 cycles. This method has a promising scope with the development of such perovskite heterogenous photo catalyst for almost complete degradation of the hazardous chemicals released into water bodies such as aldrin.

KEYWORDS: Aldrin; Advanced Oxidation Process; Photocatalyst; $Ag_2O/SmFeO_3$; Degradation

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Application of KO2/ClO- advanced oxidation process to degradation of polycyclic aromatic hydrocarbons on example of phenanthrene

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ABSTRACT

Novel advanced oxidation process based on KO2 and ClO- was applied to degradation of polycyclic aromatic hydrocarbons. It is a wide group of compounds which are negative impact on human health. Phenanthrene was chosen to represent this group of compounds due to its relatively good solubility in water and relatively low toxicity in comparison to other compounds belonging to this group. Trials of application of this method to degradation PAHs showed that phenanthrene is resistant to oxidation by this method. Only a few percent loss of phenanthrene were observed after one hour of process. Resistant of other compounds belonging to PAHs should be the aim of research in future.

KEYWORDS: PAHs, Advanced oxidation processes, PAHs degradation, wastewater treatment, sewage sludge treatment

ACKNOWLEDGMENT

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PAPER ID: cest2023_00483

Adsorption of antibiotics and dyes with individual and simultaneous mechanisms onto halloysite nanoclay and regeneration by cold plasma bubbling technology of saturated adsorbent

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ABSTRACT

Methylene blue (MB) dye and the antibiotic enrofloxacin (ENRO) were individually and simultaneously removed from aqueous solutions while halloysite nanoclay (HNC) was also regenerated using cold atmospheric plasma (CAP) bubbling. In contrast to Fenton oxidation, the CAP-bubbling method efficiently regenerated the saturated HNC, while in parallel enhanced adsorption capacity of the CAP-regenerated HNC (compared to raw HNC) was noticed after reuse in new adsorption cycles which indicates the activation of the absorbent activation during the regeneration process. This study proposes a safe, long-lasting, and highly efficient method for contaminated water remediation in which pharmaceuticals and dyes co-exist.

KEYWORDS: nanoclays; adsorption; cold atmospheric plasma; regeneration; halloysite

ACKNOWLEDGMENTS

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HORIZON 2020

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PAPER ID: cest2023_00069

Removal Of Selenium From Polluted Water By Fexoy-Sucrose Foams

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ABSTRACT

A series of iron-based carbon foams were evaluated as adsorbents for selenium removal from aqueous solutions. The carbon foams were prepared using sucrose as a precursor and then impregnated with different iron oxides/hydroxides. The efficiency of iron-based sucrose foams was compared to that achieved with a commercial activated carbon impregnated by the same method. The sucrose foams showed removal percentages of 10-90% depending on the synthesis process and pH (2 7). Acidic pH enhanced the adsorption of Se increasing the removal percentages up 80-90%. The chemical and textural properties of the carbon support play a fundamental role in the type of iron species loaded, and hence in the adsorption of selenium. The morphology and dispersion of the iron nanoparticles can also influence the adsorption processes. Furthermore, the sucrose foams developed in this study could be an efficient and sustainable method to remove other metalloids from wastewater.

KEYWORDS: adsorption; inorganic selenium; carbon foams; sucrose; iron nanoparticles

ACKNOWLEDGMENTS

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PAPER ID: cest2023_00356

Electrified membranes for microplastic fouling mitigation

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ABSTRACT

The excessive use of plastics has created a route for microplastics into our water and wastewater treatment plants. Coupled with the on-going water crises, this creates a threat to fresh water availability as microplastics disrupt the operation of these plants. Microplastics result in severe fouling to low pressure membrane technologies, such as ultrafiltration. Electrified membranes are suggested as an alternative microplastic fouling mitigation strategy. In this study, polyethersulfone (PES) pellets were sulfonated to create sulfonated polyethersulfone (SPES), resulting in an additional layer of negative charge for microplastic repulsion. PES and SPES membranes were then fabricated using non-solvent induced phase inversion, and tested under DC electric field as a fouling mitigation strategy. Additionally, several characterization techniques were utilized to confirm the sulfonation and study the morphology and structure of the fabricated membranes. These include Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS), X-ray diffraction (XRD), Raman Spectroscopy, and Fourier Transform Infrared Spectroscopy (FTIR). Finally, the microplastic flux, pore characteristics, hydrophilicity and charge of the fabricated membranes were determined experimentally. The microplastic flux increased by 16% in SPES compared to PES at 0 V. Additionally, the microplastic flux increased from 22.7 ± 0.9 L/m2.h in PES at 0 V to 34.0 ± 0.9 L/m2.h in SPES at 5 V, which reflects a 49% increase. This study lays basic foundations for this system as a microplastic fouling mitigation strategy, and creates a route for future studies on suitable membrane materials to enhance the system.

KEYWORDS: Microplastics; membrane fouling; ultrafiltration; electrochemical system

PAPER ID: cest2023_00082

Impact of synthetic musks on interspecies interactions among drinking water-isolated bacteria

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ABSTRACT

Musk fragrances are used in a wide variety of personal and house-care products, providing pleasant scent products for routine use. Therefore, these molecules are becoming emerging pollutants, which have been detected in water bodies and drinking water (DW) worldwide. Musk contaminants have concerning consequences for the environment and human health due to their bioaccumulation in the environment (particles and living organisms), and the associated endocrine disruption effect. Despite these known consequences, the scientific community has disregarded the impact of synthetic musks on microbial communities. Therefore, in this work, the impact of two widely used polycyclic musk (galaxolide and tonalid) on bacteria isolated from DW (Acinetobacter calcoaceticus, Burkoldheria cepacia, and Stenotrophomonas maltophilia) was evaluated. For that, mixed species biofilms were formed on polyvinyl chloride (PVC) and exposed for 7 days to galaxolide and tonalid. Then, the interaction among bacteria was evaluated in terms of the metabolic activity of biofilms and the ability of coaggregation. Results demonstrated that mixed biofilms formed by bacteria previously exposed to tonalid were metabolically more active than non-exposed biofilms (an increase of 42% in the metabolic activity was observed in comparison to the control). Also, the ability of auto-aggregation of A. calcoaceticus was increased by 41% after exposure to tonalid for 7 days, as well as the ability of this bacterium to co-aggregate with S. maltophilia was increased by 21% after exposure to tonalid. Galaxolide did not cause significant alterations in the interactions among the selected bacterial species. The presence of tonalid in DW seems to alter bacterial interaction, promoting the development of metabolically more active biofilms and the formation of aggregates, with a consequent increase in resistance to disinfection.

KEYWORDS: biofilms, co-aggregation, drinking water, galaxolide, tonalid

ACKNOWLEDGMENTS

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PAPER ID: cest2023_00203

Treatment of a Toluene Gas Stream by Persulfate-based Advanced Oxidation Process in a Bubble Column Reactor

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ABSTRACT

Volatile Organic Compounds (VOCs) are volatile and photo-chemically reactive species, which exhibit physical and chemical properties that allow them a great capacity for dispersion, which means that they can volatilize, dissolve in water, and/or adhere to soil particles. These characteristics, allied to their high toxicity and carcinogenicity, responsible for numerous environmental and health problems, led the Environmental Protection Agency to consider that 97 of the 189 priority pollutants registered, are VOCs. This highlighted the importance of eliminating such compounds, which are an assiduous presence in gaseous effluents derived from chemical and petrochemical industries. Toluene is one of them, being usually present in high concentrations. Although there are some treatment methods that can be applied to promote the decontamination of a toluene-containing gaseous stream, up to the authors' knowledge, only one study, developed by the group, reported the application of an activated persulfate-based Advanced Oxidation Process (AOP). This is a very promising process that can be efficiently applied to degrade toxic organic pollutants. In this work, a bubble column reactor was used; the treatment occurred through the toluene's transfer from the gas stream to the liquid effluent, wherein the sulfate radicals are generated, being toluene degraded therein. The persulfate activation was done through the pH change and the presence of metal ions as catalyst. A parametric study was performed, being therefore analyzed the influence of some parameters on the degradation of the model pollutant, aiming to find the best operating conditions that allow maximizing the toluene removal (and the organics by-products mineralization). Still, the work also focused on the impact of some hydrodynamic parameters, namely the diffuser plate, reactor configuration and the bubble size, on the process performance..

KEYWORDS: Gaseous effluents, Volatile Organic Compounds, Toluene, Activated Persulfate, Advanced Oxidation Process, Bubble Column Reactor.

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PAPER ID: cest2023_00196

SESSION 13 - WATER AND WASTEWATER TREATMENT AND REUSE

Thursday 31 August – morning

Testing a pilot-scale of constructed wetlands for pharmaceutical wastewater treatment using Jordanian zeolitic tuff

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ABSTRACT

A pilot scale of constructed wetlands (CWs) was designed, constructed and operated on August 2022 at pharmaceutical factory in Jordan. This pilot is aiming to remove pharmaceuticals (i.e. antibiotics) from treated industrial wastewater generated from secondary activated sludge system. Jordanian zeolitic tuff (RZT) and its modification (MRZ) were used as the wetland media in all CWs. A tidal flow constructed wetlands (TF) filled with MRZ was used for the first stage treatment followed by a horizontal subsurface flow (HSSF) filled with RZT as the second stage treatment. To date, the system was operated under the hydraulic loading rate 0.32 m/day for 75 days. The average influent concentrations of COD, TN, and TP were 286, 25, 6 mg/l respectively. The removal performance of COD, TN, and TP achieved up to 55%, 67%, and 25% in the CWs pilot. The removal of three key pharmaceutical compounds, i.e., ciprofloxacin, ofloxacin, flumequine was also monitored in the pilot. Over 99% removal efficiency was achieved for ciprofloxacin and ofloxacin. However, the removal efficiency performance of flumequine achieved up to 68%. The pilot results demonstrated a promising performance for innovate nature-based solutions for pharmaceuticals removal, however, the pilot performance should be evaluated over the whole year to (four seasons)

KEYWORDS: Pilot-scale, Jordanian zeolitic tuff, pharmaceutical compounds; constructed wetlands; industrial wastewater

ACKNOWLEDGMENT

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PAPER ID: cest2023_00073

Sustainable And Cost-Effective Approach For Treatment Of Plating Industrial Wastewater Effluents

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ABSTRACT

The wastewater resulting from the plating industry contains high contents of toxic metals, such as chromium, which is a serious threat to the environment due to its cumulative effects and non-degradability. Several methods have been actively investigated to remove heavy metal ions from aqueous matrices. This research aimed to study the effects of coagulation and filtration on the degree of removal of main toxic metals from the plating industry wastewater. It has been shown that the rate of toxic pollutants removal was significantly influenced by different types of coagulants used in the pre-treatment. The degree of selected metals reduction strongly depended on the pH. However, the removals did not change linearly with the coagulant dosage. The most efficient method was chosen for process conditions in which more than 80% metal reduction was achieved and the final concentrations of copper, chromium, and nickel in the treated wastewater were within the required limits. The use of combined technological solutions made it possible to remove heavy metal ions from wastewater in a sustainable way, allowing to take further work related to metals recovery.

KEYWORDS: heavy metals removal, real wastewater, plating industry

PAPER ID: cest2023_00424

Metagenomic Profile of Bacterial Community and Phage in Domestic Wastewater Treatment Plant

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ABSTRACT

For a better understanding of the microbial community and associated phage abundance in domestic wastewater treatment system, this study did a metagenomics profiling of bacterial community and phage in activated sludge process and chlorination system. The Phylum Proteobacteria is the most abundant group in all streams but the most abundant subgroups of this is different between the raw wastewater and those in activated sludge. The former comprises gamma and epsilon Proteobacteria whereas activated sludge consist of delta and alpha Proteobacteria. The other less abundant Phylum in raw domestic wastewater are Firmicutes, Bacteroidetes and Actinobacteria. The group Delta Proteobacteria are most susceptible to chlorination. Rhodocyclaceae (of beta Proteobacteria) and the family Oxalobacteraceae and Comamonadaceae are also among the most affected by chlorination. Rhodocylaceae and Procabacteriaceae are resistant to chlorine treatment. Rhodocyclaceae are well known polyphosphate accumulating bacteria, which are also responsible for EBPR and their viability is high in activated sludge. On virome profiling, in the influent, the crAss phage, which is commonly found in fecal bacteria, predicted to the host Bacteroidetes, was dominant. The other phage such as Pseudomonas, Escherichia coli, Aeromonas and Lactococcus may also derived from the human gut. EBPR (enhanced biological phosphate removal)-associated phage were observed in all samples except influent. As their hosts, phosphate accumulating bacteria were present in activated sludge.

KEYWORDS: activated sludge, aerobic, chlorination, microbiome, virome

ACKNOWLEDGEMENT

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PAPER ID: cest2023_00276

Application of the Advanced Primary Filtration (APF) process for upgrading overloaded Wastewater Treatments Plants

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ABSTRACT

Advanced Primary Filtration (APF) is an emerging wastewater treatment process for the early removal of suspended solids, aiming to enhance the efficiency of activated sludge Wastewater Treatment Plants (WWTPs), with parallel reduction of electric energy requirements. Two APF systems are currently under installation, as retrofitting processes at the existing activated sludge WWTPs of Kyperounda, Limassol, Cyprus and Marpissa, Paros, Greece, with maximum hydraulic capacities of 1,800 and 2,500 m3/d, respectively. Wastewater loading is expected to increase in both WWTPs, due to the expansion on the sewerage network. The APF process includes in series a rotating belt filter (collectively known as microscreen,) followed by a Continuous Backwash Upflow Media Filters (CBUMFs) and lamellar settling tanks (for the filtration concentrate). The innovation of the study lies in early removal of suspended solids (and thus particulate Biochemical Oxygen Demand (BOD5)), just upfront of the aeration tank. By reducing the organic load entering the aeration tank, there is ground to increase the treatment capacity of the plant without the need for expansion, while the electric energy consumption per volume of incoming wastewater is expected to decrease. Following APF treatment, the Total Suspended Solids (TSS) and BOD5 are expected to be reduced by about 90 and 60%, respectively. As a result, the total electric energy consumption per incoming volume of wastewater is expected to be reduced by 30-35%. The treatment capacity of the WWTPs is expected to increase by about 40%, thus allowing for the expansion of the local sewerage network, without the need for expanding the aeration tank. Following installation, the WWTPs at Kyperounda and Marpissa will be monitored, to prove that process efficiency and to collect data for process scaling up.

KEYWORDS: Advanced Primary Filtration (APF), wastewater treatment plant, energy savings, capacity increase

ACKNOWLEDGEMENT

This study is co-financed by the European Regional Development Fund (ERDF) and national resources of Greece and Cyprus, through the of the Cooperation Program INTERREG V-A Greece - Cyprus 2014-2020: “Upgrade of WWTPs for the management of increased demands and the reduction of the operational cost" (ANELIXI) (MIS:5050701).

PAPER ID: cest2023_00365

The Occurrence and Risk Assessment of Microplastics: different treatment technologies for wastewater treatment plants in Oman

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ABSTRACT

Microplastics (MPs) are considered an emerging pollutants and one of the greatest challenges for the environmental and Sewage treatment plants (STPs) are suspected of being major contributors to environmental MPs. The purpose of this study is to quantify and characterize MPs at different treatment technologies in major STPs in Oman. The Sampling points were Primary, tertiary effluent, and sludge. The samples were sieved in stainless sieves with a different mesh size and undergo wet peroxidation (WPO) to remove the organic matter. Suspected MPs were counted under a light microscope and morphologically characterized into fibers, fragments, foams, spheres, and others. Fiber MPs were dominant in all effluent types, followed by a considerable amount of fragments. Almost all shapes colors and several sizes of MPs were detected in the sludge sample which is considered the sink of MPs. Nonetheless, diverse treatment stages are capable of removing a significant proportion of MPs, However fiber MPs can effectively survive in advanced treatment using ultrafiltration. The outcomes of this study showed that a considerable number of MPs are discharged into the environment through treated effluent and sludge. The application of on-site management advanced practices for MPs remediation such as nanotechnology shall be recommended to the wastewater management authority in Oman.

KEYWORDS: Sewage, Priority Pollutant, Microplastic, Detection

PAPER ID: cest2023_00403

Balaena - Floating offshore Island Utility Platforms

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ABSTRACT

Balaena builds floating offshore platforms which produce freshwater and treat sewage for island and coastal regions. The platforms are powered by renewable energy (wind, solar and wave). The platform is CAPEX free, we have designed this blended financial model so that low- and middle-income countries can have long term sustainable and affordable supplies of freshwater and wastewater treatment with zero emissions.

KEYWORDS: Freshwater, sewage treatment, desalination, renewable energy, offshore,

PAPER ID: cest2023_00586

CYANOTECH: A sustainable and innovative management system for toxic cyanobacteria blooming of surface waters with combined energy production, sustainable agriculture, and food safety.

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ABSTRACT

Blooming of toxic cyanobacteria in surface waters has become more persistent and prevalent globally. Besides their aesthetic and environmental effects, a number of economic sectors including tourism, fishery, food, health, and water industries, experience annual losses in the range of millions USD. With so many diverse sectors of modern living being affected by the same problem, it is crucial to develop and apply innovative and sustainable management systems for toxic cyanobacteria that can be easily adapted into current infrastructures. CYanoTech is a two-year project that proposes a novel, sustainable, and innovative management system for mitigating the effects of toxic cyanobacteria blooming in surface waters while combining energy production and promoting sustainable agriculture and food safety. The CYanoTech system comprises of removal of the excess aquatic biomass (cyanobacteria cells and algae) from water with a low-energy non-mechanical separation technology, the treatment of the aquatic biomass for the production of energy and marketable products (fertilizers), and the application of treated and untreated surface water in hydroponic cultures that produces safe for consumptions crops (cyanotoxins-free crops). The energy produced will compensate for the total energy needs of the applied treatment processes, further reducing the system's overall carbon footprint, making it self-sustainable. Life-Cycle-Analysis will be used to prove the system's sustainability and market accessibility.

KEYWORDS: cyanobacteria, ozone treatment, anaerobic digestion, circular economy

PAPER ID: cest2023_00574

Adsorption-desorption of methylene blue dye onto marine sediments: Kinetics and equilibrium studies

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ABSTRACT

The present study concerns the investigation of the sorption and desorption phenomena of methylene blue (MB), which is an organic molecule used as a synthetic dye in several industries. For that purpose, the batch equilibrium technique was applied by using three marine sediments that were collected from the North Aegean Sea (Greece) and more specifically from unpolluted coasts of Chios island (sample S1), Lesvos island (S2 and S3). The criterion for the selection of those substrates as adsorbent surfaces were based on both their difference in their textural analysis (that ranged between 1.68–34.54%) and the content of organic matter as well (that varied from 1.70 to 5.38%). The obtained experimental results showed that both Freundlich and Langmuir isotherm models could describe the kinetics of the occurred process, whereas the correlation regression coefficients for the fit to that models were calculated to be $R^2 \geq 0.9004$ and $R^2 \geq 0.8487$, respectively. Furthermore, acquired results indicated a positive correlation between the sorption of MB and the organic matter content of marine sediments. Desorption studies revealed that the studied dye in some cases was adsorbed very weakly on sediments tested and hence was easily desorbed with seawater, while on the contrary in other cases MB was adsorbed very strongly on studied matrices with lower quantities of seawater extractable amounts.

KEYWORDS: Methylene blue, Synthetic dyes, Adsorption isotherms, Kinetics, Marine sediments

PAPER ID: cest2023_00467

SESSION 14 - MARINE LITTER - NEW PERSPECTIVES AND METHODOLOGIES

Thursday 31 August – morning

Understanding local communities' perception of marine pollution: a case study of two islands of the Cyclades, Greece

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ABSTRACT

Marine pollution is recognized and addressed worldwide as an environmental issue for which imperative actions must be taken. Floating plastic debris and beach litter may be the first things that come to mind, but the unseen benthic litter and microplastic particles also have a significant impact (Law & Thompson, 2014; Fakiris et al., 2022). The sources of marine litter may vary from fisheries and aquaculture to improper waste management and direct disposal from coastal activities (Forleo & Romagnoli, 2021). On the other hand, the impacts of marine litter are still being investigated but it is already well evidenced that it affects the environment, our health, as well as several social and economic sectors (Galgani, 2015; Beaumont et al., 2019). Island communities could offer an alternative view on the changes and the pressure put upon the marine ecosystems. Engaging with them is crucial not only to gain useful information and knowledge, but also to help create effective and sustainable management strategies, to raise public awareness and encourage change in the consumer's behavior (Sumeldan et al., 2021). The aim of this article is twofold: (i) to understand the local communities' perception of marine pollution on two islands of Cyclades, Greece (Folegandros and Kimolos), and (ii) to assess the effect of a local awareness-raising campaign (SeaChange Greek Islands) that ran for five consecutive years as a means to comprehend and to address this issue on a local level.

KEYWORDS: marine pollution, island communities, marine perception

PAPER ID: cest2023_00550

Exploring the Coastal Marine Litter Observatory (CMLO): An Innovative Approach for Monitoring and Managing Marine Litter Pollution

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ABSTRACT

Marine litter pollution has emerged as a critical environmental issue with far-reaching consequences for marine ecosystems and human well-being. The Coastal Marine Litter Observatory (CMLO) presents an innovative and comprehensive approach to address this pressing challenge. CMLO combines cutting-edge technologies, data analytics, and stakeholder engagement to monitor, detect, and manage marine litter pollution. The present work aims to provide an overview of CMLO, highlighting its key components, methodologies, and contributions to the field of marine litter research and management.

CMLO is centered around the use of Unmanned Aerial Systems (UAS), equipped with high-resolution cameras to collect aerial imagery of coastal areas. The captured images are then processed using advanced artificial intelligence algorithms to detect and classify marine litter. By focusing on litter as small as a cup of a plastic bottle, CMLO ensures the detection of small fragments that have significant ecological implications. The system covers a range of litter categories, including plastics, fishing gear, and other debris types, following international litter guidelines.

The innovation lies not only in the data collection and detection capabilities but also in the data management and analysis infrastructure of CMLO. A web-based platform has been developed to automate data processing, enabling efficient detection and classification of marine litter in real-time. The platform incorporates pre-processing steps, machine learning algorithms, and data visualization tools to provide stakeholders with accurate and timely information on litter distribution and accumulation. Additionally, the platform can generate alerts and notifications when predefined pollution thresholds are exceeded, enabling proactive interventions to mitigate further pollution and protect marine ecosystems.

CMLO also emphasizes the importance of stakeholder engagement and collaboration. The system promotes the involvement of local communities, environmental agencies, policymakers, and researchers in the monitoring and management of marine litter. By fostering a participatory approach, CMLO encourages collective action, knowledge exchange, and the implementation of effective litter prevention and cleanup strategies. By providing accurate and up-to-date information on litter distribution, CMLO empowers decision-makers with valuable insights for policy formulation and resource allocation. Moreover, CMLO contributes to scientific research by facilitating data-driven studies on litter sources, pathways, and impacts, leading to more informed management approaches.

The CMLO represents a groundbreaking approach to monitoring and managing marine litter pollution. Since 2021 CMLO is used in 5 countries located in 3 continents. In Greece more than 88 km of coastline have been monitored with 120.00 aerial images collected and more than 400.000 litter items detected. By combining state-of-the-art technologies, data analytics, and stakeholder engagement, CMLO offers a comprehensive solution to address the global issue of marine litter.

KEYWORDS: marine litter, CMLO, drones, UAS

PAPER ID: cest2023_00547

Capturing Microplastics from Aquatic Systems Using Vortex-based Cyclone Technique

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ABSTRACT

Plastic pollution is an acknowledged global problem. As estimated, about 82% of marine litter is plastics, while about 94% of marine plastics are defined as microplastics (MPs), which is less than 5mm in size. MPs have been regarded as widespread emerging pollutants. Different from the commonly used sedimentation, absorption or filtration technologies for aquatic MP capture, this work proposed a cost-effective and scalable solution using the vortex-based cyclone technique for collecting aquatic-borne MPs. Based on a lab-scaled setup and the use of artificial microbeads, the experimental results showed clear and promising evidence of the proposed concept and technology. Different operating conditions are also investigated with the aim controlling the hydrocyclone at its highest separation efficiency, subject to diverse process variations.

KEYWORDS: microplastics, cyclone separation, efficiency, digital microscopy

ACKNOWLEDGMENT

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PAPER ID: cest2023_00486

Low molecular weight polymers in aquatic environments as pollutants of emerging concerns: recovery, quantification and microstructure

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ABSTRACT

Microplastics and, more in general, synthetic polymer debrides of anthropic origin are accumulating in the environment, in particular in marine water and sediments, with risks associated for aquatic organisms and humans not well wholly understood. In this contribution it is reported a new method for the isolation of microplastics from surface seawater and the quantification by solution 1H nuclear magnetic resonance spectroscopy (1H NMR) with respect to a known concentration of an internal standard (mesitylene) dissolving the microplastics in 1,1,2,2-tetrachloroethane-d2 (TCE-d2). TCE-d2 is a high boiling solvent that allowed the analysis and quantification of poly(ethylene) (PE) and poly(dimethyl siloxane) (PDMS) MPs at 80 °C.

KEYWORDS: microplastics; nanoplastics; recovery; seawater; marine; quantification, microfiltration, NMR spectroscopy, standard method

PAPER ID: cest2023_00540

Using stories to tackle marine pollution

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ABSTRACT

Awareness on marine pollution has grown considerably over the past decades. Marine pollution is widely accepted as one of the greatest environmental challenges and the urgency to tackle it efficiently can no longer be denied. However, increased awareness of the severity of the problem is seemingly not enough to engage stakeholders to change perceptions and willfully become part of the solution. A key reason for this seeming disengagement is the way scientists, media and environmental organizations typically talk about marine pollution. Emphasis on data, shocking as it is, is apparently not enough to drive change. Research increasingly shows that storytelling plays a crucial role in shaping perceptions about environmental issues and in encouraging pro-environmental behaviors. Stories have the power to translate hard to grasp or abstract ideas to understandable concepts; increase empathy; and also help us visualize the world as we would like it to be, providing a clearer target for collective efforts. This paper provides an overview of references to plastic pollution in Greece, as well as to calls to action by various stakeholders. It analyses typical approaches and messages, examines their impact and argues that the strategic use of storytelling centered around positive messages may close the gap between awareness of the problem and action taken to solve it.

KEYWORDS: marine litter, awareness, storytelling, public opinion

PAPER ID: cest2023_00549

Assessing Marine Litter on beaches and the seafloor in the Saronikos Gulf, Greece

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ABSTRACT

Marine litter is a pressing environmental issue that requires urgent attention from international and local authorities. The European Marine Strategy Framework Directive emphasizes the need to achieve Good Environmental Status (GES) in European marine waters by 2020, with a specific focus on marine litter. This study focuses on the Saronikos Gulf, a highly polluted area in the Mediterranean, to assess the abundance, composition, distribution, and possible sources of marine litter. Data were collected from various sources, including databases, published studies, and fieldwork. The study analyzed both stranded litter on beaches and litter on the seafloor to provide a comprehensive understanding of pollution in the area. Results revealed a high prevalence of plastic litter on beaches, particularly polystyrene pieces and cigarette butts. Litter density varied across locations, with higher concentrations in the western part of the gulf. The cleanliness index classified most beaches as having "very low cleanliness." On the seafloor, plastic and metal were the most common types of litter, with litter density decreasing with increasing depth. This study contributes valuable insights into the extent and characteristics of litter pollution in the Saronikos Gulf, aiding in the development of targeted solutions for its management and conservation.

KEYWORDS: Saronikos gulf, litter, beach, seafloor, plastic

PAPER ID: cest2023_00554

PCBs measured in plastic pellets from different beaches in Saronikos Gulf, Greece

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ABSTRACT

For several years, some research groups use plastic pellets as passive samplers for the monitoring of persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs). In the present study, plastic pellets are used to determine the diffuse pollution spread in plastic marine debris throughout a closed gulf, the Saronikos Gulf in Greece. Samples of pellets were taken every five years from different beaches and were analyzed for PCBs using solvent extraction and chromatography methods. Passive air sampling was also performed to determine the sources of pollution in plastics. Plastic pellets collected in Saronikos Gulf beaches demonstrated a rather uniform overall PCBs concentration (~200 ng/g pellet) in time (2009, 2014, 2019) and space e.g. beaches located on mainland and beaches located on islands in the Gulf. All concentrations reported were the concentrations of a sum of 13 PCB congeners. Previous studies have shown that average PCBs concentrations in pellets from other beaches located in Greece but away from highly industrialized areas were above concentrations in blank virgin pellets but were much lower (~6 ng/g pellet) than the ones in pellets from Saronikos Gulf. The PCBs congener profile is similar for all pellets even if they are collected from different beaches of the gulf suggesting the same historical pollution source with a tendency to move away from the mainland over the years. The historical character of the pollution is also corroborated by the air sampling which suggested that there is minimum input from the atmosphere (~27 pg/m3 measured in a polyurethane disk) close to the minimum quantification level. Based on data collected in this study and the International Pellet Watch program, pollution in marine plastic debris in Saronikos Gulf, Greece, is comparable to other heavily industrialized places of the world and tends to move away from the mainland. PCB concentrations at the remote locations are comparable (interestingly higher) to that in the urban/industrial site. A similar trend was observed in Tokyo Bay, in previous research. Millimeter-sized plastics carry hydrophobic pollutants such as PCBs from industrial centers to near-by remote areas for several tens of kilometers or more. These observations may mean homogenization of pollution levels by floating and movable plastics.

KEYWORDS: microplastics, pollution, PCBs, Saronikos Gulf

PAPER ID: cest2023_00557

Shallow Seafloor Litter: Tracking their Sources and Spatiotemporal Trends in the Presence of Oceanographic Drivers through efficient monitoring.

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ABSTRACT

Seafloor litter is the least exploited component of marine litter. The spatially variable distribution of their densities over time is a cumulative effect of sources' intensities and natural drivers like wind/wave and current conditions in interaction with seafloor morphology. Making safe interpretations about the exact spatiotemporal distribution of benthic litter requires good knowledge of the local above-mentioned seafloor components. In this work, visual monitoring over 3 years of a shallow urbanized bay in Syros Island, Cyclades, Greece, was proved a reliable way to assess the intensity of litter sources along their coasts. It showcased that spatial ranges that are influenced mainly by the annual ocean dynamics should be treated with caution or even excluded from the analysis. There, intense litter fluxes over the year, hinder any effort to separate local anthropogenic littering intensity changes from natural litter input-output fluctuations. Towed underwater camera surveying and auxiliary bathymetric and swath sonar backscatter datasets were used to find links between the seafloor litter transport dynamics and the seabed micro- and macro-topography, finally indicating litter traps and sinks.

KEYWORDS: Seafloor litter, Long term monitoring, Marine Strategy Framework Directive, litter transport dynamics, Towed Underwater Camera

PAPER ID: cest2023_00589

Modelling plastic pollution at local level to inform action plans: Plastic Pollution Calculator

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ABSTRACT

The ISWA Plastic Pollution Calculator is a model and toolkit which assesses land based plastic pollution at a local and regional level. Since it was developed in 2018, it has been applied successfully in ten global locations across eight countries. Here we compare Calculator results from nine cities and municipalities, reflecting on the local, specific characteristics that result in the emission of plastic waste through open burning and as physical particles (debris). We identify some stark differences in the fate of plastic waste the world's cities. In Rotterdam, one of the most advanced waste management systems, non-negligible quantities of plastic waste find their way into the city's extensive network of canals and waterways, whilst the majority of plastic waste is either recycled or combusted in a state-of-the-art incinerator. Conversely, Kozzika, an informal settlement in Cairo, has emissions nearly 3,000 times greater, however in contrast to other cities, virtually all are retained on land as the neighbourhood has no pathway to the aquatic environment. Uncollected waste emerges as the primary source of plastic waste emissions in many cities. We note a progression of waste management development, whereby as cities improve their collection coverage, debris emissions increase proportionally towards the collection system rather than uncollected waste. As collection system infrastructure improves further, we see that littering and fly-tipping become most prominent on a proportional basis. The Plastic Pollution Calculator has proved to be a powerful tool in the fight against plastic pollution, providing users with the necessary information to baseline and monitor plastic waste emissions. In addition to its predictive capabilities, it tailors and suggest interventions based on its outcomes. As a new Global Treaty on ending Plastic Pollution is negotiated at the UN, the Plastic Pollution Calculator could help municipalities worldwide to assist in meeting their commitments and obligations.

KEYWORDS: Plastic pollution; Open burning; Global South; Marine Litter; SDG 11.6.1

PAPER ID: cest2023_00597

SESSION 15 - AIR POLLUTION AND HEALTH

Thursday 31 August – morning

Multi-scale high-resolution atmospheric emission inventory for the transport sector

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ABSTRACT

This study aims to develop a multi-scale atmospheric emission inventory for the transport sector with high spatial and temporal resolution using Portugal as a case study. For that, a combination of the traditional method of emissions calculation with an innovative way to gather and process data (BigAir approach) was implemented. The accuracy of the developed inventory was evaluated by applying a multi-scale air pollution system, with two sets of data: i) BigAir and ii) EMEP emission inventories. The scalability and replicability nature of the BigAir approach allows it to be used by the scientific community in other regions of the world.

KEYWORDS: Big data, critical air pollutants, road transport; railways; aviation; air quality modelling

ACKNOWLEDGEMENTS

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Black Carbon characterization with Raman spectroscopy and machine learning techniques: first results for urban and rural area

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ABSTRACT

Among the chemical substances of Particulate Matter (PM), there is a considerable quantity of black carbon (BC), which is linked to adverse public health effects and climate change. This study aims to develop an innovative method for the source apportionment of BC inside the PM, using Raman spectroscopy and machine learning techniques.

Different BC sources, including biomass ashes and vehicle emissions, and different PM samples from air quality monitoring stations have been analyzed with a Raman spectrometer. The PM samples used in the present study are collected from two different locations: an urban environment (Turin, Italy) and an alpine valley context (Oulx, Italy).

To each obtained spectrum, which presents the characteristic G and D bands, a five-band fitting has been applied to gather information that can lead to the identification of the different BC sources. Machine learning techniques, including the K-Nearest Neighbors (KNN) algorithm, have been applied to calculate the cluster resolution through a value of accuracy. Finally, the same algorithm, trained on the BC emission sources' data, tries to associate each BC in the PM to its source. In particular, a large amount of BC from diesel engine car exhaust emissions is found in all the considered PM samples.

KEYWORDS: Fossil fuel, Biomass burning, Source apportionment, D Band, G Band

PAPER ID: cest2023_00088

Evaluation of solid sorbents for acid flue gas emissions treatment.

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ABSTRACT

Removal of acid gases from exhaust emissions still represents a challenge for many industrial sectors, in particular for waste to energy facilities. In dry sorption processes, the efficiency of solid reagents is influenced by the specific surface area of the solid, the degree to which it is mixed with the gas, the concentration of the gas to be adsorbed, the temperature and humidity of the gas flow and the concentration of the reagent. Recently, new formulation of calcium- and sodium-based sorbents have been investigated. The objective of the present study is the characterization of the dry sorption capacity of HCl gaseous emissions of five different formulations of calcium-based sorbents based on the same operating conditions. To this end, an experimental installation was designed and applied. Scanning electronic microscopy (SEM) analyses were also carried out. The results showed a sorption capacity range of 8.1 – 10.8 mg Cl□mg sorbent-1 after 30 minutes. Samples C1 and C5 showed the highest sorption capacity. Samples C2 and C3 showed variable trends during the tests. Overall, for all the samples, the variance of sorption capacity increased with time. The possible reasons of such differences could be connected to the chemical composition, heterogeneous size distribution, and particle agglomeration effects.

KEYWORDS: Flue gas treatment; HCl; calcium hydroxide, sodium bicarbonate; Chemisorption.

PAPER ID: cest2023_00272

Air pollution and cardiovascular disease: state of art and control strategies within "One Health" approach

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ABSTRACT

Environmental quality is closely related to human health. In recent years, the growing awareness has led to the definition of an integrated "One Health" approach to protect simultaneously environment, humans and animals. Poor air quality is the most important factor affecting human health and increasing mortality and morbidity. Improving environmental quality is crucial to prevent human health-related risks. Poor air quality is the most important factor affecting human health and increasing mortality risk. The estimates reveal that in 2019 it led 7 million deaths with an alarming percentage of premature ones. Among diseases caused by poor air quality 70% are non-communicable and 60% affect the cardiovascular system. The economic effects are also important: medical expenses increase while the general productivity decreases due to people who cannot work for health-related problems. The situation in the European Union is slowly improving thanks to the joint efforts of the European Commission and the World Health Organization. The most significant health-related risks usually occur in urban areas. This work aims to define the state of the art on environmental policies implemented and identify direct and indirect strategies for control pollutants and reduce health risks. Future perspectives are also presented.

KEYWORDS: Air pollution, One health, Cardiovascular diseases, Health risks, AQHI

PAPER ID: cest2023_00415

Air quality monitoring and control in complex environments by advanced and integrated system

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ABSTRACT

Large civil engineering projects, such as the construction and expansion of Ports are strategic actions for the social and economic development of territories. Air gaseous emissions are among the most important environmental pressures linked to all stages of these projects. Prolonged exposure to air pollutants can cause respiratory disease, nausea, reduced resistance to infections and increased fatigue in humans. Advanced real time monitoring systems are thus needed in order to control the emissions and avoid potential negative impacts. The research presents and discusses the identification and application of an advanced and integrated multi-criteria environmental system for the air quality continuous monitoring in sensitive area. The experimental activities are carried out with reference to a real case study of the Port of Salerno (SA). Conventional and emergent air contaminants are measurred by fixed monitoring stations and mobile laboratories. All data are collected and transmitted in real time on a specifically designed spatial information system (SIT). The results of four years of analysis and monitoring are presented. The proposed system highlights the importance of developing and implementing integrated multi-criteria monitoring plan in order to be effective and guarantees environmental protection and data transparency.

KEYWORDS: air pollution; continuous monitoring; particulate matter; port area.

PAPER ID: cest2023_00506

Assessment of exposure to fine and ultrafine particulate-bound polycyclic aromatic hydrocarbons during prescribed burns

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ABSTRACT

Portugal is one of the most affected countries in southern Europe by wildfires. The human exposure characterization to fine particulate matter (PM) during fires remains limited; no information is available for ultrafine particles nor their composition on polycyclic aromatic hydrocarbons (PAHs). This work assesses fine and ultrafine PM levels and their composition on 18 PAHs during two prescribed burns performed in Porto (North of Portugal). A low-pressure impactor was used to collect 14 PM fractions (PM15nm to PM10µm) at the firefighting area. Concentrations of PM were determined by gravimetry, and its PAHs content was determined with a microwave-assisted extraction and analyzed by liquid chromatography with fluorescence/UV-Vis detectors. Total cumulative concentrations of collected PM varied between 0.34 to 1.41 mg/m3 with fine (PM156nm to PM2.5µm) and ultrafine (PM15nm to PM95nm) PM accounting for 48.6-63.1% and 11.7-31.4% of total PM, respectively. Benzo(a)pyrene, carcinogenic PAH, was detected in all PM fractions with values ranging from 5.72×10-5 to 2.63×10-3 µg/m3. The PM-bound possible or probable carcinogenic PAHs represented up to 7.62% of total PAHs. Further studies concerning humans, e.g., firefighting forces and local population exposure to fine/ultrafine PM and PAHs are urgently needed to pursue preventive measures to promote human health.

KEYWORDS: Human exposure; Fire emissions; Particulate matter; PAHs; Health risks.

ACKNOWLEDGMENT

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Radon Levels Inside the Caves of Bohol Island, Philippines

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ABSTRACT

Radon concentration in various workplaces, including tourist caves, remains higher than the recommended action level by the International Commission on Radiological Protection, which may pose a significant health risk. However, there has been no endeavor to investigate radon concentration in Philippine caves. This work investigated radon concentration inside Hinagdanan Cave, Batungay Cave, and Princess Manan-aw Cave using a passive radon detector. Radiation dose assessment and health risk estimation were also performed using the determined radon levels. The radon concentration inside these caves was above the safety limit (300 Bq/m3) and action limit (1000 Bq/m3) recommended by the World Health Organization and International Atomic Energy Agency, respectively. The dose assessment and evaluation do not exceed the annual dose limit prescribed by the Philippine Nuclear Research Institute. Lastly, the results of the lung cancer risk estimation exceed the recommended limit of 130 - 270 lung cancer cases per million people per year by the International Commission on Radiological Protection, except for Hinagdanan Cave. Radon mitigation must still be prioritized since the safety and action limit is exceeded, and administrative controls must be put in place to control radon exposure.

KEYWORDS: Radon, Philippine caves, CR-39, radiological risk, Bohol Island

ACKNOWLEDGMENT

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PAPER ID: cest2023_00143

Seasonal fluctuations of PM2.5 concentrations at six Greek islands

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ABSTRACT

PM2.5 concentrations in urban areas vary significantly spatially and seasonally. Measurements can be affected by multiply parameters such as anthropogenic activities, meteorological conditions as well as land use. In the present study one-year PM2.5 measurements from the network of low-cost sensors deployed at six Aegean Sea islands (Lemnos, Lesvos, Chios, Samos, Rhodes, and Syros) were used to study the seasonal changes and the possible impacts from the local sources (e.g., road transport, residential heating) on the air quality. It is the first time that such a long timeseries of PM2.5 concentrations was collected simultaneously at islands with different socioeconomic characteristics (e.g., Syros and Rhodes are among the most popular touristic destinations in Greece) and meteorological conditions (longer warm period in Rhodes in comparison to Lemnos, Lesvos, and Chios). Moreover, citizens' insight on local air quality and emission sources was collected through the conduction of semi-structured interviews. Results revealed that lower PM2.5 concentrations were recorded during the warm period and the range of minimum – maximum concentrations was smaller. In the cold period peak values were measured at Lesvos, Samos, and Chios mainly in the evening hours. Comparing the mean seasonal concentrations, it was found that the lowest values were measured at Syros for both warm and cold periods.

KEYWORDS: PM2.5, low-cost sensors, air quality, Greece, Aegean

ACKNOWLEDGEMENTS

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Monitoring air quality in Cyprus

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ABSTRACT

Air pollution is a significant environmental threat to public health worldwide. In Cyprus, the laboratory of Environmental Chemistry and Control of Effluents of the State General Laboratory in collaboration with the competent Authorities, the Department of Inspection of the Ministry of labour, develops and implements programs for monitoring every year the efficiency of the quality of air, using special filters. Heavy metals (As, Cd, Ni, Hg, Pb), other metals (Al, Fe, Cu, Zn, Mn, Cr, V), ions (Cl-, SO4 2-, NO3 -, Na+, K+, NH4 +) as well as 8 Polycyclic Aromatic Hydrocarbons (PAH’s) including benzo(a)pyrene, were monitored and controlled systematically and effectively for more than a decade.

Instrumental techniques like ion chromatography, ICP, ICP-MS and HPLC-fluorescence are used to determine ions, metals, and PAH,'s respectively. In this study, the results of these parameters are presented for the years 2016–2022. Heavy metals, ions, and PAHs are found in low concentrations ranging from low nanograms to micrograms per m^3.

KEYWORDS: air quality, monitoring, polycyclic aromatic hydrocarbons, heavy metals, ions

PAPER ID: cest2023_00414

Source profile of PM10 emission sources in Western Macedonia, Greece, during 2022

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ABSTRACT

Government energy policy strategies which are intended to encourage the reduction of lignite energy production, has a negative impact on industrial activities in the region of Western Macedonia, leading to important changes of the atmospheric emission profile. Taking into consideration the current situation and the reduction of industrial contribution in PM10 emissions, we attempt to estimate the PM10 source profile and examine the similarities or the differences of specific dust sources at different sites. Each sampling site differed with respect to the location of the site and its meteorological and source characteristics. In order to accomplish that, dust samples were collected for several representative sources in the study area (e.g., unpaved roads, paved roads, vehicular emissions, soil and agricultural soil, fly ash) during 2022. The collected dust samples were resuspended to laboratory generated-dust system in order to create PM10 samples (for each emission source) which were analyzed for a series of elements by the method of Inductively coupled plasma mass spectrometry (ICP-MS). The database of PM emission profiles developed here will be used in a second stage to assist source apportionment studies for accurate quantification of the air pollution causes and enhance the evaluation of environmental authorities and policy makers to take the proper proactive measures for air quality.

KEYWORDS: PM10, Source profiles, laboratory generated-dust system, elemental composition

ACKNOWLEDGEMENT

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PAPER ID: cest2023_00123

Fluctuation of Nighttime Ground Level Ozone Due to Artificial Light

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ABSTRACT

Ultraviolet (UV) radiation creates ground-level ozone (O_3) during the day and is subsequently eliminated by nitrogen oxides at night. However, excessive artificial light use, those results in light pollution, may interfere with the chemistry of ground-level O_3 at night by supplying enough energy to start that creation. Therefore, this study aims to identify the effect of artificial light on nighttime ground-level ozone production. Minute average O_3 and NO_2 concentrations with light illumination were measured in two study sites at the USM School of Civil Engineering and its Main Campus. Results of this study suggested that in low-light illumination conditions, no conversions between NO_2 to O_3 were governed due to low-light energy that was unable to break NO_2 bonds. Thus, there are no changes in O_3 concentration trends in the School of Civil Engineering. However, in high-light illumination conditions such as in USM Main Campus, O_3 fluctuated negatively with NO_2 concentrations, and potential conversions were governed.

KEYWORDS: nighttime chemistry, ozone production, anthropogenic light

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PAPER ID: cest2023_00451

SESSION 16 - LIFE CYCLE ANALYSIS (LCA)

Thursday 31 August – morning

Life Cycle Assessment on fashion industry: four case studies

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ABSTRACT

As one of the most environmentally harmful industries worldwide, the fashion industry urgently requires sustainable practices to mitigate its impact. This paper analyses the literature to determine the importance of a monitoring tool such as Life Cycle Assessment (LCA), as an enabler for the transition towards sustainable business models within the fashion industry. The aim is to analyse the literature to highlight benefits, limitations, and case studies that can serve as a basis for the implementation of this tool in fashion companies to make them more sustainable. This work is also a preparatory aim, for the creation of case studies that will be carried out in companies in the context of the Marche Region, Italy, where this industry has an important strategic and economic relevance.

KEYWORDS: Fashion industry, sustainable business model, Life Cycle Assessment, Circular Economy

PAPER ID: cest2023_00283

Design requirements for the development of an LCA Engine

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ABSTRACT

The work focuses on the development of a web-based tool to promote life cycle thinking and assessment of agricultural production. The computational tool is based on a sophisticated LCA Engine which provides personalized, real-time results, with the exploitation of real data from sensors. This comes in contrary to the standard practice of software using data sourcing solely from life cycle inventory databases available in the market (e.g. Ecoinvent, Agribalyse). The tool is designed to simulate all levels of the supply chain (production, processing, packaging, transportation, etc.) and perform an accurate calculation of the production's carbon footprint, as well as other environmental impacts that are required for environmental certification processes. In the present study, we present the design requirements of the web-based tool, as those resulted from a large-scale survey conducted in different types of potential end-users, such as farmers, farmers' associations, agri-food companies and agri-consultants. The work is funded within the framework of the Operational Programme "Central Macedonia" of the PA 2014-2020, Innovative Investment Plans, and co-financed by the Greek State and the European Union and, in particular, by the European Regional Development Fund (ERDF) (project code: KMP6-0078501).

KEYWORDS: life cycle assessment; agrifood; IoT; sensors; environmental certification;

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This work is funded within the framework of the Operational Programme "Central Macedonia" of the PA 2014-2020, Innovative Investment Plans, and co-financed by the Greek State and the European Union and, in particular, by the European Regional Development Fund (ERDF).

PAPER ID: cest2023_00158

Environmental and Economic Life Cycle Assessment of a Spanish whisky

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ABSTRACT

A considerable literature has been dedicated to evaluating the carbon footprint of fermented beverages such as wine and beer. However, far fewer studies have been committed to assess the environmental and economic sustainability of spirit distillates. The aim of this paper was to compile a complete life cycle inventory of a commercial whisky produced in Spain and to identify environmental and economic hotspots from a streamlined LCA. The system boundaries covered a cradle-to-gate approach, which included production and transport of raw materials (barley and corn), whisky manufacturing including distillation, packaging and distribution. Two functional units were considered: 100 l of whisky and one degree of alcohol content. The analysis considered four impact categories including climate change, acidification, eutrophication, and tropospheric ozone formation, calculated using the EF 3.0 impact assessment method. The results described that most of the impacts associated with this product were attributable to packaging, followed by grain alcohol and cereal production. Environmental impacts generated by the fabrication were very limited, although this stage contributed significantly to the life cycle cost of the final product. Packaging burdens (mainly from the glass bottle) can be minimized through reuse or recycling strategies.

KEYWORDS: whisky, spirituous, LCA, life cycle assessment, carbon footprint.

PAPER ID: cest2023_00180

Comparative life cycle assessment of lithium-ion batteries

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ABSTRACT

The transportation sector is the second largest source of carbon emissions worldwide. In the process of achieving zero emissions, the electrification of the sector and the replacement of internal combustion engine vehicles (ICEVs) with electric vehicles (EVs) is being promoted. Batteries as the main component of EVs contribute significantly to their environmental impact along their life cycle. The high energy demand for battery production leads to higher carbon emissions to produce EVs than ICEVs. Additionally, during the charging of the batteries, the carbon emissions are directly linked to the carbon intensity of the electricity mix used. Currently, lithium-ion batteries (LIBs) are widely used as energy sources for EVs. This paper presents a comparative life cycle assessment (LCA) of three types of LIBs: lithium-ion phosphate, lithium manganese oxide, and lithium nickel manganese cobalt oxide. The environmental impact of the entire life cycle of the batteries, from the extraction of raw materials to end-of-life (EoL) management, was assessed. The results were then compared for the three battery types. The influence of the electricity mix used to charge the batteries was also assessed, by applying a different scenario of electricity mix for power generation than the base case.

KEYWORDS: life cycle assessment; environmental impacts; electric vehicles; lithium-ion batteries

PAPER ID: cest2023_00193

LCA of Applying a Smart Farming System – Implementing a Territorial Approach for Recommending Good Agricultural Practices

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ABSTRACT

This study is part of the LIFE GAIA Sense project, aiming to evaluate the environmental efficiency of Smart Farming (SF) through LCA and to produce recommendations for good agricultural practices. Thus, the environmental performance of SF treatment, specifically regarding fertilizers/pesticides application and irrigation, is compared to that of conventional agricultural management, under similar soil and climatic field conditions. According to the goal and scope of the study, a cradle-to-field gate approach was selected, while the inventory was built with data recorded in crop logbooks and questionnaires distributed to farmers, containing details about field activities. The impact analysis results reveal the environmental benefit of the SF-based management approach in relation to resource use, ecosystem and human health protection, in most of the field cases examined. Based on single score calculations with the ReCiPe 2016 (H) impact method, the results strongly suggest fossil and mineral resource scarcity as the most essential impacts to be considered, mainly decreased for the SF fields. Moreover, a territorial approach for introducing regionalization in the application of LCA on agricultural systems is conducted. Finally, good practice recommendations are suggested to facilitate decision making, considering foreground and background system processes.

KEYWORDS: life cycle assessment, air quality management, environmental management, sustainable agriculture, smart farming

ACKNOWLEDGEMENT

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PAPER ID: cest2023_00354

Life Cycle Assessment and Cost Benefit Analysis for the integrated assessment of an innovative Mn-TiO2 nanoparticle photocatalytic paint

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ABSTRACT

Life Cycle Assessment (LCA) and Cost Benefit Analysis (CBA) are applied for an integrated assessment of a new photocatalytic paint-product developed within LIFE VISIONS project. The TiO_2-nanoparticle photocatalytic paint has been demonstrated to efficiently remove NOx and VOCs, thus contributing to improved indoor air quality with substantial related human health benefits. LCA was conducted using openLCA software and Product Environmental Footprint (PEF) dataset. Cradle-to-grave approach was followed, considering all life cycle processes related to production, application and disposal, in order to examine the potential environmental benefit compared to conventional paint. Thus, simulations were performed considering different building types and electricity needs, to evaluate the sustainability advantage of the photocatalytic product under different conditions. Computational Fluid Dynamic (CFD) simulations are also deployed to reveal the efficiency of the proposed photocatalytic paint in terms of indoor air quality improvement under different scenarios of application. The results are used to evaluate the health benefits for the CBA, on the basis of a Driver-Pressure-State-Impact-Response (DPSIR) methodology. Indoor pollutant concentration levels from the CFD simulations will be used as input to estimate the dose-response functions for quantifying health impacts. Resulting health impact indicators will be translated into monetary terms during the final stage of CBA.

KEYWORDS: TiO2 photocatalytic paint, indoor air quality, computational fluid dynamics modelling, life cycle assessment, cost benefit analysis

ACKNOWLEDGEMENT

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Classification, characterisation, standardisation and weighting in life cycle analysis (LCA): a case study of teaching innovation for higher education

San Miguel, Guillermo

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ABSTRACT

Training deficiencies in sustainability analysis can pose a barrier to advancing towards sustainable development. Life cycle assessment (LCA) is a basic tool in the analysis of the environmental performance of products. This paper describes exercise for teaching innovation for higher education in this field focused on the practical application of the impact assessment stage that involves transforming inventory data into impact values through classification, characterization, normalization and weighting. This exercise describes a parallel analysis of two heating systems, one based on natural gas and the other on biomass fuel for which inventory data and a simplified impact assessment method are available. This case study will allow students to become familiar with the conceptual and practical basis of the life cycle approach and the procedures described in ISO 14040.

KEYWORDS: Teaching innovation, training, normalization, weighting, characterization, case study

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More than meets the eye: Uncovering the social impacts of a household hazardous waste management system

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Abstract. Within the scope of the "Circular Economy Implementation in Greece" project (LIFE18 IPE/GR/000013, www.circulargreece.gr), which focuses on improving waste management practices, a pilot initiative is currently underway to be implemented in the Western Macedonia Region and the Municipality of Athens in Greece. This initiative, centered on addressing the issue of Household Hazardous Waste (HHW), aims to establish an integrated collection network and management system. To assess the social impacts of the planned HHW pilot project, a Social Life Cycle Assessment (S-LCA) approach is being adopted, in accordance with the Guidelines released by the United Nations Environment Programme (UNEP)/ Society of Environmental Toxicology and Chemistry (SETAC) Life Cycle Initiative. The S-LCA study involves a comprehensive, multi-step process. The findings offer valuable insights into the social impacts of the planned HHW pilot project, one of the first efforts of HHW management in Greece. These insights can provide crucial information to decision-makers, including government authorities, environmental organizations, and waste management professionals, in their efforts to effectively address HHW management. This study, beyond helping to establish a foundation for effective HHW management practices in Greece, also serves as a valuable reference for other countries facing similar challenges.

Keywords: Circular economy; Waste management; Waste prevention; Sustainability; Social life cycle assessment (S-LCA).

ACKNOWLEDGEMENT

This research is partly funded by the LIFE-IP CEI Greece project “Circular Greece - Circular economy implementation in Greece” (LIFE18 IPE/GR/000013) which is co-financed by the EU and the Green Fund public-law entity reporting to the Hellenic Ministry of Environment and Energy

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Life Cycle Assessment of fertilization practices on greenhouse gas emissions in Cyprus

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ABSTRACT

Over the past decade, Cyprus has been suffering from the detrimental consequences of climate change. Rising temperatures, along with water scarcity, drastically degrade the productivity of rural ecosystems as a result of climate change in the primary agricultural sector. Besides the negative effects of the climate change on the primary sector productivity, agricultural activities also contributes to greenhouse gas emissions. This study provides insides from LCA models that examine the impact of various practices on greenhouse gas emissions, as well as how alternate fertilizing strategies contribute considerably to emissions reduction in diverse agricultural systems. In comparison to chemical fertilizers and fresh organic manure, the use of composted materials emits the fewest GHG emissions. Nitrogen emissions, in particular, are substantially decreased suggesting that the integration of these type of inputs in nutrient fertilization strategies is important to mitigated climate change. Additional research is required to evaluate methane emissions in the field in order to appropriately estimate the impact of these methods.

KEYWORDS: LCA; environmental impact; agriculture; carbon footprint; global warming potential

PAPER ID: cest2023_00332

Environmentally-Extended Multi-Regional Input-Output Analysis of neodymium, cobalt and lithium used in electric vehicles

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ABSTRACT

In the transportation sector, the market share of world electric vehicle sales has changed from 0.0% in 2010 to 3.2% (2.1 million) by 2020, and according to forecasts, sales in 2030 may rise to close to 30%. This drastic change is encouraged by environmental goals set to reduce CO2 emissions, not emitted by electric vehicles (EVs) during the use phase. However, clean technologies (such as electric cars) can cause other effects in mining, processing metals, and the manufacture of permanent magnets or batteries. In addition, the use of electric cars can increase the dependence on countries that control the mining and/or production of materials like neodymium, lithium or cobalt. This work performs an Environmentally-Extended Multi-Regional Input-Output Analysis (EEMRIO) to quantify the flow of neodymium, lithium and cobalt (through a Material Flow Analysis) and assess the CO2 equivalent emissions (through a life cycle assessment) of these materials, needed to manufacture the permanent magnets and batteries of electric vehicles. This method is useful to analyze the origin (countries) where the environmental impact is produced, in contrast to conventional methodologies that only calculate global impacts. Different scenarios, based on the environmental objectives of the European Union and China, were considered. China shows a key role in mining, processing and manufacture of permanent magnets and batteries, with 60.8% of mining and 79% of manufacturing respectively. Due to Chinese domain, China is the country with highest emissions of CO2-eq, a 73.11% of total emissions. Obtained results are useful to assess which environmental proposals are more effective to reduce the environmental impact of EVs and to assess the dependency of these rare earths.

KEYWORDS: electric vehicles, critical raw materials, life cycle.

PAPER ID: cest2023_00067

SESSION 17 - RENEWABLE ENERGY SOURCES

Thursday 31 August – afternoon

Social Acceptability of Offshore Wind Projects in Greece: Citizen Perspectives on Challenging Issues of Site-Selection Problem

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ABSTRACT

Lack of social acceptance remains a major constraint towards offshore wind project (OWP) deployment. The incorporation of local population perspectives and concerns into the site-selection process of OWPs can assist to overcome the respective barriers. In this work, an appropriately designed methodological framework is introduced for the identification of citizen perspectives on many challenging issues of site-selection of OWPs. The methodology includes three consecutive phases: (Phase 1) design of questionnaire survey and acquisition of citizen responses; (Phase 2) quantitative and qualitative analysis of citizen responses and synthesis of survey results; and (Phase 3) creation of an OWP roadmap for Greece in GIS, in accordance with the citizen perspectives and requirements. In total, 1,802 citizens participated in the survey from various geographic locations of all Regions of Greece. The survey results reveal the high social acceptability (80.6% of the participants) for OWP deployment in Greece and present the citizen requirements on the selection of eligible sites for their installation (e.g., a minimum distance of 5,000 m from shoreline has been suggested (median value)). In conclusion, the proposed participatory tool could facilitate the deployment of OWPs in Greece, by avoiding socially unsustainable sites and, thus, strongly enhancing the social acceptability of the future projects.

KEYWORDS: citizen participation; offshore wind; social acceptability; site-selection; GIS

ACKNOWLEDGMENTS

This work was co-financed by Greece and the European Union (European Social Fund) through the Operational Programme “Human Resources Development, Education and Lifelong Learning” in the context of the Act “Enhancing Human Resources Research Potential by undertaking a Doctoral Research”, Sub-action 2: IKY Scholarship Programme for Ph.D. candidates of Greek Universities.

PAPER ID: cest2023_00018

Domestic Photo-Voltaic installations - their contribution and practicalities

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ABSTRACT

The roofs of domestic-scale properties used to haveone overall main function – to keep the weather out. But since the first solar-PV panels were fitted in the UK in 1994, it has become increasingly clear that, to reduce carbon emissions and thus contribute to the transition to net-zero, all suitable roofs need to be electricity generators as well as weather protection.

Based on the author's 10 years' experience of roof-mounted PV systems, this paper reports on system performance over the recent 3½ years, including part-charging an electric car. The practicalities of specifying the system , the options available and the operational considerations complete the exploration of a modern system. The paper reports in some detail on the results from 3½ years' operation.

The paper also explores financial considerations, largely in a UK context, but a framework is given for decision-making in other generation and financial situations.

Finally, the paper briefly discusses the wider implications of such systems, for example for local and national AC grids.

KEYWORDS: Renewable energy sources; Net Zero emission transition; photo-voltaics; impact of citizen science on environmental attitudes, behaviour, knowledge.

PAPER ID: cest2023_00062

Techno-economic assessment of a high temperature thermal storage integration into a sludge drying process in combination with PV electricity

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ABSTRACT

During the ongoing transition towards cleaner energy production to tackle climate change, it is important to identify economically viable solutions. While Renewable Energy Sources (RES) offer clean energy, they cannot consistently meet energy demand. Therefore, energy storage technologies are necessary, particularly for thermal demand where thermal energy storage is the most sustainable, efficient, and cost-effective solution. In this study, a combination of RES, thermal storage, and electrical resistors converting electrical energy into thermal energy is proposed to hypothetically meet the energy requirements of a sludge drying facility. The implementation feasibility of such a setup is assessed, by using commercially available software tools but also developing a new methodology. This methodology calculates the efficient dimensioning of the initial setup (RES and storage technology), based on the hourly energy demand and RES production. Two main technical scenarios were identified. At the end, the most energy efficient scenario was chosen. The economic benefits were extracted, using the setup and the dimensioning proposed from this scenario. The future step of this assessment is to evaluate the environmental profitability of this setup, under the third sustainability development pillar.

KEYWORDS: thermal storage; power-to-heat; decarbonization; Green Heat Module; heat supply

ACKNOWLEDGMENTS

This work is funded within the framework of the NetZeroCities project and, in particular, from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036519.

PAPER ID: cest2023_00124

Effects of High Temperature and Liquid Nitrogen Cooling: A Case Study of granite rocks from Kazakhstan

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ABSTRACT

Cryogenic fracturing using liquid nitrogen (LN2) is a new geothermal well stimulation method to augment porosity, permeability, and overall contact area in Hot Dry Rock (HDR) reservoirs in an environmentally acceptable way, without potential surface or groundwater contamination, formation damage, and huge water consumption. Procedures representing different exposure times and frequencies were compared by investigating the degree of rock integrity damage created. Granite rocks equilibrated at different elevated temperatures from 200oC to 500oC were immersed in LN2 for different freezing times (FT) and a variable number of freezing-thawing cycles (FTC). Rock strength was measured in compression tests. Scanning electron microscopy (SEM) was used to confirm the extent of visible damage and catalog the fracture evolution of our granite specimens. Two different granite rocks were studied: Zhylgyz (sample 1) and Sayac (sample 2). The experiments document mechanical rock damage by thermal shock and the degree of thermo-fracturing rises with temperature difference and time of LN2 treatment in both freezing time and freezing-thawing cycle methods.

KEYWORDS: Granite, Kazakhstan, Liquid nitrogen, Geothermal Energy

PAPER ID: cest2023_00161

Interface engineering approaches for efficient and robust perovskite solar cells

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ABSTRACT

The field of perovskite photovoltaics has been witnessing a surge of interest over the past few years across the breadth of advanced nanomaterials, nanoscience and nanotechnology. Intensive research activity focuses on the development of hybrid perovskite absorbers with controlled nanomorphology where we can modify intrinsically different properties (crystallinity, defects, grain boundaries) and optimize charge transport in the bulk structures at the corresponding interfaces. The perovskite absorber and its interfaces with the electron transport layer (ETL) and the hole transporting material (HTM) play a pivotal role in obtaining perovskite solar cells (PSCs) with high power conversion efficiency (PCE) and enhanced stability. This contribution deals with advanced engineering strategies developed by our group focusing on the optimization of perovskite interfaces to regulate the geometric, structural and electronic properties of the solar cell basic components.

KEYWORDS: Perovskite solar cells; interface engineering; water resistance; efficiency; stability.

ACKNOWLEDGEMENTS

The author acknowledges funding of this work by European Union’s Horizon 2020 Marie Curie Innovative Training Network 764787 “MAESTRO” project and additional support by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the “2nd Call for H.F.R.I. Research Projects (PVLumo-KA 80635).

PAPER ID: cest2023_00277

Water scarcity, energy independence and the role of hybrid renewable energy systems

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ABSTRACT

Water scarcity problems and the need for reduced consumption of fossil fuels lead to the transition to renewable energy sources (RES). The proper management of RES is the key issue, especially in small not interconnected islands. In this research work a Hybrid Renewable Energy System (HRES) on a small island in the Aegean Sea is evaluated for ten years of hydrometeorological data. The objective is the production and storage of the required energy for the electricity needs of the area, as well as, for the desalination of seawater for domestic and irrigation water fulfillment. Results concerning the reliability of the system, the fulfillment of water and energy demands and the loss of load expectation are presented. The simulations will give valuable information about the produced and stored energy, its controlled distribution for the water and energy demands of the island and HRES's potential in these demands of the local society over one decade.

KEYWORDS: HRES, water scarcity, energy management, energy storage

PAPER ID: cest2023_00208

Time Evolution of Renewable Energy Applications Social Acceptability. The Wind Energy Case in Decarbonization Areas

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ABSTRACT

Energy transition policy towards zero carbon electricity generation by 2030/2050 in European as well in national level is based on increased exploitation of Renewable Energy Sources (RES) giving great importance to public opinion and public participation. Considering the above, it is important to analyze in detail the society's current view regarding the installation of additional RES applications in local level. Wind energy is one of the most mature technologies applied in order to decarbonize the electricity sector, while due to the size of the contemporary wind turbines they are always a subject for intense debate.

Moreover, social acceptability of wind parks has always been characterized by a dynamic relationship between local society and the corresponding applications. Actually, the general broad acceptance of RES varies widely when one considers public opinion locally in areas where RES projects have been or are going to be installed. In order to investigate the wind-based applications acceptance on an "objective" basis the Soft Energy Applications and Environmental Protection Laboratory of the University of West Attica recorded the time evolution of the public attitude during the last twenty years, since the first commercial wind energy applications are dated at late 90's. The results of the recent research have been statistically processed. At present, the resulting conclusions are not as positive as in the previous decade and highlight the need for additional information concerning the benefits arising from the operation of similar installations.

KEYWORDS: Energy Transition, National Energy and Climate Plan, Wind Energy, Public Attitude.

PAPER ID: cest2023_00337

A New Material for Microencapsulation of Phase Change Materials for Thermal Energy Storage

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ABSTRACT

Phase change materials (PCMs) serve as energy storage materials that can effectively reduce the heating and cooling load. To overcome the issue of leakage in practical applications, there has been a growing significance in conducting research on microencapsulation and composite production. In this study, humic acid, which has an organic structure, was used for the microencapsulation of PCMs. To evaluate the morphological, thermal, and chemical properties of the synthesized composite materials, Differential Scanning Calorimetry (DSC) and Fourier Transform Infrared spectroscopy (FTIR) were utilized. The thermal resistance of the composites was tested at a temperature of 70 °C. DSC analysis revealed that the paraffin composite had a melting point of 38.79 °C and a latent heat storage capacity of 52.56 J/g. Based on these comprehensive analyses, it can be concluded that the microcapsules obtained demonstrate remarkable potential as energy storage materials.

KEYWORDS: Phase change materials, Thermal energy storage, Paraffine, Humic Acid, microcapsule

ACKNOWLEDGMENT

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PAPER ID: cest2023_00530

Thermal energy storage properties of gelatin-gum arabic microcapsules containing lauric acid

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ABSTRACT

In this study, gelatin-gum arabic microcapsules containing lauric acid were prepared for thermal energy storage applications. Lauric acid and gelatin-gum arabic were used as the core material and shell material, respectively. The synthesized microcapsules were analyzed using differential scanning calorimetry (DSC) for thermal characterization. DSC analysis revealed that the melting and freezing points of the synthesized microcapsules were determined to be 41.35°C and 39.76°C, respectively, with a latent heat storage capacity of 171-173 J/g. The thermal analyses confirm the successful microencapsulation of lauric acid and its suitability for thermal energy storage applications.

KEYWORDS: Phase change materials, Thermal energy storage, Lauric Acid, microcapsule

ACKNOWLEDGMENT

This work was financially supported by the Research Projects Unit of Nigde Ömer Halisdemir University (The Project Code: FEB2016/21-BAGEP).

PAPER ID: cest2023_00546

Solar attenuation due to particulate matter in arid environments

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ABSTRACT

The depletion of solar irradiation has several causes such as clouds and suspended particulate matters in the atmosphere. Particulate matters play an important role in decreasing solar irradiation by blocking partly the solar energy from reaching the ground. This lost irradiation must be taken into consideration when planning large installations of PV panels' fields along with other environmental factors. The blocking effect of PMs is higher in places where the density of PMs is higher due to geographical location or the lack of precipitation. The main objective of this work is to study experimentally the impact of particulate matters of different sizes (PM2.5, PM10, and TSP), measured at ground-level, on global horizontal irradiation (GHI) in arid climates. The measurements were taken over a six-month period, from May to October 2022. The city of Riyadh, Saudi Arabia, was chosen to represent arid conditions due to its high suspended particulates density and the lack of precipitation. The PM measurements were recorded every minute from dawn to dusk and were processed to obtain a correlation between the measured PM values and the actual GHI. In addition, a comparison between the GHI obtained by the developed model and the one obtained from ASHRAE clear sky model. During the period of the experiment, the measurements showed that the ASHRAE clear sky model overestimated the amount of solar energy reaching the ground by over 10%.

KEYWORDS: Solar irradiation, Particulates matter, ASHRAE

PAPER ID: cest2023_00463

SESSION 18 - WATER AND WASTEWATER TREATMENT AND REUSE

Friday 01 September – morning

Application of peroxide-releasing compounds for the removal of cyanobacteria cyanobacteria harmful blooms (cyano-HABs) in contaminated waterbodies: properties, toxicity and mitigation efficiencies

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ABSTRACT

Mitigating cyanobacteria harmful algal blooms (cyano-HABs) at source through an efficient, cost effective, and safe manner has gradually become a global environmental urgency. Hydrogen peroxide (H2O2) was introduced the past decade as an emerging solution for the restoration of cyanobacterial contaminated sites, as well as an environmentally safer alternative to copper algicides. Though studies showed high treatment efficiency of H2O2 and greater selectivity towards cyanobacteria than green algae, it is also known that dense blooms required high doses that distressed the remaining ecosystem, including zooplankton and phytoplankton species. In this study, calcium peroxide (CaO2) granules, a slow H2O2 releasing compound, were examined as an alternative source of H2O2 to liquid H2O2 application. The main objective was to develop of more environmentally friendly and cost effective in situ treatment for toxic cyanobacteria. To do so, our investigations focused on the H2O2 releasing properties of granules in different water matrixes, their toxicity on Echinogammarus veneris sp., and efficiency on mitigating Microcystis sp. and Aphanizomenon sp., in comparison with equal accumulative doses of liquid H2O2. Results showed that the presence of organic and inorganic components in a surface water matrix reduced the availability H2O2 and affected the kinetics of its release from granules. The presence of humics in surface water enhanced the release of H2O2 and has led to the generation of hydroxyl and hydroxyalkyl radicals that increased treatment efficiency. Treatment of Microcystis and Aphanizomenon species with 0.5 g/L CaO2 granules outperformed 3 mg/L liquid H2O2, while concentrations lower than 1.5 g/L CaO2 granules showed minimal impact on the non-targeted invertebrate species. In addition, an upscale treatment study showed greater mitigation efficiencies of peroxide granules in comparison with equal doses of liquid H2O2.

KEYWORDS: calcium peroxide granules, cyanobacteria, hydrogen peroxide, EPR

PAPER ID: cest2023_00573

Drinking water from surface and ground water: production costs and influence of the climate change

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ABSTRACT

Drinking water production may be affected by climate changes (i.e. intense rainfall events and high temperature periods) which impact on the availability and quality of the water source, above all surface water bodies. Efforts are being made to adopt the best strategies in the drinking water treatment plant (DWTP) management under these adverse conditions, with the aims to guarantee potable water and optimizing water production costs.

This study refers to the large DWTP of Ferrara, Italy (2.5 107 m3/year of water distributed in 2021) which treats surface water (Po River) for around 70 % and alluvial well water for the remaining 30 %.

It presents the results of an analysis of the annual drinking water production costs and the related items before and during COVID-19 pandemic. A focus is then done on the effects the climate change may cause on the water quality at the source, the resulting management needs, and the final production costs. It emerges that production costs are increased during the years due to the increased costs of energy, chemicals and activated carbon. Water withdrawal is the issue which most affects the final production costs due to the high energy consumption.

KEYWORDS: climate change, drinking water treatment plant, groundwater, production costs, surface water

PAPER ID: cest2023_00057

Global Sensitivity Analysis of a Mathematical Model for AnMBR Systems Treating Municipal Wastewater

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ABSTRACT

This study conducted a Global Sensitivity Analysis (GSA) of a mathematical model for simulating urban wastewater treatment in anaerobic membrane bioreactors (AnMBRs) at ambient temperatures. The Anaerobic Digestion Model ADM1 was modified and implemented in Matlab/Simulink, comparing three sensitivity analysis methods: One At a Time (OAT), Morris and Fourier Amplitude Sensitivity Test (FAST)..Experimental data from an AnMBR operating on municipal wastewater during summer and winter periods were used for model calibration and verification. The AnMBR had a 40L laboratory membrane bioreactor with a submerged flat sheet membrane and a 40L biogas collection tank. Experiments covered temperatures of 14-26°C and three hydraulic retention times (HRTs): 2 days, 1 day, and 12 hours. Performance evaluation included parameters such as COD effluent, total nitrogen effluent, biogas production, and volatile suspended solids concentrations. The primary aim was to compare the effectiveness of the OAT Morris and FAST sensitivity analysis methods in capturing the model's sensitivity to input parameters. This global sensitivity analysis enhances our understanding of the model's behavior and its applicability in designing and operating AnMBRs for urban wastewater treatment.

KEYWORDS: AnMBR; ultrafiltration; ADM1

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PAPER ID: cest2023_00290

Unveiling the transformation of dissolved organic matter in drinking water treatments based on FT-ICR-MS and spectral analysis

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ABSTRACT

The use of fourier transform ion cyclotron resonance mass spectrometer (FT-ICR MS) and fluorescence excitation-emission matrix (EEM) systematically provide more comprehensive information on the changes in dissolved organic matter (DOM) composition and characteristic in water treatments. Therefore, this study aims to provide information on the molecular and spectroscopic characteristics of DOM in a full-scale drinking water treatment plant (DWTP) and summarize the effects of different treatment processes on DOM. This study sheds light on the molecular transformation of DOM in conventional treatments and advanced treatments.

KEYWORDS: Drinking water treatments, Dissolved organic matter, FT-ICR MS, Spectral analysis

PAPER ID: cest2023_00419

Wetting study of PVDF - carbon nanodiscs membranes for water treatment applications via membrane distillation

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ABSTRACT

The use of fourier transform ion cyclotron resonance mass spectrometer (FT-ICR MS) and fluorescence excitation-emission matrix (EEM) systematically provide more comprehensive information on the changes in dissolved organic matter (DOM) composition and characteristic in water treatments. Therefore, this study aims to provide information on the molecular and spectroscopic characteristics of DOM in a full-scale drinking water treatment plant (DWTP) and summarize the effects of different treatment processes on DOM. This study sheds light on the molecular transformation of DOM in conventional treatments and advanced treatments.

KEYWORDS: Drinking water treatments, Dissolved organic matter, FT-ICR MS, Spectral analysis

PAPER ID: cest2023_00252

Biological Oxygen-dosed Activated Carbon (BODAC) filters - A bio-based treatment for wastewater reuse and reclamation

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ABSTRACT

Water reuse from municipal wastewater treatment plants (WWTPs) effluent has recently gained attention. This effluent water usually contains nutrients and trace contaminants, such as organic micro-pollutants (OMPs). Conventional municipal WWTPs are not currently designed to completely remove these OMPs, making additional and reliable treatments might be needed before the water is safely discharged to the environment or is to be reused. Biological oxygen-dosed activated carbon (BODAC) filters were operated as one of the treatments to further remove nutrients and OMPs from the municipal WWTP effluent in Emmen, the Netherlands, for producing ultrapure water. The long service life, i.e., more than 11 years without carbon replacement or off-site regeneration, of the BODAC filters makes it an attractive bio-based technology for water purification. Additionally, the BODAC filters were demonstrated to be able to protect the reverse osmosis (RO) units, placed downstream of the filters, from (bio)fouling. In this study, a holistic approach by analyzing BODAC granules and water samples was conducted for one year to understand the mechanisms behind the long-term operation of the BODAC filters at a full- and pilot-scale. Additionally, microbial community analysis was conducted to elucidate the putative microbes for the efficient BODAC filters performance.

KEYWORDS: Biological activated carbon, wastewater effluent, organic micro-pollutants (OMPs), biofouling prevention

PAPER ID: cest2023_00368

SESSION 19 - CLIMATE CHANGE

Friday 01 September – morning

Electricity generators in the European Union emissions trading system: definitional aspects in the light of a judicial decision

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ABSTRACT

The "electricity generator" definition (introduced through Directive 2009/29/EC, based on electricity sale and effective since 1.1.2005) is significant within the European Union greenhouse gases Emissions Trading System (ETS). Established through Directive 2003/87/EC, ETS currently (2021-2030) runs Phase IV of free allowances distribution (for emitted carbon-dioxide equivalent tonnes), following the 2005-2007, 2008-2012 and 2013-2020 Phases. Starting with Phase III (2013), electricity generators do not receive free allowances (except for specific reasons), with auction intended for the power sector. For Phase III preparation, the legally non-binding "Guidance paper to identify electricity generators" (revised v2, 18.03.2010), partly limiting the definition's scope (through comparison of on-site electricity consumption with production), was published by the European Commission; it was withdrawn in preparation for Phase IV, with a European Court of Justice decision (5th Chamber, 20.6.2019, Case C-682/17) involving the definition (among other questions) issued in between. Since the definition reaches beyond the power sector, aspects of it (scope, retroactivity, congruity with the equal treatment principle) are considered, relevant to the decision's content, underlining merits of the Guidance paper provision (differentiation between occasional and core electricity sale, less prominent differences in allowances cost recovery possibilities) and the fairness of a flexible electricity sale starting point.

KEYWORDS: European Union Emissions Trading System, Electricity Generator, Directive 2003/87/EC, Guidance paper to identify electricity generators

PAPER ID: cest2023_00297

A study of the properties of alkali activated cement concrete with potassium carbonate activator

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ABSTRACT

Alkali-activated cements (AAC) have recently attracted the vivid interest of the civil engineering industry as promising innovative alternatives to Portland Cement (PC) which is responsible for 8% of anthropogenic CO2 emissions. In this context, this paper studies concrete produced using potassium carbonate (K2CO3)-activated slag cements, on which there is paucity of information. A preliminary study included one-part versus two-part cements and different liquid/solid ratios. Following this, mechanical property and durability testing of the resulting concrete was performed for different curing conditions. The results indicated that strengths would be suitable for C20/25 concrete (i.e., suitable for domestic uses); these strengths were gained early in the curing process (already at 7 days) in most cases. However, by lowering the liquid/solid ratio of the mixes, higher 28-day strengths of up to C30/37 concrete were achieved. Ongoing work is investigating durability of this type of concrete with results so far showing good promise.

KEYWORDS: concrete sustainability; alkali-activated cements; potassium carbonate; ground granulated blast furnace slag; waste management

ACKNOWLEDGEMENT

The contribution of A. H. Zanki, K. Patel and M. Jennings in carrying out the tests with the assistance of Graham Bird and Paul Elsdon is gratefully acknowledged

PAPER ID: cest2023_00333

Investigating ammonia-free urea hydrolysis biocementation processes

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ABSTRACT

Biocementation (i.e., the production of biomimetic cement through the metabolic activity of microorganisms) has attracted the vivid interest of researchers worldwide in the last decade. To date most research works and commercial products proposed biocementation using the urea hydrolysis metabolic route, as it is a fast and easy to control process. However, its major limitation is ammonia production, with adverse environmental impacts. Consequently, research effort has focused on how to alleviate or mitigate ammonia by-products, while using this metabolic route.

The paper presents results of soft organic soil biocementation using an ex-situ urea hydrolysis process, developed so that the produced ammonia does not reach the soil. Indigenous ureolytic bacteria extracted from the soil of a site in East Anglia, UK were used to produce the urease enzyme, which catalyses the urea hydrolysis reaction. Following the proposed ex situ process, measured ammonia contents were found to be within acceptable limits. Soil strength increased and calcite precipitated in the soil although biocementation by bioaugmentation with the same indigenous bacteria gave higher soil strengths and $CaCO_3$ precipitation than the ammonia-free process. After the presentation of results, further advantages and disadvantages of the respective biocementation methods (ex situ vs. in situ) are then discussed.

KEYWORDS: low-carbon cements, biocementation, urea hydrolysis, ground improvement, soft soils

PAPER ID: cest2023_00347

Exploring the mitigation potential of tree crops ecosystems in the Mediterranean region

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ABSTRACT

Orchards agro-ecosystems display a significant potential to act a net sink for atmospheric carbon, offering significant land-based mitigation services. This mitigation potential depends greatly on cultivated species and applied cultivation practices. In this context, the study herein aims to explore the potentials arose regarding the removal of CO2 from atmosphere by tree crops and to underline the significance of this type of cultivations in the field of climate change mitigation. For this purpose, the novel methodology (CO2RCA) that was designed and developed in the context of the LIFE ClimaTree project (https://www.lifeclimatree.eu/) and later was further tested and optimized in the context of the Horizon 2020 Shui project (https://www.shui-eu.org/), will be used. This methodology aims at the detailed calculation of the CO2 balance related to the trees of an orchard and the cultivation practices applied. Five typical tree crop species (orange, olive, apple, peach, almond) of southern Europe (Greece, Spain, Italy) are herein examined. The obtained results are capable to support the design of coupled climate and agricultural policies with significant contribution to the circular economy. Thus, our findings can inspire and be involved in future design of eco-schemes and CO2 voluntary markets, in the context of the new Common Agricultural Policy (CAP) contributing to the Circular Economy pillar of the Mediterranean EU countries.

KEYWORDS: Carbon sequestration, ecosystem services, climate policy, carbon farming, land-based mitigation

PAPER ID: cest2023_00376

SESSION 20 - ENVIRONMENTAL DATA ANALYSIS AND MODELLING

Friday 01 September – morning

Grey forecasting models optimized by firefly algorithm for natural gas consumption prediction in Turkey

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ABSTRACT

Natural Gas is assumed to have a vital role as an energy source in all countries, serving as the primary fuel for industries, homes, and various sectors. The forecasting of natural gas consumption is very crucial for efficient energy management and the formulation of appropriate policies related to its production and usage, accurately. Forecasting has significant economic implications as it enables the implementation of cost-effective strategies based on reliable predictions of natural gas usage. This research focuses on predicting the consumption of natural gas in Turkey by employing Grey Forecasting Models (GF) Optimized by the Firefly Algorithm. The Firefly Algorithm optimizes the model parameters, while the GF models, namely GM (1,1) and NGBM (1,1), estimate the natural gas consumption in Turkey. The performance of these grey forecasting models is evaluated by comparing them with ARIMA and linear regression models. The calculations illustrate that the proposed NGBM (1,1) model, based on the Firefly Algorithm, surpasses other grey models such as OGM(1,1), GM(1,1) as well as statistical methods like ARIMA and linear regression, in terms of prediction accuracy.

KEYWORDS: Natural gas consumption; Grey forecasting; Parameter optimization; Firefly algorithm

PAPER ID: cest2023_00117

Predicting Land Cover Map Changes in the Philippines for use in LULC-based Carbon Capture Monitoring using Deep Learning

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ABSTRACT

In the area of Carbon Capture and Storage (CSS), monitoring plays an important role not only to determine if there is any anomalies in the release of CO2 in the atmosphere, but also to prepare for disasters and to plan better future developments in the industrial sector, transportation sector, real estate development, and other sectors. One way to monitor changes in the carbon cycle is by looking at Land Use and Land Cover (LULC) changes, since the primary methods of carbon capture and storage is by biological and geological sequestration. In this study, we designed a Deep Learning model that can predict land cover changes in the Philippine Land Cover Maps generated by the National Mapping and Resource Information Authority (NAMRIA). We evaluated our results and our model yielded a 78.64% overall accuracy and a Kappa coefficient of 0.725.

KEYWORDS: Land Use and Land Cover (LULC), Land Cover Prediction, Carbon Capture and Storage, Deep Learning

PAPER ID: cest2023_00171

Remote Sensing Mapping of Fine Particulate Matter Concentrations by Random Forest Modeling

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ABSTRACT

Fine particulate matter (PM2.5) is a widespread atmospheric pollutant that poses severe health risks, including respiratory and cardiovascular diseases1,2. Monitoring and mapping near-ground PM2.5 concentrations are crucial for public health. As satellite-derived aerosol optical depth (AOD) data is correlated with PM2.5 concentrations3, remote sensing has been effective in estimating near-ground PM2.5 concentrations. However, to improve mapping accuracy, other relevant factors should also be considered4 by taking advantage of machine learning algorithms such as random forest5,6.

In this study, we aimed to estimate the daily PM2.5 concentrations using a random forest regression model that incorporated MAIAC AOD data (1 km spatial resolution), meteorological, topographic, and spatiotemporal variables. The model achieved an accuracy of R2 = 0.85 and was then tested in the Huaihai Economic Zone (HEZ), consisting of 10 major prefectural cities of three neighboring provinces in east China, from 2000 to 2020. The estimated daily PM2.5 concentrations were used to produce a yearly PM2.5 concentration dataset for HEZ by averaging daily concentrations. The synthesized dataset had an R2 of 0.77 when compared with the observed yearly average PM2.5 concentrations. This indicates that it is a ready-for-use product for various purposes. Based on the synthesized dataset, the yearly average PM2.5 concentrations of HEZ were also calculated. Despite an increasing trend from 2000 to 2010 and a decreasing trend from 2010 to 2020, the overall trend of PM2.5 concentrations over HEZ was decreasing during the 21 years.

Our study demonstrates that random forest modeling, incorporating spatiotemporal variability of AOD and other relevant factors, can accurately estimate and map PM2.5 concentrations. The daily and yearly PM2.5 concentration data produced by our method in the study can be a valuable resource for environmental management over large geographic areas.

KEYWORDS: particulate matter, atmospheric pollution, remote sensing, random forest, AOD

PAPER ID: cest2023_00387

Rule-based Quantification and Mapping of Ecosystem Services Across Three Spatial Scales by Example of Germany

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ABSTRACT

The state of ecosystems influences their services for humans. Therefore, the European Union aims to assess and map ecosystem conditions and ecosystem services at the level of the Union and the Member States, in order to implement maintenance or protection measures, if necessary. This paper aims at creating a methodology allowing to quantify and map the potential supply of selected forest ecosystem services over time, considering the influence of climate change and atmospheric nitrogen deposition which is, in contrast to previous approaches, reproducible. Therefore, the methodology was operationalised in a rule-based manner enabling to quantify and map ecosystem services at the local, regional and national level using Germany as an example. To this end, in a first step 125 near natural forest ecosystem types covering Germany were grouped into 78 classes according to the degree of similarity of their ecological characteristics that influence the provision of ecosystem services. Thereby, ecoclimatic, soil, hydrological, nutrient balance characteristics and 12 potential ecosystem service capacities were taken into account. Three potential ecosystem services (habitat, carbon storage, primary production) were quantified for selected representatives of the ecosystem type classes according to complex, but fully transparent rules, and mapped at the local, regional and national level.

KEYWORDS: Ecosystem condition; ecosystem integrity; EU Biodiversity Strategy; Geographic Information System

FUNDING

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PAPER ID: cest2023_00130

Urban Heat Island mitigation scenarios by Blue-Green Infrastructures modelling

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ABSTRACT

The integrated planning of cities landscape and blue-green infrastructures (BGI) is an approach poised to play an increasingly positive role in climate change adaptation for the human population. Cities worldwide are rapidly expanding to accommodate the increasing urbanization. Phenomena including Urban Heat Island (UHI) and urban flooding are thus more likely – the occurrence and severity of which will be exacerbated by more extreme weather events. BGI offer a network of semi-natural engineering solutions for the sustainable mitigation of such threats to urban liveability.

Scientists have developed scenario modeling tools capable of investigating either phenomenon. Yet their combination has been underexplored. In this study, we integrate, in a feedback loop, the inputs and outputs of two globally used BGI planning-support modeling tools (i.e., UrbanBEATS and TARGET) in one framework. UrbanBEATS allows us to optimally plan systems for managing stormwater quality and quantity based on user and policy requirements. The planned changes in land cover due to BGI is then used in TARGET, a one-dimensional urban climate model, to simulate the impact of BGI on the UHI effect.

We apply this framework to the Municipality of Modena, a medium-sized municipality located in the northern part of Italy in the River Po Valley. The area is particularly suited for the study given the tendency towards increasing imperviousness and worsening summer heat events evolving to longer dry conditions and shorter but more intense rainfalls.

The simplicity of the models and minimal data requirements guarantee widespread applicability of the framework by public authorities to plan the adoption of BGI and make cities more sustainable, liveable and resilient.

KEYWORDS: urban planning, urban modelling, floods, urban heat island, blue-green infrastructures

PAPER ID: cest2023_00287

Fair and Efficient Allocation of EU Emission Allowances

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ABSTRACT

Under the European Union Emission Trading System (EU ETS), the European Union issues and allo- cates emission allowances (EUA) to the member states to cap the total volume of Greenhouse Gas (GHG) emis- sions. Since the first years of operation, the EU ETS allo- cation procedure has undergone multiple changes in an attempt to both fix over-allocation issues and balance sur- plus as well as to protect firms from carbon leakage. This is partially done through the means of grandfathering emission permits, auctioning or benchmark-based allo- cation. In this work, we study the allocation methods applied by the EU throughout the years, and we establish a notion of fairness based on the goals that the EU aims to achieve. Aiming to reach a balance between fairness and efficiency, we collect a series of indicators that describe the economic conditions and the energy intensity of each member state, and we perform a cluster analysis to cate- gorize the countries. We then perform a regression analy- sis to examine whether our selected indicators best descri- be the free allowance allocation of the EU ETS through- out the years and observe similarities between countries in the same clusters. Finally, we provide a simple yet flexible allowance allocation optimization problem which can incorporate various fair allocation principles proposed by the literature.

KEYWORDS: EU ETS, Cap-and-Trade, Emission Trading System, Allowance Allocation, Individual Fairness

PAPER ID: cest2023_00077

SESSION 21 - ENVIRONMENTAL BIOTECHNOLOGY AND BIOENERGY

Friday 01 September – morning

Biorefinery model for the production of biofuels and bioproducts from lignocellulosic biomass

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ABSTRACT

This work studies advanced biofuel and biomaterials production using lignocellulosic biomass from poplar crops. In this sense, lignocellulosic biomass transformation into biojet fuel, bioLPG, green diesel and High-Density Polyethylene (HPDE) was studied through an exhaustive evaluation, including a techno-economic analysis, a life cycle assessment and physico-chemical and thermodynamical analyses. Biorefinery models were simulated using the chemical engineering software AspenPlus® v.12. In all cases, the NRTL thermodynamical method was employed, except for the HDPE production, where the Polymer method was used for the mass and energy balances. All biorefineries were fed with 77 t/h of feedstock. On the one hand, in the biojet fuel set-up, the biorefinery produced 92,400 t/year of biojet fuel and 39,917 t/year of green diesel. On the other hand, in the HDPE configuration, 103,000 t/year of HPDE were obtained. The life cycle analysis (LCA), carried out using the simulation software SimaPro® and the Ecoinvent® database, measured the environmental impact generated, kg of CO2-eq/MJ biofuel and kg of CO2-eq/kg of HDPE, at each process. Techno-economic results evaluated the relation between fixed and variable costs through a cash flow to obtain the products' minimum selling price (MSP). Even though economic competitiveness is barely achieved, when the processes by-products such as lignin are considered, the MSP drops enough to be competitive with their conventional counterparts. Besides, a sensitivity analysis was performed to evaluate different scenarios where the simulated biorefineries were competitive, demonstrating the potential of poplar biomass residues as feedstock. In all cases, the CO2-eq footprint was compared with European standards, obtaining encouraging results compared to the Renewable Energy Directive II, which means the produced biofuels are eligible for financial support by public authorities. Finally, biofuels properties were compared to the American Society for Testing and Materials (ASTM) standards, where the specifications of road transport fuels and aviation turbine fuels are shown (consisting of a conventional and synthetic mixture). All biofuels met the standards.

KEYWORDS: biojet fuel, biomass valorization, bioenergy, bioplastic, biorrefinery

PAPER ID: cest2023_00071

Enrichment of mesophilic syngas-converting consortia for methane production

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ABSTRACT

The use of waste biomass as raw material for syngas production has emerged as a sustainable and cost-effective alternative to the conventional gasifiable feedstock. In addition, syngas bioconversion into value-added compounds could be an interesting approach for carbon fixation and syngas valorization, but some limitations must be overcome. One of the most important issues is to establish a robust microbial culture able to use CO as a carbon source. In the present study, an anaerobic consortium was enriched with a synthetic syngas mixture with a composition similar to that obtained from biomass gasification. Four syngas dilutions (25, 50, 75 and 100%) were tested to determine the CO tolerance of the mixed culture and evaluate its growth kinetics. The results showed the successful enrichment of a mesophilic syngas-converting consortium able to thrive in concentrations up to 30% CO. Volatile fatty acids (mostly acetate) and CH4 were the main products of its metabolism, reaching up to 54.27±1.04 mM of VFAs concentration and a CH4 production of 15.41±0.15 mmol·d-1. The accumulation of organic acids in the liquid phase appeared as a key factor for the development of the community, triggering its inhibition.

KEYWORDS: carbon monoxide, mesophilic consortia, methane, syngas, volatile fatty acids

PAPER ID: cest2023_00094

Direct upgrading of biogas produced by anaerobic digestion: preliminary results at laboratory scale.

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ABSTRACT

The present study investigated, at laboratory scale, the possibility of achieving biogas upgrading with a single step of treatment, namely without involving any pre- or post-treatment or multiple stage recirculation. In this respect, three commercial molecular sieves (i.e., Honeywell 13X, 4A, and 5A) have been tested according two different configurations in series (4A/13X and 4A/5A) in 25/75 v/v relative amounts. A control trap containing only the 4A molecular sieve using the same amount of the in series configurations has also been used. Real biogas feed directly from the production reactors at atmosphere pressure has been used in the experiments. 4A sample resulted highly efficient in biogas upgrading (CO2 retention rate of 42.4 gCO2/kg, equivalent to 0.96 mmolCO2/g) but its activity was limited to 18 days while by increasing the material amount and combining different types of molecular sieves in series, performance increased. The possibility to regenerate and reuse the sieves was also proven although preliminary.

KEYWORDS: anaerobic digestion, biogas upgrading, biomethane, CO2 adsorption, molecular sieves.

FUNDING

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Production of sustainable exopolysaccharides from *Schizophyllum commune* using brewery spent grain and physicochemical and rheological characterization

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ABSTRACT

Cost-effective and biodegradable biopolymers derived from natural sources are promising alternatives to their counterparts. They are gaining increasing interest for environmentally friendly applications in the food, cosmetics, and medical industries. Schizophyllan (SPG) is an extracellular polysaccharide, in the β-D-glucans group, produced by Schizophyllum commune. The utilization of inexpensive side-streams from the agri-food sector could enable the cost-effective production of bio-products that is mainly affected by fermentation media cost. In this study, mycelial mass and SPG were produced via submerged cultures of S. commune in a 4-L lab-scale stirred tank bioreactor. The use of brewer's spent grain (BSG) as a carbon source favored the cultivation efficiency. BSG-based medium resulted in 2.3-fold and 1.9-fold higher biomass and SPG production respectively compared to glucose-based medium. The crude SPG was characterized via viscometry, particle tracking microrheology, TGA, FTIR, DLS, and FT-Raman. SPG aqueous solutions displayed increasing levels of shear thinning behavior and viscoelastic properties with increasing concentration. FTIR and FT-Raman spectra revealed the characteristic peaks of β-glucans. SPG demonstrated enhanced thermal profile and surface charge values. This study demonstrated a circular-oriented approach for the efficient production of sustainable polysaccharides with tailored properties that can be used in food-related systems.

KEYWORDS: anaerobic digestion, biogas upgrading, biomethane, CO2 adsorption, molecular sieves.

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Increasing Tolerance of the Biomass Plant Szarvasi-1 Energy Grass to Abiotic Stresses by S-methylmethionine and Na-salicylate

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ABSTRACT

Szarvasi-1 energy grass (Thinopyrum obtusiflorum syn. Elytrigia elongata, Elymus elongatus ssp. ponticus cv Szarvasi-1, Poaceae, Triticeae) has been developed from wild tall wheatgrass genotypes for bioenergy production (Csete et al., 2011). It has been characterized as a widely tolerant plant to salinity, drought and certain heavy metals (Zn, Ni) (Sipos et al., 2013). Nevertheless, biomass is often decreased by stress. We have investigated the priming effect of S-methylmethionine (SMM) in nutrient solution prior to Cd stress and the effect of SMM and Na-salicylate (SA) as foliar spray under drought conditions in field experiments.

Cd amendment in 0.01 mM concentration decreased the root and shoot growth, chlorophyll concentration, stomatal conductance, the maximal quantum efficiency of PSII and increased carotenoid content. SMM priming positively influenced these parameters compared to Cd treatment without priming. It was found that the translocation and accumulation of Cd decreased in primed plants. Cd treatment modified the root and shoot element accumulation patterns compared to the control. SMM priming changed this pattern of nutrient uptake of which Fe showed characteristic accumulation in the roots to increasing SMM concentrations. These findings suggest that SMM priming exerts a positive effect on Cd stressed Szarvasi-1 plants that retained physiological performance and growth. This ameliorative effect is most probably based on the lower root-to-shoot Cd translocation by the upregulated Fe uptake and transport.

We have conducted a long-term field study on a set of 21 quadrates of sandy soil. The plants were exposed to natural conditions of drought in 2020 and 2021 April to July. SMM and SA foliar spray treatments were applied in 0.05 mM concentration twice in the period. Distilled water treatment served as control. Measurements were made one week after the treatments and at harvest. In 2020, it was found that the transpiration and photosynthetic CO2 fixation was stimulated in May and June after the SMM and SA treatments compared to the control but by July the values were equalized. In 2021, there was a weak stimulation in CO2 fixation only. The photochemical reflectance index showed a significant increase for both treatments. Other parameters such as maximum quantum efficiency of PSII, chlorophyll content and even dry mass yield was not different from the control. The temporary increase in CO2 fixation may have triggered shoot-to-root carbon allocation enabling enhanced root growth and higher stress resistance. We have concluded that SMM and SA treatments have a great potential in biomass production under adverse environmental conditions.

KEYWORDS: energy plant, abiotic stress, s-methylmethionine, na-salicylate

FUNDING

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Comparative Analysis of Two Microalgae-Bacterial Symbiotic Association Growth in Papermill Effluent Enriched Through Food Waste Digestate

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ABSTRACT

New treatment methods are needed to better recycle waste towards the circular economy. Microalgae can be used as an asset to treat effluent and simultaneously produce biofuel. This paper aims to evaluate the growth of microalgae-bacterial symbiotic association in papermill effluent enriched through food waste digestate. Besides that further removal capacity of nutrients from effluent were also evaluated. Two microalgae strains were observed: Auxenochlorella protothecoide, Tetraselmis indica in combination with mixed bacterial inoculation versus the monoculture of microalgae.. Auxenochlorella protothecoide-bacterial symbiotic system growth in the effluent was 1.6 times more than monoculture growth of Auxenochlorella protothecoide. On the 10th day, the symbiotic Auxenochlorella protothecoide system removed 86.95%, 85.67%, and 78.53% of chemical oxygen demand (COD), total dissolved nitrogen (TDN), and total dissolved phosphorus (TDP) respectively. The paper mill effluent after treatment can be recycled to use further for irrigation purposes.

KEYWORDS: Algal biomass, Microalgae-Bacterial Consortium, Pulp and paper mill effluent, Abbreviations – PPE-Paper Mill Effluent, COD- Chemical oxygen demand, TDN- Total dissolved nitrogen, TDP- Total dissolved phosphorus.

PAPER ID: cest2023_00505

SESSION 22 - SUSTAINABILITY & THE SDGs

Friday 01 September – morning

Re-assessment Estimation of the Wastewater Treatment Plants' Seismic Vulnerability

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ABSTRACT

Many empirical studies use questionnaires for the vulnerability estimation of technical structures. Wastewater Treatment Plants (WWTPs) are critical infrastructure whose the seismic impacts may affect the environment and the society. Interesting results are revealed from the comparison of seismic vulnerability questionnaires granted between different periods.

In this study a Questionnaire "A" (Que-A) of 44 questions was distributed to the responsible operators of a representative sample of 116 Greek WWTPs during 7 months in 2021. After six months, a similar Questionnaire "B" (Que-B) of 14 questions was distributed to another representative sample of responsible operators of 40 WWTPs which lasted 3 months in 2022. Both surveys were used Likert Scale and were checked for their internal reliability and validity.

The results revealed that the recipients were graduated operators of the WWTPs occupying positions of high responsibility for both "A" and "B" Questionnaires, and their experience didn't differ each other. A limit correlation between vulnerability and seismic vulnerability was noticed in Que-B. No difference was observed between the frequencies for seismic vulnerability of Que-A and vulnerability of Que- "B". The same was occurred comparing the seismic vulnerability of both the Questionnaires. The same results for both the Questionnaires were extracted comparing the seismic vulnerability due to structural vulnerability, non-structural vulnerability or operational vulnerability. Finally, the soil-water pollution in the post seismic period (immediate and after 24 hours) presents the same percentages for both the Questionnaires. Concluding, the study supports the claim that these two Questionnaires produce similar results while Que-A has reliability, and can be used for WWTPs' vulnerability estimations.

KEYWORDS: Wastewater Treatment Plants, Questionnaire, Vulnerability, Seismic Vulnerability, Reliability

PAPER ID: cest2023_00061

Green management as an instrument of activation of employees in the mature age

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ABSTRACT

Green management combines the concepts of environmental management and human resources management in such a way as to develop "green" skills and motivate and ensure pro-ecological activation of employees - by placing sustainable development at the center of the organization's HR processes. The aim of the article is to present the concept of green management as an instrument of activation of the elderly. We conclude that it is necessary to maintain the awareness that work is an important factor affecting the activity of the elderly and determines their place in the social structure. The challenge is to create such employment conditions that employees of mature age (aged 60 and over) have a suitable job that would take into account their aspirations, skills, and health). It is necessary to conduct appropriate policies aimed at activating mature workers and reducing the level of unemployment among them by changing the pension system, as well as health care and granting social benefits, promoting flexible forms of employment, increasing the possibility of undertaking and continuing various activities, ensuring optimal working time and working conditions, implementation of innovative processes, counteracting discriminatory behavior, increasing employability and encouraging lifelong learning.

KEYWORDS: green management, green enterprise, mature work, green jobs

PAPER ID: cest2023_00151

OTAER biotechnology: a new pathway of reaching the Zero Net Carbon in Odours Treatment

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ABSTRACT

Emissions of odours into ambient air represent a serious problem and cause for conflict, due to the effects they cause on the population and on the exposed environment. Their treatment is therefore a priority. The approach currently pursued by the conventional odour treatment technologies is focused on reducing the odour concentration and/or on the degradation of the odorous substances into non-odorous ones. The operation of these systems, however, determines the production and emission of greenhouse gases (GHGs) and therefore climate change issues. The research presents and discusses the identification and development of an advanced, integrated, and sustainable odour treatment technology, biological based, called OTAER system. The aim is to promote a new integrated treatment system that combines the reduction of odours with the control and recovery of GHGs for the purpose of subsequent valorization in energy terms. The technology fits into the principles dictated by the New Green Deal and in compliance with the guidelines of the SDGs (objectives n.7 and n.13). The research presents the results of an intense experimental validation activity of the OTAER system on different odorous compounds. The percentages of abatement and the production of algal-biomass are reported and discussed. The proposed system highlights the importance of developing and implementing integrated biotechnologies, aiming to applying circular economy approaches, in order to guarantees the total environmental protection, including the reduction of climate change emissions.

KEYWORDS: air pollution; biotechnology; environmental sustainability; Hydrogen sulfide; odor treatment wastewater treatment plant.

PAPER ID: cest2023_00375

Evaluating effectiveness of Environmental Impact Assessment procedure in Greece

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ABSTRACT

Effectiveness of Environmental Impact Assessment (EIA) resides in its capacity to ensure environmentally sound and sustainable development. As an ex ante tool aims to evaluate the most significant potential environmental impacts of a project, both during the construction and operation phase, before the implementation as an attempt for mitigating them. Additionally, environmental monitoring is an imperative part of this demanding procedure. Greece belongs to the European Union (EU) and EIA was firstly introduced based on the novel environmental Law 1650/1986. Thereafter, last major reform occurred with the Law 4014/2011 as amended, which partly transposed the EIA EU Directive 2014/52/EU, contained challenging and innovative provisions mainly including a non - mandatory scoping phase, screening process based on thresholds and inclusive lists, extended duration of environmental licensing, e-governance tools (National Electronic Environmental Registry) intending in a more efficient public consultation etc. Nowadays, questions are raised as to whether the amendment of legislation ensures the protection of the environment alongside the country's development trajectory. Taking into account the global trend for streamlining and simplification of EIA along with the current energy crisis, loss of biodiversity, climate crisis etc. this study aims to explore the effectiveness of EIA implementation in Greece. This evaluation relied on a literature review as well as on an open - ended questionnaire survey, where an extended pool of specialized stakeholders has been involved (EIA consultants, legal experts, environmental permitting authorities' personnel and NGOs representatives).

Regarding EIA study quality, most stakeholders mentioned insufficient consideration of environmental impacts and design alternatives in company with indicating the need for environmental data obtained primarily from field measurements. The same goes for accomplishing higher quality of Appropriate Assessments (AA), required reports for projects and activities located in or close to protected areas. Transparency of EIA studies is typically obtained through the explicated statement of used methods, assumptions and data sources. The latter should be easily accessible for both practitioners and public. Furthermore, despite the recent national Climate Law (passed firstly in 2022) integrate climate change adaptation in environmental permitting, findings emphasize the necessity of incorporating mitigation measures into EIA studies capturing how proposed projects will contribute to make the EU climate-neutral by 2050.

Due to the crucial role of environmental inspections by competent authorities, the majority of respondents expressed that strengthening of post-monitoring and audit mechanism is essential. Identified weaknesses include understaffing and inadequate funding of the authorities. To address these issues, the newly controversial measure of private environmental inspectors has been adopted. However, most respondents consider that this could be supporting in case of be associated with establishing an independent Environmental Inspectors' Authority.

Last but not least, despite legal provisions aimed at ensuring equitable involvement of all stakeholders in environmental permitting decisions, participants highlighted lack of effective public participation in enabling meaningful engagement. The EIA process should be more responsive to public concerns and feedback. Information sharing, open government and workshops with physical attendance options for those without internet access were recognized fostering inclusivity in EIA procedure. Overall EIA's effectiveness varies depending on the governance system thus it becomes essential periodically to be reviewed.

KEYWORDS: Environmental Impact Assessment (EIA), Greece, evaluation, questionnaire survey, key stakeholders perception

PAPER ID: cest2023_00461

Assessing the progress of insular areas in relation to the Sustainable Development Goals (SDGs): The case of six isolated Greek islands

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ABSTRACT

The Sustainable Development Goals (SDGs) localisation describes the complex process of translating the 2030 Agenda for Sustainable Development within the local context and challenges, defining, implementing and monitoring local actions and strategies that contribute to the global achievement of the SDGs. This article seeks to address this issue by assessing the progress of six isolated Greek islands towards achieving SDGs, namely the islands of Karpathos, Chalki, Tilos, Symi, Kasos and Megisti (Kastellorizo), through the quantification of relevant indicators. In an attempt to perceive the effect of insularity in achieving SDGs, the islands' progress regarding selected goals is compared to the one of areas found in the Greek mainland and have similar characteristics to the islands in terms of population and distance from the country's capital, Athens.

KEYWORDS: SDGs, Insularity, Islands, Indicators

PAPER ID: cest2023_00263

Ethical considerations of participatory modelling in the context of sustainable development

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ABSTRACT

Sustainable development deals with grand challenges related to human well-being and environmental sustainability. Assessing sustainability initiatives goes beyond technical solutions and requires the engagement and deliberation of multiple stakeholders. Participatory modelling is a promising approach to explore sustainability alternatives by using technical tools (e.g. simulation) while actively involving stakeholders. The discussion around sustainability alternatives has ethical implications as it deals with matters that affect people and the environment. However, despite ethical aspects are implicit in participatory modelling processes, they are often overlooked. This study aims to make visible the ethical dimension of participatory simulation models in the context of sustainability. Here we propose to have sustainable development and human rights as ethical standpoints for participatory modelling efforts in complex social-ecological settings. A practical-oriented ethical evaluation is proposed in the form of questions structured across a relevant participatory modelling framework. An ethical lens is essential to guide social-ecological systems modelling throughout to identify pathways that align with principles aiming to protect human dignity, promote justice, and prevent environmental harm. The proposed ethical framework aims to promote the design of socially accepted and ethically transparent models that support decision-making processes aligned with the Sustainable Development Goals (SDGs) transitions.

KEYWORDS: ethics, participatory modelling, simulation, sustainable development, human rights

PAPER ID: cest2023_00032

The education approach to sustainable water management

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ABSTRACT

Water has a leading role in sustainable development. Water security is a key challenge worldwide. In recent years, new challenges from intensive urbanization and climate change have come to the fore. These challenges are intertwined with environmental, economic and social issues, which threaten the world's population and lead to an increased responsibility to improve the management of water resources in a sustainable way in order to ensure the life and future of the earth. Despite the efforts that have been made, water management is a cause for concern. Education can empower people in such a way that they become active agents of sustainable development themselves and this could be a fundamental step towards a better global future. The article seeks to highlight the necessity of water as a subject of environmental education and to state the conditions required for its successful implementation, in order to achieve awareness of natural resources and develop capacities for the sustainability of our global society.

KEYWORDS: environmental education, water education, water management, sustainable development, water safety.

PAPER ID: cest2023_00457

SESSION 23 - HYDROLOGY AND WATER RESOURCES MANAGEMENT

Friday 01 September – morning

Water centrality to enabling water-energy-food systems

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ABSTRACT

Water is a key enabler of global water-energy-food nexus systems. The role of water in energy generation and its role in food provision, is made explicit. These are aspects that are often overlooked, or 'embedded' in assessments, skimming over the critical role that water plays in societal-enabling systems. The historical role of water in enabling agriculture, settlements, civilization, and development is discussed. The role of water in the achievement of the United Nations Sustainable Development Goals is discussed, showing that in some cases, achieving water-related goals in de-facto necessary for the accomplishment of others. Water may be the most important resource needed in a broader water-energy-food context, as well as in the scope of human development. The review highlights the consequences of 'water going wrong'. The paper ends with a call for greater 'nexus awareness' in policy and decision making, while cautioning against the potential ironic situation of returning to a sectoral, water-centric view of resource management.

KEYWORDS: nexus; systems thinking; water centrality; water-energy-food

ACKNOWLEDGEMENTS

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PAPER ID: cest2023_00048

Behind the scenes: The WFD 2000/60 policy making.

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ABSTRACT

This research investigates the impact of legislative negotiations in the water policy of European Union and the crucial role of the European Commission as the formal agenda setter. The coordination of EU institutions and other actors -member states, interest groups and especially "Non-Governmental Organisations"- in law-making process of Water Framework Directive (WFD) 2000/60/EC play an important role in water governance. We have demonstrated that the policy complexity in Water Framework Directive 2000/60 legislative procedure between 1996 and 2000, the complicated nature of the legislative proposal, the large number of amendments, and divergent views had significantly delayed procedures. Consequences of policy complexity in the European Union is very important for European integration and decision-making processes. Our research demonstrates that the adoption of WFD is not only a function of political or institutional factors, but it is also shows how important is the design stage of the Directive. While our study focused on the case of water policy, the question of how policy making, and delay of legislative processes affects the efficiency of EU governance.

KEYWORDS: environmental legislation; policy coordination; water management; Water Framework Directive;

PAPER ID: cest2023_00279

Evaluating the water quality of stormwater runoffs in urban area

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ABSTRACT

This paper presents the results of stormwater quality monitoring from four constructed wetlands located in residential and industrial catchments. Preliminary results revealed that pollutants' types and concentrations vary depending on the catchments' characteristics. It is found that the residential catchments often hold higher total phosphorus and suspended solids, while the industrial areas are found with high concentrations of Iron and Strontium. Nonetheless, high metal concentrations are observed in both catchments, raising concerns about the effectiveness of stormwater treatment devices and the current guidelines adopted in the design and construction of these systems. While it is found that all catchments displayed exceptional levels of pollutants that are not safe for the freshwater environment, the pollutant concentrations remained below the average concentrations in the Melbourne area. Less commonly discussed metals such as Barium and Strontium were found in all water samples with concentrations greater than the values discussed in the literature. During the investigation, challenges were faced due to the voluntary nature of the guidelines and the lack of data on trace metals. It is, therefore, recommended that further monitoring is required to confirm the changes in stormwater runoff quality and to assess the appropriateness of the current guidelines for improved management.

KEYWORDS: Heavy metals, best practice management, stormwater runoff, water quality

PAPER ID: cest2023_00370

Changes in geomorphic units alter nitrogen fixation in a large lowland tropical river

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ABSTRACT

The present investigation was carried out over 50 km reach the Padma River of Bangladesh, downstream of the confluence of the Ganges and Brahmaputra rivers. The study area is highly dynamic, with various geomorphic units (GUs) such as primary and secondary channels (C&S) islands (VI), bars (L, T and SB), vegetated bank (EK), dry channel (ED) and water depression (WD). A field study was carried out in low flow (dry/winter) season to measure the nitrogen fixation rate (NFR) in each type of GUs. Later NFR was upscaled in different seasons based on the surface area of GUs. Principal component analysis was applied considering the seasonal variation of GUs (surface area and number) and the distribution of nitrogen fixation estimated in GUs in different seasons. Results showed that changes in the number and surface area of GUs across seasons could alter NFR. This systematic investigation of the spatial and temporal distribution of geomorphological and NFR measuring and monitoring will help plan river restoration and ecosystem management programs.

KEYWORDS: Geomorphology, biogeochemical process, Seasonal variation, Large lowland river, Bangladesh

PAPER ID: cest2023_00259

A comprehensive monitoring approach to evaluate the impact of an urban landfill on a naturally reducing aquifer

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ABSTRACT

The processes leading to high levels of arsenic, iron, and manganese in a naturally reducing aquifer beneath a landfill are investigated. Traditional groundwater monitoring (physical-chemical parameters, major and trace inorganic compounds, organic compounds) has been complemented with the analysis of environmental isotopes of groundwater and of the dissolved gases (e.g., CH4 and CO2). The results suggest that landfill gas circulating in the aquifer (as demonstrated by 14C dating of methane) enhanced the naturally reducing conditions of the aquifer, eventually resulting in the observed high concentrations of redox-sensitive elements. At the same time, high pressure of CO2 at some piezometers locally lowers pH, hence increasing the dissolution of sedimentary carbonates and alkalinity. In addition, the reuse of water from leachate treatment to meet circular economy requirements was invoked to explain the high levels of tritium and 2H, associated with strongly significantly negative 13C, observed in a production well and in a nearby piezometer. Environmental isotopes can fruitfully complement traditional monitoring when the comprehension of processes is desired, but expert judgment is required.

KEYWORDS: groundwater, methane, environmental isotope, urban waste, pollution

PAPER ID: cest2023_00569

Development of flood risk maps using Remote Sensing Techniques in Cyprus

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ABSTRACT

Floods are the most devastating natural disasters and are likely to become more frequent, dominant, and severe due to climate change, population growth, urbanization, and other factors related to watersheds and human activities. A flood can be defined as a body of water that causes runoff to land that is not normally covered by water. Ecosystems and floods are closely related. Urbanization across watersheds can lead to many causes of flooding. However, earth observation technologies such as satellite remote sensing can contribute to more efficient flood risk mapping by the European Directive 2007/60/EC on Flood Risk Assessment and Management. An interdisciplinary, integrated approach is used to present current and historical regimes of the selected watershed in Paphos region of Cyprus, combining Earth Observation (EO), Geographic Information Systems (GIS), hydraulics, surveying techniques (such as laser scanning), and crowdsourcing. This article presents a comprehensive examination of the utilization of satellite-based remote sensing techniques for flood detection, monitoring, and integration with flood models, highlighting recent advancements in the field.

KEYWORDS: Flood, Risk assessment, Modelling, Earth Observation, GIS

ACKNOWLEDGEMENTS:

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PAPER ID: cest2023_00267

Coding Water Efficiency

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ABSTRACT

Repetitive documentation is a common theme across engineering projects. On one key project that tracked clean water leakage from pipelines across a major city, this was the case. This project involved constructing chambers around clean water mains that enabled a tracking device to be inserted into the main to identify leaks. An automation process was developed to create the designer documents faster and with a lower opportunity for human error. Similar hazards arose for each site making it simple to develop a checklist for these repetitive risks. A VBA code was written that could populate the necessary templates using data from a table. The engineer input was reduced to researching and inputting the findings in a table, saving time formatting, and typing out repetitive inputs. This enabled a larger volume of packs to be developed, additional chambers to be built, more leaks to be identified, and less water from being lost. The automation facilitates good design and risk identification, but the output will still only be as good as the input. This automation has begun with a 'home-made' approach to coding and has the potential to develop a user-friendly tool accessible across multiple projects and sectors.

KEYWORDS: Automation, CDM, Coding, Efficiency, Water loss

PAPER ID: cest2023_00366

Domestic water consumption determinants in urban neighborhoods: A case study of Vijayawada, India

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ABSTRACT

Domestic water consumption accounts for a large share of urban water demand. The present study discusses a study on domestic water consumption in ten different neighborhoods in Vijayawada, India. The study examines the relationship between per capita water consumption and various socio-economic, physical, and supply-related variables. The study conducted a primary survey of 117 households to collect data on water consumption and related factors. Multiple regression analysis was used to identify the significant determinants of per capita water consumption. The study found that supply continuity, household size, household income, building height, building age, and annual water charges significantly affect per capita water consumption in the studied neighborhoods. The study also found that different types of neighborhoods have different per capita water consumption levels and determinants. The study results assist urban planners and local bodies in systematically managing water demands through spatial and policy solutions. The study identifies that urban planners and local bodies can manage water demands through effective spatial and policy solutions.

KEYWORDS: Domestic water consumption, determinants, neighborhood, per capita water consumption, consumption pattern

PAPER ID: cest2023_00065

SESSION 24 - CLIMATE CHANGE

Friday 01 September – morning

Fair guidance in ratcheting up the national net-zero emission ambitions

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ABSTRACT

National net-zero pledges have brought the Paris Agreement temperature target within reach, yet they still need a boost. Current evaluations and analyses of net-zero targets have fallen short in equity. We use a transparent and multidimensional approach to go beyond the long-standing dispute of detailed equity definitions and assess the Paris Agreement compatibility of national net-zero targets from a general equity perspective. We use the allowed national emissions as a reference to incentivize countries to increase their targets. If countries follow a linearly increasing ambition level of Nationally Determined Contributions (NDCs) to net-zero commitments and then remain on this path, global warming will be limited to about 1.8 °C (high NDCs) or -1.9 °C (low NDCs) by 2100. Our work provides essential information for reviewing and advancing net-zero commitments and promoting the convergence of national actions towards the 1.5 °C goal.

KEYWORDS: Net-zero pledges; equity; Paris Agreement

PAPER ID: cest2023_00394

Review and evaluation of the methods for building the Carbon Farming Calculation Tool

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ABSTRACT

Agriculture accounts for around 30% of total GHG emissions worldwide. Carbon calculators are vital to accurately measure GHG emissions from farms and decrease their impact through carbon harvesting techniques. This paper aims to review various carbon calculator models and group them into typologies to provide helpful information on selecting the most appropriate calculator for different farming systems. Farm scale calculators enable farmers to monitor GHG emissions and reduce them by adopting sustainable agricultural practices. Landscape-scale calculators are useful in larger areas, with different land uses and agricultural practices. The AgRE Calc, Cool Farm Tool, and Solagro carbon calculators were the most adequate to estimate greenhouse gas emissions from agricultural activities. By comprehending GHG emissions in agriculture, accurately calculating them, and adopting sustainable practices, farmers can strive to achieve carbon neutrality by 2050.

KEYWORDS: carbon harvesting, carbon neutrality, farm scale carbon calculator, sustainable agriculture

ACKNOWLEDGMENT:

Work funded by Project “Carbon Farming Geolocation Support by Establishing a Spatial Soil Database Management System” - LIFE20 PRE/GR/018 LIFE GEOCARBON.

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Assessing Climate Change Impacts in the Tana Basin, Ethiopia

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ABSTRACT

Climate change effects on long-term groundwater (GW) resource developments in the Tana Basin, Ethiopia, were investigated using a fine-resolution GW model based on MODFLOW-NWT. The GW model was calibrated with 98 historical instantaneous well-level measurements and 38 years of monthly lake level data. Using this model we simulated long-term climate change impacts by considering two representative concentration pathways (RCPs) from the two extreme global circulation models available in the region. While the MIROC5 simulated GW table (GWT) was found to be stable, the CSIRO-Mk3 simulated GWT exhibited large fluctuations (+2 m to −4 m) by 2100 due to climate change. More critical impacts were predicted for the lake, where total lake releases from the baseline scenario were projected to change by +50% (MIROC5) or −22% (CSIRO-Mk3) by the end of 2100.

KEYWORDS: groundwater model; sustainability; MODFLOW-NWT; Upper Blue Nile

ACKNOWLEDGMENT:

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Climate change, overheating and public health: analysis of dynamic and correlations in EU regions

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ABSTRACT

An intense concern about global warming and increased temperatures as a result of climate change has been observed worldwide during the last decades. The need for cooling expressed in Cooling Degree Days (CDD) at the EU level has increased by 169.8% since 1980. Extreme temperatures, intense heatwaves, and other natural disasters have hit European cities recently and have led to increased fatalities, becoming a significant hazard for a vulnerable population. Even if the consequences of climate change on human health are generally known, there is a gap in the quantification of this impact based on specific geographic and climate characteristics. This paper aims to quantify the impact through the analysis of overheating indicators and mortality rates and to identify correlations between these two variables. Then, it develops typologies of cities and regions based on their correlation levels and their specific characteristics to evaluate which of them are more vulnerable to climate change. Through this process, useful knowledge for policymakers, which will plan future climate change adaptation strategies, could be produced. Results showed that the correlations between overheating and mortality are strong, especially for landlocked regions with continental climates and for highly urbanised areas. R-squared values for most of the regions were high, especially for the period 2014-2019 and especially for countries that registered lower energy consumption climatic corrected for space cooling, possibly as a result of energy poverty. Findings showed that policies for regions with the above-mentioned characteristics should be strengthened in the short-term future.

KEYWORDS: climate change; overheating; correlation; mortality; vulnerability; public health

PAPER ID: cest2023_00066

Climate change, air pollution, and risks to honeybees – a review of biomonitoring data

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ABSTRACT

Environmental pollution and climate change are among the biggest concerns of the World population and represent an increased risk for the survival of very sensitive animals and insects, including honeybees. Environmental health monitoring can be performed through the biomonitorization of sentinel species. Honeybees are essential pollinators for global sustainale terrestrial productivity. This work presents a global overview of the available information on biomonitoring of honeybees and identifies the most characterized environmental pollutants. Available data clearly demonstrate the presence of different metals (arsenic, nickel, cadmium, lead, etc.), PAHs (naphthalene, acenapthylene, acenaphthene, fluorene, phenanthrene, anthracene, pyrene, chrysene, benzo(a)pyrene, benz(a)anthracene, isomers of benzofluoranthene, indeno(1,2,3-c,d)pyrene, and dibenz(a,h)anthracene), polychlorinated biphenyls, plasticizers residues, and microplastics on bees. The contamination of bees was increased near urban areas and/or locals with increased anthropization. Biomonitoring of bees allows the identification of local sources of pollution in the surroundings of beehives (e.g., urban traffic emissions, forest fires, and agriculture). Additional studies are needed to better characterize the impact of environmental pollutants on bees.

KEYWORDS: Environmental biomonitoring; Sentinel species; Bees; Metals; Polycyclic aromatic hydrocarbons

FUNDING:

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ACKNOWLEDGMENTS:

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Living labs in climate response

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ABSTRACT

Climate change is one of the most critical issues of our times, as it is predicted to have detrimental social, environmental, and economic impacts. A radical transition from our current system is needed to accomplish climate mitigation and adaptation. This transition requires the adoption and implementation of innovative solutions in both the technological and social realms. It is important that the innovations come from a strong bottom-up process, involving citizen's, to be effectively accepted and implemented. The Living Labs (LLs) are initiatives that started around 20 years ago and aim to co-create innovation through the involvement of users in real-life settings. According to a more elaborated definition by ENoLL (European Network of Living Labs), LLs are open innovation ecosystems in real-life environments using iterative feedback processes throughout a lifecycle approach of an innovation to create sustainable impact. By their definition, LLs appear to be a suitable approach to empower citizen's participation in the necessary innovations for climate change response. This paper builds on a bibliometric quantitative analysis of the scientific literature to explore how the concept of the living labs is employed in the formation of innovative solutions regarding climate change adaptation and mitigation. The results of the study will be used in the facilitation of the LL of Chios at the framework of the Horizon project CLIMAS. The main project ambition is to learn from the ongoing and past experiences in citizens' engagement in climate change action such as Climate assemblies and Living labs and help the diverse European regions and local communities to resist through deliberative democracy. The project will deliver an innovative problem-oriented climate adoption Toolbox, co-designed together with stakeholders by applying a values-based approach, design thinking methods and citizen science to promote their direct engagement and empowerment. All that will be carried out with a gender and diversity approach. In this paper, the Scopus database was searched using the keywords "Climate change" and "Living Labs". There were 90 papers found, and most of them (84) were published from 2019 till now indicating a tremendous growth of the scientific interest in the subject. Most of the papers come from European institutions (>70%) reflecting the importance that is given in Europe to citizens' participation for the co-creation of innovation regarding climate change. Then, the text-mining software VOSviewer was used to extract the keywords (author or index) that occurred at least 5 times in the corpus of the 90 papers. The keyword analysis gives the first indications on the directions in a research field. The process resulted in 15 keywords. The most frequently occurring keyword was "sustainability", as the term relates to three pillars, namely the environmental protection, the economic development, and the social welfare, that are affected by climate change. Additionally, according to its classic definition as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs", sustainability has a strong focus on the future state of the environment which is now widely accepted that will be compromised by the consequences of climate change, unless a radical shift in the energy paradigm will occur. A second bunch of keywords is related to the urban environment ("urban living lab", "urban planning", "smart city", "urban growth"). Urban living labs have become a popular form of urban experimental innovation in many countries in the last decade. These labs respond to the increased complexity of future challenges calling for local solutions that acknowledge the local conditions—political, technical, and social. "Energy efficiency" is also a term that appears frequently in the literature and relates to the urban environment and climate change mitigation. A third group of keywords relates living labs and climate change with the protection of natural environment ("nature-based solutions", "biodiversity", "ecosystems"). Finally, commonly found keywords are related to the scope, the organization, and the outputs of the living labs ("conceptual framework", "stakeholder", "co-creation", "experimentation", "innovation", "decision making"). In conclusion, the last 5 years there is a tremendous growth in the scientific literature on the employment of living labs in empowering citizens for co-creating and testing innovative solutions for climate response. The papers address urban and natural problems, whereas there is also a focus on the processes that take place inside the living labs.

KEYWORDS: Climate change, Climate adaptation, citizen engangement, Mediterranean biogeographical region

PAPER ID: cest2023_00325

Dynamical downscaling of medium- and short-term climate series for assessing climate impacts on a world heritage site

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ABSTRACT

The present work utilizes forecast models to dynamically downscale climatic series by performing high-resolution atmospheric simulations for the area of Dion, Pieria (Greece). The study area was selected due to the presence of an outdoors world heritage site that is exposed to hazards connected to extreme weather events and climate change. The site is situated in a coastal area and therefore is strongly influenced by wind flows originating from the sea. Convective precipitation exacerbates corrosion by enhancing the wet deposition of reactive species and meteorological factors can also cause fading and deterioration on stone monuments. Climate data used in the frame of the present analysis were downscaled from a low resolution down to a fine grid of 500 m, adequate to resolve local topography-induced flow and thermal phenomena. This approach aimed to validate and intercompare the performance of the two mesoscale models in simulating local flow and thermal effects at a very high resolution. While both models appear able to capture the local structures directly caused by the overlying synoptic circulation, notable differences are expected in the simulation of thermally induced flows, including sea- and land-breeze as well as cloud effects under strongly convective conditions.

KEYWORDS: mesoscale meteorological models, dynamical downscaling, heritage site, extreme events

PAPER ID: cest2023_00358

EIP-AGRI innovation drivers on the path to climate change mitigation and adaptation: multi-actor approach mapping

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ABSTRACT

Multi-Actor projects (MAPs) are a type of action funded by the EU Horizon 2020 and Horizon Europe programmes to foster agricultural innovation in response to the challenges of climate change and rural depopulation. This study describes the regional deployment and synergies of 120 MAPs coordinated by different European countries. The analysis includes the mapping of coordination and partners, and the interactions within the H2020 landscape. The results show that Western European countries, especially Spain, France and the UK, are the main origin countries for both project coordinators and participants of MAPs, while Eastern and North European countries, as well as Ireland, present a lower share. Greece, Denmark and Sweden stand out as the countries with more significant participation relative to their population. The number of connections between projects reveals the networking and knowledge co-creation and sharing within the innovation programmes with larger countries, as well as Belgium and the Netherlands, as main EU innovation hubs performing the higher number of interactions, while Eastern countries such as Croatia and Slovakia have low figures. Therefore, the present study provides insights into the regional distribution and synergies of MAPs and suggests areas for improvement in terms of geographical balance and collaboration.

KEYWORDS: Rural development, EUREKA, Innovation drivers, AKIS, Green Deal

PAPER ID: cest2023_00114

Island sustainability means much more than smart and green infrastructure. Learning from Astypalea

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ABSTRACT

Processes of globalization and neoliberal governance, multi-layered as they are, permeate islands' borders to different degrees. Delving into common development pathways currently undertaken by islands, we draw on the study case of the island of Astypalea in search of a new meaning of 'island sustainability'. Having been strongly advertised as an exemplar for green transition throughout the development of the program "Astypalea Smart and Sustainable Island" (a partnership agreed between the Hellenic Government and Volkswagen), the Greek island is currently situated at a crossroads between different development pathways that ultimately represent divergent paradigms and upheld truths on what development is or is not. Amidst tourism reliant development and conspicuous sustainability initiatives, the islanders' wishes and perceptions are here analyzed with the aim of understanding people's levels of satisfaction regarding the program implementation process and regarding the island current development trends. For this, we have used a range of quantitative and qualitative research methods and the present article is a combination of both. Perceptions converge in the direction of holistic sustainable development that is aligned with Astypalea's sociocultural and environmental characteristics. Residents offer rich narratives rooted on appreciated dimensions of space, time and conviviality strongly associated with the condition of islandness and other existences of Southern thought in the Mediterranean.

KEYWORDS: insular development, sustainability, smart islands, green transition

PAPER ID: cest2023_00570

Utilization of alkaline converted ash blends from lignite and biomass combustion for carbon capture

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ABSTRACT

The replacement of fossil fuels by renewable biofuels is one of the ways to limit climate change and improve the quality of the atmospheric air. For existing solid fuel combustion plants, a partial replacement of coal with biomass from wood or agriculture waste is applied. In this paper the effect of alkaline conversion of mixed coal and biomass ash to produce carbon sequestration sorbents was studied. The influence of the amount and type of biomass ash on the morphology, structure, surface characteristics and CO2 capture capacity of the obtained products was studied.

KEYWORDS: Biomass blended coal; Utilizations of ash mixtures; Alkaline conversion; Carbon capture

ACKNOWLEDGEMENTS:

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The Carbon Footprint of International Tourism in the European Union

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ABSTRACT

In recent years, international tourism has emerged as an activity with a high contribution to carbon emissions. Calculating the carbon footprint of tourism is the first step towards achieving low-carbon tourism development, mainly if it includes a detailed assessment of the carbon footprint by country of origin, destination country, and sector of economic activity. This research aims to estimate the carbon footprint of international tourism expenditure for the European Union countries. The carbon footprint calculation employs an Environmentally Extended Multi-regional Input-Output (EEIO) model. It combines the intra-regional and inter-regional transactions with data from the Tourism Satellite Accounts (TSA). The findings show that for countries with strong tourism growth, the carbon footprint of tourism is about 4% of the total carbon footprint, while it is significantly lower for other countries. Furthermore, the sectors of electricity generation, transport (water, air, and land), food products industry, accommodation, and food services contribute about 85% of the total CO2 pollutants due to international tourism.

KEYWORDS: Carbon Footprint, International Tourism, EU27, Input-Output Analysis

ACKNOWLEDGEMENTS:

The present study was financially supported by the Bulgarian National Science Fund, Ministry of Education and Science of R. Bulgaria under Grants KP-06-H69/3 and KP-06-Austria/7.

PAPER ID: cest2023_00023

Bidirectional effects between the dental industry and climate change

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ABSTRACT

While the last decade has seen rapid advances of dental sciences, the literature indicates that the profession has yet to embrace the emerging field of environmental sciences and the interactions with population oral health. This work involves a systematic thematic analysis of the circular relationship between the dental industry and climate change. Among the effects of the dental industry to the environment include water contamination, mercury release, use of microplastics, and a slow adoption of recyclables. Effects of climate change to dentistry include the expansion of "dental deserts", exacerbations of social determinants of oral health, disruptions and dislocation of dental practices due to natural disasters, a gradual worsening of the maldistribution of the dental work force, effects on oral hygiene due to water scarcity and more.

KEYWORDS: climate change, oral health, dental industry, social determinants of health

PAPER ID: cest2023_00434

Spatiotemporal Characteristics of Industrial Carbon Emissions in Anhui Province, China: A Multiscale Analysis

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ABSTRACT

Greenhouse gas emissions, especially carbon dioxide, have contributed significantly to global warming1,2. In Anhui Province, an eastern Chinese province experiencing rapid industrialization and development3, industrial carbon emissions have risen due to heavy dependence on fossil fuels, leading to a pressing need for energy conservation and emission reduction4,5.

In this study, we examined the spatiotemporal evolution of industrial carbon emissions in Anhui Province at provincial, municipal, and enterprise scales from 2000 to 2016, using relevant statistical data such as industrial energy consumption, industrial GDP, and industrial enterprise data. We employed various methods, including the carbon emission coefficient method, nuclear density estimation method, and spatial autocorrelation analysis.

Our findings show that from 2000 to 2016, the industrial sectors in Anhui Province exhibited a growth trend, and industrial carbon emissions experienced a rapid increase followed by a decrease. We identified six types of industrial sector development (power function growth, linear growth, increase-to-decrease fluctuation, fluctuation growth, exponential decrease, and stability) for the 35 industrial sectors of Anhui on the provincial scale, and three types of industrial carbon emissions intensity (steady decrease, increase-then-decreased, fast-then-slow decreased) for the 16 prefectural cities of Anhui on the municipal scale. The spatial relationship between the south and north was significant on the enterprise scale, with an increasing gap over time. It is noted that the relationship between the number of total regional enterprises and industrial carbon emissions was mainly insignificant.

Our study provides data support for energy-saving and emission-reduction target decomposition in different regions and offers a reference for relevant government departments to develop corresponding energy consumption and low-carbon development strategies

KEYWORDS: industrial carbon emissions, spatiotemporal characteristics, Anhui Province

PAPER ID: cest2023_00389

The geopolitical risk index effect on the energy market, emissions and climate change

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ABSTRACT

Over time, global crises have affected the energy market much more than major geopolitical events. In recent years, humanity has been faced with the Covid 19 crisis, which has caused great disruption in the energy market and unprecedented phenomena in oil prices.

Also, during the same period, due to the decrease in global production and the low demand for energy, there were unusually large reductions in emissions across the planet. In the post-covid era, the world is faced with the crisis of the Russian - Ukrainian war and the corresponding surge in gas and oil prices. As these critical geopolitical events have the dynamic to affect the entire world, this investigation utilizing the Geopolitical Risk index of Caldara and Iacoviello (2021) aims to identify if events related to energy, green investments, or measures of pollutant emission assessments can be predicted.

I) Can the Geopolitical Risk Factor (GPR) be a tool for predicting events related to the energy crisis?

II) GPR can be a reference point for green investments

III) Does the GPR have the possibility to be a measure of pollutant emission assessment?

KEYWORDS: GPR, energy market, emissions, RAS

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PAPER ID: cest2023_00504

SESSION 25- ENVIRONMENTAL DATA ANALYSIS AND MODELLING

Friday 1 September -morning

Predictive Transport Model of Bisphenol-A in Main Pampanga River

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ABSTRACT

Phenolic endocrine disrupting compounds (EDCs) like Bisphenol-A (BPA) can interfere in the natural processes being done by the endocrine system of living organisms. To assess the effect of such contaminant in the Main Pampanga River of the Philippines, a transport model was developed using the Water Quality Analysis Simulation Program (WASP) by US EPA. The flow inputs were estimated using the Hydrologic Modeling System (HEC-HMS) by the US Army Corps of Engineers – Hydrologic Engineering Center. The following data were used to estimate the flows via HEC-HMS: IFSAR DEM, land cover, soil map, rainfall and weather data, streamflow data, and dam parameters. WASP Inputs included the following: physical and chemical properties, river cross-sectional profiles, boundary conditions, and loads. BPA concentrations from literature, population data, and waste generation data were used to estimate the BPA boundary concentrations and loads. The statistical parameters of the calibration and validation of the BPA transport model showed that the model is acceptable (NSE > 0.5) with good fit relative to observed data points (R-squared > 0.8). The PBIAS values are also between -25 and +25, thus satisfying the criteria for model accuracy.

KEYWORDS: Endocrine disrupting compounds, Bisphenol-A, HEC-HMS, WASP, Pampanga River

ACKNOWLEDGMENT

This study is funded by the CHED-PCARI Project entitled “Developing Information Infrastructure for Managing Antibiotics and Endocrine Disrupting Substances in Pampanga River Basin and its Coastal Environs: Maps, Transport Models, and Bioindicators of Ecological and Public Health Risks”, which is also called as Pampanga River Basin (PRB) Project.

PAPER ID: cest2023_00264

Simulating The Fate Of Selected Pahs İn Saronikos Gulf, Eastern Mediterranean, Using A Far-Field Water-Quality Model.

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ABSTRACT

The aim of this study is to investigate the distribution of selected Polycyclic Aromatic Hydrocarbons (PAHs) and predict their fate in the marine area of Saronikos Gulf. A three-dimensional model (Delft3D-FLOW) was used to simulate sea circulation and hydrographic variables (salinity, temperature), for a 365-day simulation time period (year 2018). A water-quality model (Delft3D-WAQ), set at the same grid as the circulation model, was used to model biogeochemical variables and as a next step, simulate the occurrence and distribution of selected PAHs in the water column. The main pathways for PAHs entering the marine environment of Saronikos have been determined and set as discharges in the modelling area. The dispersion and transformation of PAHs has been simulated, and the predicted concentrations have been compared with published observational studies. The main processes determining the fate of target compounds have been evaluated regarding their contribution to the annual mass balances.

KEYWORDS: PAHs, marine pollution, coastal environmental modelling, Delft3D, Saronikos Gulf

Acknowledgements

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A Machine Learning Approach For The Prediction Of Solid Fuels Consumption In Turkey

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ABSTRACT

Solid fuels are very crucial energy sources as most of industries use them for obtaining heat, electricity and light. Furthermore, since solid fuels are scarce sources in Turkey, it is very important to forecast the consumption in order to effectively manage the energy policies and to conduct an effective planning for industries. In this study, it is aimed to forecast and to model the produce of solid fuels like lignite and coal in Turkey. In statistical analysis, machine learning techniques are applied for forecasting. There are several types of different machine learning algorithms such as supervised and unsupervised learning, reinforced learning, self-learning, feature learning etc. The methods we used are categorized as supervised learning since they build a mathematical model of a set of data that contains both the inputs and the desired outputs.

KEYWORDS: Solid Fuels, Environmental Data Analysis, Machine Learning

PAPER ID: cest2023_00118

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A Deep Learning Model, Interpreted With An XAI Technique, To Simulate And Optimize The Remediation Of Oil-Drilling Cuttings In Bubble Flow Reactors

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ABSTRACT

A multitask deep neural network (DNN) is developed to simulate the ozonation of oil-drilling cuttings (ODC) and is interpreted through a technique of explainable artificial intelligence (XAI) to provide knowledge about the experimental conditions that will maximize the decontamination of ODC. On a semi-batch bubble flow column, ozonation experiments of ODC are carried out after pretreatment with synthetic seawater (SW) and the anionic surfactant sodium dodecyl sulphate (SDS). The performance of ozonation experiments is evaluated by measuring the removal efficiency of the total organic carbon (TOC). The experimental data are used for training and testing an DNN that can predict accurately the TOC removal efficiency of the ozonation process as well as the values of different variables such as pH, oxidation-reduction potential (ORP), temperature (T), pressure drop (ΔP), based on the values of the input variables of the model. The acquired model is interpreted through the Shapley Additive explanations (SHAP) method, an important advancement in the field of machine learning interpretation provided by XAI, regarding the significance of the models' input variables in the TOC removal efficiency. This step aims at establishing the experimental conditions that lead to the highest remediation rate.

KEYWORDS: Ozonation, Soil Remediation, Bubble Column Reactor, Deep Neural Networks, Multitask Learning, Explainable Artificial Intelligence.

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Analysis Of The Sars-COVID 19 Trend: From Time Series To Visibility Graphs

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ABSTRACT

Sars COVID-19 epidemic continues to represent a relevant and current topic, which is of concern mainly with respect to possible variants. Predictive monitoring can address the need to reduce the risk of spreading the virus, but it needs to rely on non-invasive, as well as effective and inexpensive strategies. Wastewater-Based Epidemiology (WBE) fits into this context, representing an approach to surveillance of diseases and early warning for any outbreaks of pathogenic viruses, which provides results relating to the trend of the epidemic in the form of time series. An innovative approach that allows to infer information on the spread of Sars COVID-19 is to transform the data of these time series into visibility graphs using the so-called visibility algorithms. The connective structure of the visibility graph inherits many properties of the starting time series and allows to extract nontrivial information on the behavior of the system using topological metrics of the Complex Network Theory (CNT). In this work, the time series of Sars COVID-19 corresponding to a 12-month period for a treatment plant serving a large size basin is analyzed in order to provide useful data on the spread of the epidemic.

KEYWORDS: Sars-COVID19, time series analysis, visibility algorithms, graph theory, Wastewater-Based Epidemiology

PAPER ID: cest2023_00202

Assessment of Pesticide Occurrence, Attenuation and Transport Dynamics in the Pampanga River Basin

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ABSTRACT

The goal of this study is to detect chlorpyrifos, a pesticide, in the Pampanga River basin and to create a new model, or improve upon an existing one, that can accurately predict the concentration levels of micro pollutants in the river bed. The complete dry and wet seasons are accounted for by taking samples within a single calendar year. Method of analysis include the preparation of samples in line with the standard test available utilizing GC-MS. The analyses were done at the National Sciences Research Institute- Research Analytical Services Laboratory. The widely acceptable water quality model (WASP8) provided by the USEPA is used with an added feature like Monte Carlo Program is incorporated in this model to predict future concentration results. The research includes a risk analysis of potential hazards posed by both target and non-target organisms.The first samples were taken from locations that had been previously determined to have a high concentration of the pollutants of interest, such as nearby farmlands and tributaries. Identified sampling sites with high concentrations of target pesticides (chlorpyrifos, endosulfan and malathion) constitute subject regions for the model. A dynamic box model was used in the Pampanga River channel with loads based on the laboratory results. Actual test results from GC-MS demonstrated that the model, with parameters and constants provided, can estimate amounts of pesticides at the downstream of the river water. The model is cross-validated based on the fact that it produces a mean error of 0.0263% when applied to the tributaries and a mean error of 0.65% when applied to the main channel.The predicted exposure concentrations for most of the identified pesticides were found to be greater than the regulation permissible value during the risk assessment for aquatic species. Additional study on safe pesticide concentrations is required before the Philippines can implement exposure scenarios and models for pesticide authorization. Further studies are also needed to build top-tier model and risk management that may be utilized in the Philippine scenario.People will require this model to help them make educated choices about how to deal with micro-pollutants like pesticides. The results of this investigation can be used as a basis of social and industrial strategies.

KEYWORDS: Water Quality Modeling, Pesticides, Solid Phase Extraction, Elution, Method Validation

ACKNOWLEDGEMENTS

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A Critical Review Of The Site Selection Process For Offshore Wind Farms

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ABSTRACT

Renewable energy sources are the main solution for Climate Change and growing energy demand. In particular, wind energy, and especially offshore wind energy, are fast-growing renewable energy sectors and may offer one of the best solutions to the energy crisis.

The siting of the offshore wind farm location is amongst the most challenging aspects. In order to obtain the optimum location for these types of projects, various factors must be considered, and alternative options evaluated. A great amount of information about this topic are collected and analysed, to get conclusions about lessons learnt, strengths and weaknesses. An overview of the siting of offshore wind farms is presented in this paper, which reviews the relevant literature on the study area, the used methodology, the used technology (fixed or floating), the used criteria, and the journal in which the research was published.

The first results indicated that a significant number of reviewed studies addressed China as a study area. One of the most reviewed technologies of offshore wind farms is the bottom-fixed foundation, which is a well-known substructure technology. Finally, in the majority of the analysed studies, multi-criteria decision-making methods were used.

KEYWORDS: Offshore wind farms, critical review, sustainable siting

ACKNOWLEDGMENTS

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Capability Of High Resolution Satellite Images To Characterize Urban Surfaces: Spectra Comparison And Correlation With In Field/Lab Measurements

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ABSTRACT

Environmental remote sensing is an increasingly useful tool for the study of large areas thanks to new sensors with high spatial resolution. These sensors could be able to identify and analyse several urban surfaces, like roofs and pavements. Thus they could be used to study urban areas for several applications, as the characterization of different surfaces related to the development of the UHI (Urban Heat Island) phenomenon. The main goal of this paper is to study the spectral correlation between this kind of satellite imagery (high spatial resolution and good spectral resolution) and ground measurements using instruments with high spectral resolution. For this purpose, an image from WorldView 3 sensor was acquired and several spectra of urban surfaces were measured with the ASD FieldSpec 4 field spectroradiometer. The study area is the ceramic district of Sassuolo, in the northern part of Italy. Statistic parameters were used to assess the differences between acquired spectra and satellite image spectra. The achieved results are encouraging: remote sensing could characterize the correlation between remote sensing data and ground measurement is high for homogenous surfaces.

KEYWORDS: Remote sensing, environment, UHI, urban surfaces

PAPER ID: cest2023_00133

Urbem: A Method And Tool To Refine Regional Emission Inventories For Urban Atmospheric Studies

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ABSTRACT

As cities are growing in size and complexity, the estimation of air pollution exposure requires detailed spatial representation of air pollution levels. Intra-urban atmospheric studies require up-to-date and credible emission inventories. The Copernicus Atmosphere Monitoring Service (CAMS) provides consistent and quality-controlled information on anthropogenic emissions from Europe in the spatial resolution of 0.1 x 0.05 degree (lon/lat). The UrbEm method and tool applies a prompt and effective approach to spatially refine these emissions for any European city (or area). In particular, a top-down approach is built upon the CAMS-REG-AP database of anthropogenic air pollution emissions, creating added-value products of road transport emissions (line sources), mass emitted from industrial units (point sources) and surface emissions attributed at a grid of 1 km resolution. The disaggregation is based on publicly available, well-established, contemporary gridded datasets, which provide high resolution, suitable sector-specific proxies per source category, such as population density from Global Human Settlement (GHS), land use categories from Copernicus Land Monitoring Service (CLC 2018) and road networks from OpenStreetMap. In this work, the downscaling approach is applied in 9 diverse European Urban Centers and the improvements of the spatial disaggregation of CAMS emissions are comparatively examined.

KEYWORDS: air pollution, emissions, urban air quality, Chemistry Transport Modelling

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Modelling Metal And Energy Recovery From Acid Mine Drainage By Means Of Bioelectrochemical Technology

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ABSTRACT

This work presents a Monod-based mathematical model able to predict the performance of a bioelectrochemical system (BES) treating Acid Mine Drainage (AMD). The BES was operated as a microbial fuel cell (MFC), in order to recover not only the metals but also all the chemical energy contained. The model was based on two different microbial populations performing electrogenic and non-electrogenic metabolisms respectively. During the MFC operation the metal contained in the AMD were the electron acceptors at the cathode. Because of that, Cu^{2+} and Fe^{3+} were reduced to Cu^0 and Fe^{2+}. The model formulation was based on a set of differential equations describing the simultaneous evolution of the main chemical components in the system. The model developed accurately predicted the concentration of the acetate and biomass at the anode, the metals at the cathode as well as the electrical current generated.

KEYWORDS: Acid mine drainage; bioelectrochemical system; mathematical modelling

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Anthropogenic Metal Pollution In Saronikos Gulf: Historical Evolution And Risk Assessment Based On Selected Sediment Cores

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ABSTRACT.

Anthropogenic metals (Cd, Cu, Hg, Pb, Zn) are chemical elements known for toxic effects when present in elevated concentrations. There are various sources of these metals to marine sediments. The presence and levels of anthropogenic metals in sediments may cause adverse implications to ecosystem and human health. The present paper is a preliminary presentation of anthropogenic metal levels in selected short sediment cores obtained during a 2017 sampling campaign in the various sub-areas of Saronikos (Elefis bay, Eastern, Western and Outer). The vertical distribution of Cd, Cu, Hg, Pb and Zn along with sediment quality evaluation are discussed. In the background sediment layers (below 15-20cm) the ranges of Cu, Pb, Zn, Hg and Cd (in mg/kg) are 9.3-37.3, 18.8-35.1, 16.8-85.3, 0.019-0.033 and 0.041-0.090 respectively. In upper sediment layers affected by anthropogenic pollution the ranges of Cu, Pb, Zn, Hg and Cd (in mg/kg) are 13.7-138, 33.9-181, 35-435, 0.031-1.73 and 0.051-0.65. The metal contents in the sediments of Saronikos generally do not exceed the ERL (effects range low) and ERM (effects range median) sediment quality guidelines widely used as risk indicators to benthic biota. However, most metals in Elefsis bay and Hg in Elefsis and other locations of Saronikos as well, present elevated concentrations above the quality limits posing risk to marine biota and possibly to human health.

KEYWORDS: industrial pollution, urban pollution, background levels, sediment quality assessment

ACKNOWLEDGMENTS

We are grateful to the Hellenic Center for Marine Research (HCMR) and our colleagues Prof. S. Poulos, and Dr Aik. Karditsa, for the assistance during the sampling. The 2017 sampling campaign was financed by the European Union (European Social Fund) and National Funds (Hellenic General Secretariat for Research and Technology) in the framework of the project ARISTEIA I, 640 “Integrated Study of Trace Metals Biogeochemistry in the Coastal Marine Environment”, within the “Lifelong Learning Programme”. The laboratory analyses were partly funded by the aforementioned project and partly by the Special Account for Research Grants of the National and Kapodistrian University of Athens via funding of the Department of Chemistry.

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The Benefits Of Introducing Digitization In Agricultural Sectors

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ABSTRACT

The rapid development of digital technologies has propelled the introduction of digitization in all fields. Among them is agriculture. Thus, farmers can benefit from innovations that make their work easier and increase their efficiency. Digitization aims to increase competitiveness in terms of agricultural production in a shorter period and has the role of helping to prevent the large losses that are specific to agriculture carried out using traditional methods. Through digitization (i) losses caused by poor production planning can be prevented, based on inaccurate data, (ii) the erroneous design of agricultural activities is reduced, such as the delayed application of protection treatments against pests, (iii) reduces/eliminates the lack of transparency regarding the information you must provide in relation to each product.

KEYWORDS: digitalization, agriculture, digital solutions

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PAPER ID: cest2023_00275

SESSION 26- CIRCULAR ECONOMY AND BIOECONOMY

Friday 1 September -Morning

The Building Façade As An Active Skin: Water Bio-Remediation Through A Probiotic Layer System

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ABSTRACT

In 2020, the United Nations demonstrated that the building sector is responsible for 38% of all energy-related CO_2 emissions [1]. Architecture as an invasive practice, bears a responsibility and the capacity to minimize its negative ecological impact. This study investigates alternative methodologies of architectural design that employ the upgrading of greywater through the building envelope to integrate the building in the environment's metabolic cycles. The building façade may be treated as an active membrane that controls energy and material resources to carry out energy-related functions. Its performance may be modeled by the operational principles of cell membranes and living organisms. The activation of the membrane is achieved by managing greywater resources, while architectural design is informed by biotechnology and environmental engineering. On a different note, water is a vital resource for the sustenance of life whose scarcity increases rapidly. By upgrading greywater, the building membrane becomes a space for different species to inhabit. Considering the above, an interdisciplinary design method is proposed that: • Allows the envelope to circulate water in a controlled manner. • Incorporates the bio-remediation of greywater. • Adapts the envelope to create living "pockets" activated by water. These pockets host vegetation and microorganisms, serving as a probiotic layer that regulates the micro-climate and supports local fauna.

KEYWORDS: greywater bioremediation, bio-systemic architecture, active architectural membrane, biodiversity restoration, building metabolism

PAPER ID: cest2023_00106

The AquaSPICE Industrial Symbiosis Enabling Platform

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ABSTRACT

. The role of the AquaSPICE Symbiosis Enabling platform is to facilitate the development of one-to-one waste reuse value chains, through the collaboration of an industrial waste source and a potential waste user. This can be achieved by adopting a three-step process in order to: (i) map and characterize the potential sources and sinks of waste in a region; (ii) match them based on technical criteria; and (iii) identify and assess potential business models for opportunity exploitation.
KEYWORDS: industrial symbiosis, aquaspice project, online platform

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The platform presented in the paper arises from "AquaSPICE - Advancing Sustainability of Process Industries through Digital and Circular Water Use Innovations", a collaborative research project that has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 958396.

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Biogas Desulfurization by Pelletized Biomass Ash in a Fixed Bed Arrangement

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ABSTRACT

The removal of H_2S is a prerequisite to the energetic valorization of biogas in combined heat and power (CHP) plants. Conventionally, the final step in desulfurization involves filtration over granular activated carbon (GAC). Rising market prices for GAC have fostered research on alternative filtration media. Here we investigated the feasibility of globally available biomass ash (BA) as a cost-efficient alternative. A filter column (V = 2.4 L) was loaded with 800 g BA (10 % moisture) and upstream-fed with a total of 2.76 m³ raw biogas sampled from a food waste fermentation plant. At the outlet H_2S, O_2, CO_2 and CH_4 were monitored. The H_2S was completely sequestered by the filter material and no breakthrough was observed, resulting in a load of 0.26 wt.-% H_2S. XRF analyses suggested even further potential. First tests with a new, static batch reactor using a feed of >99 vol.-% H_2S and pelletized BA achieved H_2S uptakes of up to 4 wt.-%, outweighing the reported uptake capacity of conventional GAC. Further investigations are underway to assess the pelletized BA under flow-through conditions. Results will pave the way to scale up the system and test it under real world conditions at a food waste fermentation plant.

KEYWORDS: Biogas, desulfurization, biomass ash, wood ash, pelletizing

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PAPER ID: cest2023_00249

Utilization Of Olive Pomace Derivatives In The Production Of Sustainable Lubricants.

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ABSTRACT

The UN's Sustainable Development Goals sets 2030 as the year by which certain key targets have to be achieved including the responsible consumption and production. The idea of the Industrial Symbiosis - the process by which byproducts of an industry or industrial process become the raw materials for another can substantially contribute to the creation of circular development towards the so-called "Zero Waste Goal" - by focusing primarily on the first of the 3Rs, "reduce," followed by "reuse" and then "recycle. Food processing industrial by-products streams contain largely biodegradable organic matter comprised of different components such as fats, oils, protein, carbohydrates, pigments, flavonoids and antioxidants. Valorization and utilization of these as value added products are essential to improve sustainability, provide economic benefits and reduce GHG emissions. The evolution of bio-refinery concepts and the materialization of the future refinery concepts might be on the benefit of the lubricants industry through the supply of low-carbon intensity raw materials. Olive pomace (OP) is a by-product of the olive oil production process during pressing or centrifugation. There many ways that this residue can be further processed/valorized, either for nutritional purposes (where applicable) or in other added value applications as it has been demonstrated in the literature. Within this context, OP can also be exploited, under certain circumstances, as an alternative renewable raw material for biobased lubricants. In this work the capabilities of materializing OP as a source for biolubricants is explored, the possible pathways and the products quality is analyzed while the overall sustainability of the process is discussed.

KEYWORDS: Sustainability, biolubricants, circular economy, zero waste goal

PAPER ID: cest2023_00499

Sustainability Performance Prospects Across The Lubricants Value-Supply Chain

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ABSTRACT

Transitioning to a net-zero world is one of the greatest challenges humankind has faced. It calls for nothing less than a complete transformation of how we produce, consume, and move about. Within this context, the lubricants sector will have to deliver a new deal regarding the sustainable performance of the industry. In this paper the authors will explore viable pathways for materializing the sustainable future of lubricants through highlighting the opportunities and challenges in technology, manufacturing, application, and re-use. In the lubricants industry, sustainability can be mirrored as the minimization of the negative impacts on environmental and socio-economic aspects throughout the life cycle assessment in all stages of a certain product from the design and the origin of the raw materials up to the end-of-life of the used product. Several aspects of the lubricants value-supply chain can build further sustainable character, such as the selection of low impact raw materials, the adoption of alternative manufacturing techniques and alternative chemistries, the energy saving potential and the real usefulness of end-of-life products. Following the definition of lubricants viable future main pillars, the foundation for developing the next generation methodologies for assessing the sustainable performance of lubricants are analyzed. As a result, there is a prominent need to design and build widely accepted protocols that would set a series of measurable sustainability indicators, calculate the impact of each of them on the sustainable character of the ready-to-use lubricants and communicate this to the user by means of a relative sustainable performance scale.

KEYWORDS: Sustainability, life cycle assessment, lubricating oils, and greases, circular economy

PAPER ID: cest2023_00508

Poly-Hydroxyalkanoates Production From Mixed Microbial Cultures: Effect Of Dissolved Oxygen And Ph.

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ABSTRACT

The accumulation potential of poly-hydroxyalkanoates (PHAs) produced from an acclimated mixed microbial culture (MMC) under different dissolve oxygen (DO) levels and pH was investigated, using volatile fatty acids (VFAs) as carbon source. Specifically, the PHAs production potential of the MMC was evaluated in batch mode in a 5L bioreactor under controlled high aeration (DO level set at 25% saturation, DO25) and low aeration (DO level set at 5% saturation, DO5). The effect of the controlled DO level on the PHAs yield expressed in % PHAs/DCW (w/w) and also the monomeric composition was evaluated in comparison to the results obtained during constant aeration at 2L/min/L rector i.e. with highly varying DO (DOv). The optimal yield of 79.5±0.14% PHAs/DCW was achieved for DO25, while in the cases of DO5 results were similar to those from DOv, i.e. 60 % PHAs/DCW and 65 % PHAs/DCW, respectively . In all cases, P(3HB-co-3HV) was produced whereas the assimilation of propionate to HV in the polymers did not seem to be correlated to the DO changes, with HV content being above 5% in all cases. The subsequent simultaneous advantageous for the process, indicating that control of DO and not of pH proved to be even more advantageous for the process enhancing the assimilation rates as well, indicating that the production of PHAs from MMCs may be quite efficient if the cultivation conditions are properly controlled.

KEYWORDS: polyhydroxyalkanoates, dissolved oxygen, mixed cultures, pH, nutrients limitation

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Comparative Evaluation Of Three Different Membranes For The Treatment Of A Brewery And A Dairy Treatment Effluent

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ABSTRACT

A laboratory-scale system with a capacity of 7L/h consisting of three different ultrafiltration membranes operating alternatively, was designed and installed at the Sanitary Engineering Laboratory (SEL) facilities. The purpose of this membrane system was to test the performance of alternative membranes in terms of secondary effluent treatment from a dairy and a brewery industry located in Patras industrial area. The three membranes selected after a literature review were a PVDF UF tubular membrane module, a ceramic UF tubular membrane module and a polysulfone HF UF tubular membrane module. The batch experiment protocol followed for each membrane consisted of a chemical cleaning procedure and a 5-hour continuous operation with secondary effluent from the two industries. The laboratory results showed that the permeate water complies with the limits set by Greek legislation for unrestricted irrigation. The PVDF membrane showed the best membrane performance in terms of effluent quality with better results in organic load removal. It also showed higher stability with very low standard deviation values. In terms of TMP increase and effluent drop during the 5-hour batch trials, the ceramic membranes showed lower values, while the PVDF membranes were more stable after the first hour of the trial and showed a very low increase for the rest of the trial.

KEYWORDS: cross flow technology; industrial effluent; ultrafiltration.

ACKNOWLEDGEMENTS

The research leading to these results has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement no 958266 (AccelWater project),

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Screening Of Oleaginous Yeast *Trichosporon Coremiiforme* EXF-8679 In Commercial Sugars And Treatment Of Olive Mill Wastewaters

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ABSTRACT

Trichosporon is a genus of yeasts that belongs in the family of Trichosporonaceae., they typically can be found in soil, but several species are in the natural part of the skin microbiota of humans and other animals. *Trichosporon coremiforme* is considered as an oleaginous yeast.

KEYWORDS: Trichosporon coremiforme, oleaginous yeasts

PAPER ID: cest2023_00346

Treatment of two-phase olive mill waste and degradation of phenolic compounds with simultaneous bio-electrochemical conversion of CO_2 to CH_4 using a Microbial Electrolysis Cell

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ABSTRACT

This study deals with the treatment of a potent two-phase olive mill waste (TPOMW) through the degradation of its phenolic content, with simultaneous bio-electrochemical reduction of CO_2 to CH_4, using a dual-chamber Microbial Electrolysis Cell (MEC). The MEC operated for 120 days and the effects of different dilutions (1:10, 1:5 and no dilution) and applied potentials (0.5 V and 1 V) on its performance were studied. The results showed that decreasing the dilution (from 1:10 to 1:5 and to no dilution) led to an increase of the COD removal (from 74%, to 77% and to 87%, respectively), of the total phenolic content removal (from 73%, to 76% and to 79%, respectively), as well as of the produced CH_4 (from 0.08, to 0.48 and to 2.33 mmols, respectively). Increasing the applied potential (from 0.5 V to 1 V), while the TPOMW was employed in the anode with no dilution, resulted in further increase of both the COD and the total phenolic content removal to 91%, while the produced CH_4 further increased to 2.88 mmols. The results indicate that the MEC technology can be potentially exploited for the treatment of the potent TPOMW and produce CH_4 as a waste-to-energy source.

KEYWORDS: MEC; TPOMW; phenols; electromethanogenesis; applied potential

ACKNOWLEDGEMENTS

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SESSION 27- WASTE MANAGEMENT AND TECHNOLOGIES

Friday 1 September -Morning

Exploring The Effects Of Static Magnetic Fields For The Enhanced Valorization Of Sewage Sludge By Anaerobic Digestion

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ABSTRACT

Anaerobic digestion (AD) is an interesting and sustainable option to handle sewage sludge (SS), as it generates a methane-rich biogas and a digestate with potential fertilizing properties. Several strategies have been proposed to enhance AD performances and the valorization of SS. Among these, the application of a static magnetic field (SMF) has been poorly evaluated and recently gained attention. This work investigated the effect of low-intensity SMF (20-50 mT) on methane production from AD of SS, comparing it to the effect deriving from the application of a high-intensity SMF (1.5 T). Magnetic pretreatment at 20 mT was particularly effective, as it increased biomethane production up to 12.9% compared to the control test. On the contrary, 1.5 T was detrimental in terms of cumulative methane production, as it resulted in a 20.9% decrease. These outcomes suggest that SMF intensity is inversely related to biomethane generation and that further investigations are worthy to understand the mechanisms underlying AD enhancement by SMF application.

KEYWORDS: static magnetic fields, sewage sludge, anaerobic digestion, biomethane, nutrient recovery.

PAPER ID: cest2023_00090

Improving The Homogeneity Of A Sewage Sludge-Based Phosphorus Fertilizer By Monte Carlo Simulation Of The Production Chain

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ABSTRACT

Sewage sludge mono-incineration with subsequent phosphorus (P) recovery from the ash is becoming increasingly important in many European countries. Plant operators are facing the challenge to produce a homogeneous P output which needs to conform to fertilizer standards (including trace elements levels) upon processing. This needs to take into account (i) the compositional variability of municipal sewage, (ii) design of incinerator and phosphorus recovery unit, and (iii) logistical and management aspects. In this study, those challenges were considered in Monte Carlo simulations based on a discretized sewage sludge input. To propagate the uncertainty along the entire process chain of thermal sewage sludge treatment and P-recovery, a simulation model was implemented using MATLAB. Specifically, logistical factors, different management options along the treatment chain, technical boundary conditions were investigated and the distribution of the P_2O_5 concentrations in the output (fertilizer/ash) was calculated. The results show how appropriate handling and treatment of sewage sludge helps to reduce the width product properties (e.g. P_2O_5 distribution, trace metal distribution in the output. From the options tested, storage management (including automated crane operation) had the strongest homogenization effect and could be easily implemented at incinerator sites.

KEYWORDS: sewage sludge ash, Monte-Carlo-simulation, risk analysis, phosphorus recovery

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ACKNOWLEDGEMENT

The operational group “Recycled P-Fertilizer from Sewage Sludge” receives support by the EU in the framework of the European Innovation Partnership (EIP-Agri) and the Development Plan for Rural Areas of the Federal State of Hesse 2014-2000 under grant number RPGi-51.1-51i0200/15-2018.

Lessons Learned By Modelling Biogas Production In An Italian State-Of-The-Art Landfill Active For 35 Years

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ABSTRACT

"Fossetto" landfill is in operation in the municipality of Monsummano Terme (Tuscany, Italy) since 1988, at its origin, it was used as a controlled landfill where mixed municipal solid waste, without any separate collection, was disposed of. Since 2003, a biogas recovery system is active, while a mechanical-biological treatment (MBT) plant and a reverse osmosis leachate treatment plant that recirculates leachate are installed since 2006. This plant provides long-term biogas monitoring that allowed to calculate, with a simplified methodology, the biogas recovery efficiency. Biogas generation modelling via the USEPA LandGEM model showed that the adoption of MBT grandly reduced the biogas production, while extraction efficiency was calculated at around 40% over the last ten years, lower than expected. Efficient separate collection leading to the reduction of both the incoming waste amount and of its biogas potential production coupled with mechanical biological treatment proved effective to reduce landfill environmental impacts. More research is needed to establish new technologies to further reduce fugitive biogas emissions from the landfill.

KEYWORDS: biogas, extraction efficiency, greenhouse gases, landfill, landgem model.

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Valorization Of Waste Graphite Deriving From "End Of Life Lithium-Ion Battery Recycling" For A Second Use In Wastewater Treatment.

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ABSTRACT:

Exponential utilization of Lithium-ion batteries (LIBs) has produced a notable amount of hazardous waste recently. The current practices focus on recovering precious metals available in cathode giving less priority for anode material (graphite) recoveries and valorizations. However, thinning of existing graphite ores, and extensive application of graphite for high tech industries made graphite to be a critical raw material to Europe recently. Accordingly, an attempt was made to valorize black mass, after leaching of metals. The batteries were physically processed, and the product was leached using 1mol/L, H_2SO_4 at 90°C for 90min with solid-liquid ratio 1/10. The remaining material was rich in graphite, which was used in this study. Three adsorption materials; Graphite Oxide (GO), Graphene Oxide (GrO) and Exfoliated graphite (EG) were made from the black mass to be used in organically contaminated wastewater treatment. After physical and chemical characterization, batch adsorption experiments were carried out separately for three different spiked organic contaminated (MO, MG, and MB) wastewater samples. Adsorption kinetics and isotherms were determined to conclude the best valorization option for the spent graphite available in black mass of LIBs. Accordingly, the study concluded that GrO to be the best option for spent graphite valorization.

KEYWORDS: lib recycling, graphite valorization, adsorption experiments, wastewater treatment, black mass recycling

PAPER ID: cest2023_00266

Development of Scenario-based Decision-Making Framework for Marine Oil Spill Waste Management

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ABSTRACT

This study developed a scenario-based decision-making framework to help select the appropriate strategy to deal with marine oil spill response waste by considering different impact factors, including the type of spilled oil, the quantity and quality of waste, the capacity of transportation, the capacity and location of treatment and disposal facilities, and the feasibility of strategies. Based on the combination of impact factor conditions, 1600 and 4608 input scenarios were generated for liquid and solid oily waste, respectively. An optimization model with an objective of minimizing costs was developed and programmed in RStudio to evaluate each input scenario. The real-world data was collected for the optimization modeling parameters. The results indicated that the best strategy for managing liquid oily waste from spilled refined oil (e.g., diesel and bunker) should be the sending of waste to a processing facility for physical and chemical separation. For solid oily waste, pyrolysis is the best option if available followed by incineration.

KEYWORDS: decision making, marine oil spill response, optimization, scenario, waste management

PAPER ID: cest2023_00122

AI Assisted Food Waste Prevention In The Hospitality Sector: The Case Study Of Two Hotels In Santorini And Kos, Greece.

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ABSTRACT

According to EUROSTAT (2022), approximately 131 kg of food waste (FW) per inhabitant were generated in EU in 2020. Restaurants and food services were responsible for 9% (12 kg) of this total. According to the best estimates, in Greece, where the hospitality sector holds significant economic importance, its share accounts for 10.7% of the total FW. Recent studies in Egypt, Italy, Portugal, Finland, Sweden, and USA, estimate that 20% – 60% of food served in the hospitality sector gets wasted (Malefors et al., 2019). The wide variance in reported FW levels can be attributed to the diverse nature of the sector. The "Restaurants and food services" sector encompasses a broad spectrum of establishments, including small family-owned restaurants and global restaurants chains. Moreover, food services can be further classified into various segments such as HORECA (Hotels, Restaurants, Café), "on the go" outlets, and catering. Furthermore, FW generation patterns within the sector exhibit considerable variation, influenced by factors like the target customer groups, operational conditions, eating habits, and the socio-economic and cultural context. Given these complexities, the recommended approach for FW measurement in the "Restaurants and food services" sector, typically involves a combination of direct and indirect methodologies, including weighing, questionnaires, and interviews, which contribute to the development of the appropriate conversion coefficients. A recent trend in professional kitchens) involves the adoption of automated, specially designed FW monitoring and quantification systems, such as WINNOW (https://www.winnowsolutions.com), KITRO (https://www.kitro.ch) and others. These AI systems not only replace traditional scales, but also offer a comprehensive solution by utilizing image processing, deep-learning technologies, and hardware components to capture and analyse food waste data. This study presents the implementation of such an AI system, specifically the KITRO system, in two hotels located on the islands of Kos and Santorini. The primary objective of this study was to investigate the potential of AI-driven food waste prevention in the "restaurants and food services" sector. The hotels have reported that the system facilitated informed management decisions and streamlined optimised work practices, which resulted in reduced food waste, lower food provisioning costs, and subsequently, a lower environmental footprint.

KEYWORDS: food waste prevention, food waste measurement, hospitality sector, AI, KITRO, Greece

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Assessing Self-Reported Food Loss And Waste In Primary Production In Greece.

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ABSTRACT

Regarding primary production, the Commission Delegated Decision EU (2019) 1597 outlines certain methodologies to effectively assess and report food waste (FW). The first pan-European monitoring of FW levels indicated that in 2020, primary production accounted for approximately 11% of the total FW generated in EU. Notably, there is no data on food loss (FL), as the European Commission has yet to define an official methodological framework for estimating and reporting such losses. Measuring FW in the primary sector, faces numerous challenges due to the sector's inherent characteristics (diverse range of produce, the nature of farms, the cultivation practices etc.). Additionally, very few farmers measure and/or maintain records of food losses and waste (FLW). Nevertheless, nearly all farmers, regardless of farm size, possess a strong understanding of where food is lost during the production process, along with a rough estimate of the relative quantities lost. This study investigates both the focal points and causes of FLW in the primary production sector (according the EU definitions of FLW), in Greece. It is part of a wider ongoing study centred around the quantification of FLW in the country. This research is carried out within the EU LIFE-IP CEI-GR project. The study employed a combination of questionnaires, and interviews to gather data (244 questionnaires were collected, 11 participants were interviewed). Producers were requested to provide data pertaining to their primary products, estimations of FLW, the edibility of the food wasted, and their disposal methods. The analysis of the results, shows that FL are closely linked to factors such as: the cultivation methods; the timing of cultivation and harvests within a growing cycle; and the specific plant species. The susceptibility of the products and the associated FLW, varies significantly based on both the chosen cultivation technique and the species cultivated or even the specific plant variety. To better illustrate the width of variation, according to the producer statements, greenhouse tomato cultivation results in a mere 0.1% of FL and waste, of which 5% is salvageable for consumption. Conversely, field-based tomato cultivation results in 5% FL and waste, with 50% of it being suitable for human consumption. The main commercial agreements and practices between producers and traders are structured in such way that the trader receives the products, conducts the sorting (in lieu of the producer) and quality assessment, and does not compensate the producer for the quantity he found unsuitable for marketing. Consequently, the waste stemming from harvested products is not primarily recorded during the production phase, but rather at the marketing stage.

KEYWORDS: Food loss, food waste, primary production, Greece

ACKNOWLEDGEMENTS:

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PAPER ID: CEST2023_00563

Community composting as a tool for sustainable municipal solid waste management and social and economic sustainability: a decision support tool

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ABSTRACT

The problem relating to waste management is currently one of the topics of greatest interest to the scientific community due to the effects it has on the environment in general. In this study, attention was focused on the composting technique for the treatment of the organic fraction of municipal solid waste and the subsequent use of the produced compost as an organic soil improver. In particular, the main objective was to evaluate the environmental and social impact linked to the management of the organic fraction of waste produced in the city of Potenza as part of the DECOST (DEcentralised COmposting in Small Towns) project, which aims to develop a new closed-loop system for the valorization of organic fractions, integrating decentralised composting and urban agriculture. The environmental performance was evaluated using the LCA methodology, which made it possible to compare two composting treatment scenarios at different scales: community composting and centralised composting. The impact that this treatment technique has on the environment was assessed using a combined approach, Life Cycle Assessment, and subsequent assessment of the most affected impact categories using SimaPro 9.4.0.1 software. Most of the data used for the elaboration of the impacts is real and derives, as regards community composting, from the pilot installed in the city of Potenza, assuming as a functional unit one tonne of organic waste separated at the source and considering the following impact categories: Global warming (GWP), Human toxicity (HTP), Acidification (AP), and Eutrophication (EP). In conclusion, it can be said that community composting represents a viable alternative for the treatment of the organic fraction and absolutely performs well from an environmental point of view. In a region like Basilicata, in which the organic fraction represents the fraction quantitatively most produced and collected and in which there are completely absent plants intended for its treatment, this technology can represent one of the solutions to managing part of the organic fraction produced.

KEYWORDS: Community composting, life cycle assessment, environmental sustainability, social impact

PAPER ID: cest2023_00542

SESSION 28- HYDROLOGY AND WATER RESOURCES MANAGEMENT (2)

Friday 1 September Afternoon

Customizing Global Hydrological Models For Local Applications: It Is Not Only About Informative Data!

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ABSTARCT

Hydrological modelling at the continental and global scales is scientifically attractive since, for instance, the large samples generated, as model outputs, can lead to process understanding along the Earth's strong hydroclimatic gradients. Such large-scale modelling is also important for the society with the hydro-meteorological information being provided at poorly gauged and even ungauged locations addressing the various water-related challenges. Nevertheless, continental and global hydrological models are expected to provide reliable and useful information at the regional scale, and hence model setup and parameter identification requires application of state-of-the-art scientific practices. The information content in the "traditional" data used in catchment modelling is not sufficient to diagnostically guide the parameter identification and improve process understanding in large-scale applications (Pechlivanidis and Arheimer, 2015). The large spatial scales require many "unknown" features, e.g., lake extents, snowpack cover, land cover changes, reservoir regulations, dam capacities, irrigation practices, etc., that directly influence the hydrological response, while fluxes in the catchment can be left unresolved. Due to the large physical heterogeneity, the complexity of hydrological models and the limited data traditionally available, the current model identification practices in catchment modelling cannot accurately represent the physical processes and lead to a robust model for large-scale applications. Even when more sophisticated identification practices are applied, large scale hydrological models are still over-tuned to capture the dominant processes and their spatiotemporal dynamics, and little attention is given to fluxes at the regional scale. To make large-scale models useful for local/regional purposes, effort is needed to customize the models using local data from various sources (e.g. in-situ and earth observations) and for various fluxes (Figure 1).

Here, we showcase the Lake Hume catchment in Australia, where we used the data from the global World-Wide HYPE (WWH) hydrological model as a benchmark to quantify how much the model performance (and hence process understanding) can be improved by fine-tuning the parameters by conditioning them to local in-situ and earth observations (EO). We note that the WWH was set up using global datasets and with the objective to perform adequately over the entire globe. We show the information that WWH missed for application at this local scale, including mis-delineation and omission of dams and reservoirs. In the local customization, the model was refined to include local lakes and managed reservoirs and recalibrated on locally-available discharge measurements and the freely available global EO-based MODIS evapotranspiration data from NASA. The results show significant improvements in the model estimation of discharge and the actual and potential evapotranspiration. This underpins the importance of including as much local information as possible in modelling chains used for decision-making. Where data are not available, the results show the potential of EOs to fill in that gap. Overall, we highlight the success of local customization of large-scale hydrological models through information extraction and use in model identification.

KEYWORDS: Data information, In-situ and Earth Observations, Large-scale hydrological modelling, Model identification

PAPER ID: cest2023_00034

Dısaggregatıon Of Global Clımate Model Data To Create Idf Curves Under Rcp8.5 Scenarıo

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ABSTRACT

Global climate change is one of the most important problems of our age. Its possible harmful effects are flood formation, loss of life and property, severe drought etc. Many studies are carried out to reduce these damages and to limit the impact area. The creation of precipitation intensity-duration-frequency curves (IDF) is one of these studies. These curves are especially used in the design of water structures. IDF curves are usually generated from observed precipitation data. This situation causes these curves to stay away from precipitation changes due to climate change. Therefore, these curves need to be updated under future climate projections. In this study, this problem was emphasized and the IDF curves of Muğla province were tried to be estimated according to the years 2023–2098 under the RCP8.5 scenarios of the HadGEM-ES, GFDL-ESM2M global models with the equivalent quantile matching method.

KEYWORDS: climate change, climate model, disaggregation, idf curves

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Assessment Of Policy Impact On Water-Energy-Food-Climate-Land Nexus In Latvia

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ABSTRACT

The Water-Energy-Food (WEF) nexus is recognized as an effective approach to assessing complex systems. In the last decade, the interest of stakeholders in having a holistic overview of the policy impact at different spatial and temporal scales is rapidly rising. Although several works developed WEF nexus qualitative and quantitative tools aimed at assessing interactions among the nexus systems components, there is still an increasing need to evaluate the impact of relevant policies in a nexus context. This work extended the WEF nexus assessment by including Land (L) and Climate (C) and by developing a System Dynamic Model (SDM) aimed at quantifying the Latvia WEFLC nexus system under baseline (without policy implementation) and policy conditions up to 2050. Results showed that the benefit of the implementation of policy/ies in a sector leads to trade-offs in others (e.g., increasing cereal production is expected to increase nitrogen load to water bodies with a consequent impact on aquatic ecosystems). This work was developed in close collaboration with stakeholders whose feedback was crucial to elaborate and validate the results. The outcome of this research could contribute to informing decision-making in Latvia and be used as an entry point for further nexus policy assessment.

KEYWORDS: Water-Energy-Food-Land-Climate nexus, Latvia, policy impact, stakeholders, System Dynamic Model

PAPER ID: cest2023_00430

Advancements, Design, and Improvement Strategies for Modern-era Membranes for the Treatment of Wastewater

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ABSTRACT

Membranes are widely used in industries such as food and beverage, pharmaceuticals, and wastewater treatment plants, among others, to purify and recycle water, separate dissolved substances from the environment, such as organic and inorganic contaminants, and recover valuable materials. Additionally, they may be supported by different materials such as a fibrous network that should be impermeable to substances in a solution. Along with the type of materials, the polymeric membranes may be classified into different groups according to the process and respective usage. They can be divided according to the type of material into organic and inorganic ones, besides the organizational structure of their matrices as isotropic and anisotropic. Organic membranes are made from synthetic organic polymers and the most used in industrial applications are polyethylene (PE), polytetrafluorethylene (PTFE), polyamide (PA), polyvinylidene fluoride (PVDF), polypropylene (PP), polysulfone (PS), regenerated cellulose (RC) and cellulose acetate (CeA). Meanwhile, the main inorganic membranes used in industry technologies are made from materials such as ceramics, silica, zirconia, glass, metals, and zeolites. Regarding the structure of polymeric membranes and their respective matrix, they can be classified as isotropic and anisotropic. This review article will cover the use of different membranes and their role in treatment of wastewater.

KEYWORDS: Wastewater, desalination, membrane, treatment, zeolites, optimization.

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Simulating the 1-hr Unit Hydrograph for the Ungauged Watershed of Swaqa

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ABSTRACT:

This study uses QGIS-3.28 to extract the geomorphological features for the ungauged watershed of Swaqa and employs SWMM-5.2 to simulate its 1-hr unit hydrograph (UH). Visualizing the watershed as an impervious surface of virtual curve number equals 100 subjected to an effective rainfall of 1cm depth, the SWMM has successfully simulated the 1-hr UH after computing the watershed width as this study proposes. The simulated 1-hr UH follows the common pattern of synthetic UHs. It has peak flow of 133m^3/s which requires 4.5 hours to attain its value after the runoff has begun. The watershed has lag-time of 4 hours and it drains rainwater to around 45 hours. The derived UH is useful to obtain storm hydrograph for flood analysis and rainwater harvesting studies in the arid region of Swaqa. From regression analysis, a strong relationship was observed between the UH peak flow and the geomorphological attributes of the watershed. Based on that, this study introduces a general equation to predict the UH peak flow given the watershed area, stream length, surface roughness and slope. The predicted peak flow is close to the SWMM simulated value; therefore, this equation is useful to construct synthetic UHs for ungauged watersheds.

KEYWORDS: SWMM, ungauged watershed, unit hydrograph, watershed width.

ACKNOWLEDGMENT

The author likes to thank the founders of the software QGIS-3.28 and SWMM-5.2 for providing free versions that made the accomplishment of this research easy. Providing free DEM layers for the study region by NASA Earth-Data center is also highly appreciated.

PAPER ID: cest2023_00386

Understanding Urban Expansion in the Yangtze River Delta Region: Insights for Urban Agglomeration Development

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ABSTRACT

Urban agglomerations have emerged as a new trend in global urbanization as the population and economy continue to expand[1,2]. A significant challenge of this century is managing and tracking the rise of urban agglomerations[3]. Therefore, studying urban expansion patterns is crucial for planning and decision-making in urban agglomeration development[4]. In this study, we examined four aspects of urban agglomerations: expansion speed, expansion difference, expansion direction, and landscape pattern. We also investigated the interconnection and differences in the expansion process of each city to reveal the spatiotemporal evolution patterns of the Yangtze River Delta region's urban expansion. We utilized various measures, including the speed index of urban expansion, the differentiation index of urban expansion, gravity center migration[5], landscape indices[6], and spatial autocorrelations, based on the land-use data of six periods (1995, 2000, 2005, 2010, 2018). Our results reveal that the built-up area in the region increased from 29,600.715 km^2 to 48,013.895 km^2 over 23 years, exhibiting a "peak-trough-peak" trend. The slowly expanding cities were mostly located in the interior of Anhui Province and northern Jiangsu Province, while rapidly expanding cities were primarily found along the Yangtze River and in coastal areas. The gravity center of the Yangtze River Delta region shifted to the faster-expanding southwest. The spatial structure tended to cluster, and the built-up land had a simpler form, higher compactness, and lower fragmentation. Rapidly expanding cities had more straightforward forms and compact structures, whereas slowly expanding cities had more complex shapes and higher fragmentation. This study provides insights into the spatial and temporal evolution of cities and the characteristics of landscape patterns at the urban agglomeration scale, enabling a better understanding of the level of urbanization in urban agglomerations.

KEYWORDS: urban expansion, gravity center migration, Yangtze River Delta Region

PAPER ID: cest2023_00388

SESSION 29- ARTIFICIAL INTELLIGENCE IN ENVIRONMENTAL APPLICATIONS
Friday 1 September afternoon

Opportunistic Integrated Communication and Weather Sensing

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ABSTRACT

Technological developments for environmental sensing are usually involved with significant resources. An interesting emerging one is the concept of integrated sensing and communication (ISAC), which is gaining attention in the context of 6G technologies. In this talk I will review the state of the art of the technology of weather sensing using existing measurements from wireless commercial microwave links (CMLs). This technology, first introduced in 2006, can be interpreted as opportunistic ISAC or as opportunistic internet of things (IoT).The fact that CML sensors are randomly distributed, and each of them samples the 2-D field of interest (e.g., rain field) as a nonlinear projection along a line, raises interesting practical and theoretical questions to their use for reliable reconstruction of the field. In this talk I will review the state-of-the-art of the CML technology for weather sensing and will focus on future trends and on open problems. Besides dealing with its scientific and technological challenges, I will discuss it as a test case for two general issues: (1) data from a 3rd party as an engine for novel technologies; (2) the interplay between academic research results and their utilization for the public good.

KEYWORDS: Opportunistic sensing, CML, IOT, ISAC
Paper ID: cest2023_00444

SWIRL: Statistical downscaling for Wind Pattern Reconstruction using Machine Learning

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ABSTRACT

Ports are critical infrastructures for global supply chains, crucial hubs and strategic to future trade. However, they are particularly exposed to Climate Change (CC) impacts, estimated to have broad implications on economy and human welfare. Therefore, a timely introduction of adaptation measures addressing CC impacts on ports becomes a major priority and can be proactive if based on projected climate. Yet, this challenge requires high spatial resolution timeseries for the present and the projected climate which are frequently missing. Moreover, employed downscaling procedures are not always skillful, particularly for extremely complex wind fields. The scope of this study is the development of reliable high-resolution wind speed/direction timeseries through Machine Learning (ML) techniques application. The employed ML regression schemes exploit ECMWF-ERA5 Reanalysis data as input training dataset (10931 instances) for Heraclion port area (Crete-Greece), containing 1 site of interest and 4 peripheral (period 1975-2004). Analytical simulations were conducted towards evaluating the regression accuracy on test data in terms of the Mean Absolute Error (MAE). Study outcomes revealed that ML techniques can efficiently reconstruct wind speed/direction timeseries, contributing to the wind downscaling and reconstruction problem, capable of supporting stakeholders needs on port scale regarding CC adaptation.

KEYWORDS: wind speed, wind direction, wind pattern, machine learning, statistical downscaling

PAPER ID: cest2023_00100

A Metaverse Framework For Waste Management

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ABSTRACT

Metaverse and more specifically the technologies that comprise it like virtual and gamified environments, eXtended Reality (XR), the Internet of Things and Artificial Intelligence can bring a new era to the means of real time monitoring and decision making and ultimately, disrupt the field of waste management. In order for waste management strategies to fall in line with EU legislation, directives and strategies (i.e. European Green Deal, Circular Economy, Sustainable Development Goals of the United Nations etc.), key stakeholders and policy makers need to have access to data and information. This information needs to be direct and accurate in order for them to proceed further and employ the necessary directives. At the same time, access to large amounts of incomprehensible data could result in wrong interpretations and thus, in ineffective or inefficient measures. The concept of the metaverse has become increasingly popular in recent years, with many speculating on its potential impact on various aspects of society, including waste management (Dwivedi et al., 2022). The metaverse is a virtual world that is often described as an immersive, shared space that allows for persistent interactions between users, regardless of physical location. It is expected to create new opportunities for waste management through virtualization, simulation, and digitization (Papamichael et al., 2023). The opportunities arising from the metaverse involve reimagining waste management and addressing the growing concerns about waste and pollution in the physical world. In the metaverse, users can simulate and experiment with different waste management strategies, test their efficacy, and collaborate on innovative solutions. For instance, users can design and test recycling programs, experiment with waste-to-energy technologies, and develop new ways to reduce waste generation (Pappas et al., 2022).Simultaneously, the metaverse serves as a mediator between education and awareness-raising on waste management concerns (Kraus et al., 2023). With the ability to simulate various scenarios, users can experience the potential consequences of waste mismanagement, such as environmental pollution and health risks. This immersive experience can increase understanding and engagement among users and inspire them to take action towards sustainable waste management practices (Kristoffersen et al., 2020). At the same time, it offers the potential for new business models and revenue streams related to waste management. For example, virtual marketplaces could be created for the sale and exchange of recycled materials, and waste management companies could offer virtual services such as waste audits and virtual waste management consulting (Capellán-Pérez et al., 2019; Gonçalves et al., 2022; Papamichael et al., 2022; Pappas et al., 2021).However, the implementation of the metaverse as a tool for waste management also raises several challenges. Firstly, there are concerns about the energy and resource consumption required to run the metaverse itself. The development and operation of the metaverse will require significant computational power and data storage, which could result in increased carbon emissions and resource consumption. Additionally, there are concerns about the potential for digital waste and the environmental impact of the materials used to create virtual environments (Dwivedi et al., 2022; Kraus et al., 2023).In conclusion, the metaverse presents a unique opportunity to reimagine waste management and create innovative solutions to address the growing concerns about waste and pollution in the physical world. However, the implementation of the metaverse also requires careful consideration of its environmental impact and potential challenges, such as energy consumption and digital waste. With proper planning and implementation, the metaverse has the potential to revolutionize waste management practices and create a more sustainable future.The present work will showcase a framework of how we can implement gamified and virtual worlds that provide data visualization in a user-friendly and role-playing manner (e.g. virtual embodiment of a key stakeholder). We

also envision these worlds to be fed with real-time or low latency inputs of waste management data, sourcing from external sensors and thus, providing a sense of hybrid worlds, mixing the synthetic environments with the real world information. Lastly, AI models could be trained using this data and information and act as assistants in decision and policy making. So, this holistic Metaverse framework from sensor data and virtual worlds to decision making including AI-assistance could drastically change the field of waste management, leading into a new era where advanced tools will be in service to improve people's daily lives.

KEYWORDS: metaverse, waste management, digitalization, industry 4.0, strategy development

PAPER ID: cest2023_00411

Drone Imagery Combined With Soil Moisture Monitoring for Efficient Irrigation

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ABSTRACT

Urban green infrastructure provide several benefits to inhabitants and helps cities adapt to climate change. This project aimed to develop a landscaping data integrator that provides smart data solutions for urban green infrastructure management, using soil, moisture sensors, and plant health imagery associated with workflow support for watering. Geostatistics was used to produce maps of soil moisture and compare them with thermal images taken by drones and the Normalized Difference Vegetation Index (NDVI) images of urban parks in Loule, south Portugal. The results revealed a linear regression with a coefficient of determination $R^2 = 0.9607$, $R^2 = 0.9432$, $R^2 = 0.9523$, respectively, for the months of August, September, and October. The method can be used to optimize urban green space management and assist in watering decisions.

KEYWORDS: green infrastructure, smart irrigation, ndvi, drone, geostatistics.

Acknowledgments

The study was supported by a grant from the Foundation for Science and Technology–Portugal (UIDB/04007/2020) and by projects GSSIC – Green Spaces SMART Irrigation Control, grant number ALG-01-0247-FEDER-047030 and LIFE GEOCARBON. Particular thanks to GSSIC project's companies Visualforma - Tecnologias de Informação, S.A. and Itelmatis, Lda.

PAPER ID: cest2023_00455

Air-19: Reliable Monitoring Of Air Quality And Microorganisms In Postpandemic Municipality Building

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ABSTRACT

Nowadays, the link between air pollution and covid-19 is proven beyond doubt in the literature with key pollutants being particulate matter and CO_2. Our team has been involved in the development of reliable air quality sensing devices using low-cost sensors measuring particulate matter, differential pressure, humidity, and temperature. We have developed a new measuring device, that detects with high reliability CO, CO_2, humidity, and temperature but also viruses in ambient air. The new architecture consumes less power and supports the integration of industrial CO_2 sensors operating at 12 to 24 volts and using the industrial 4-20mA protocol. Furthermore, five novel near-real-time indices were developed to model risks that endanger public health indoors: a) risk of infection, b) ventilation efficiency, c) aggregated exposure d) AQI and e) congestion. Real-time data streams from six devices (three PM ones and three C2O2O ones, in pairs) that were deployed at a municipality building in the center of Athens, Greece, during a 5-month-long pilot application were used for the indices calculation also generating real-time warnings. Results show that congestion exceeds the limits frequently in the cashier area on the third floor during visitor hours while outdoor pollutants penetrate indoors from a busy road.

KEYWORDS: low-cost sensors, infection risk, aggregated exposure, ventilation efficiency, middleware

PAPER ID: cest2023_00152

Insights gained from a stormwater e-monitoring case study in Viimsi, Estonia

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ABSTRACT

The Baltic Sea is at risk from urban societies' diffuse pollution, which includes harmful substances, nutrients, and marine debris. Stormwater, the primary means by which these pollutants are transported, is typically evaluated through the collection and analysis of grab samples, which show the water quality at a particular moment in time. This method, however, is ineffective at capturing instances of high pollutant concentrations, which makes it more difficult to accurately assess the pollutant load or the impact of the pollutants on the environment. In order to better monitor fluctuations in stormwater quality, an e-monitoring station based on surrogate water quality parameters was built in Viimsi, Estonia. The developed system was based on variables such as pH, turbidity, dissolved oxygen, electrical conductivity, flow rate, and water level. The developed system was successful at capturing high frequency data (5-minute time step) over a three-month period, missing only 15% of the data collected and capturing extreme values that would otherwise not be captured (with traditional grab sampling). The gathered data opens up new avenues for stormwater management and investigations (such as identifying unauthorized connections), as having high frequency and real-time data is the first step towards creating a smart stormwater system that can be controlled in real-time in accordance with water quality criteria.
KEYWORDS: e-monitoring, stormwater, surrogate parameters, water quality, smart cities

PAPER ID: cest2023_00303

Sustainable Smart Agriculture: Plant disease detection with deep learning techniques in cotton cultivation

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ABSTRACT

To meet the needs of an ever-growing global population, the agricultural sector has the responsibility of increasing production, managing diseases and pests that attack crops, and implementing sustainable practices. Deep learning techniques used in sustainable smart agriculture have proven effective in this scientific field for their fast and reliable predictions and their contribution to accurate classifications, for reducing the reckless use of agrochemicals that impose a burden on crops. Early stage plant infestations detection is essential for rapid treatment achievement in order to reduce or eliminate its negative effects on the crops. In this work Convolutional Neural Networks (CNN) models were used, focused on the detection and recognition of pests and diseases. Specifically, using transfer learning from the pre-trained EfficientNet model, the model's accuracy and loss function were examined on a new data set with images of cotton plants from Greek crops, in order to identify healthy and aphid-infested plants.

KEYWORDS: Convolutional Neural Networks, Plant Disease Detection, Smart Sustainable Agriculture

FUNDING

This study was supported by EPAnEk—NSRF 2014-2020, Region of Central Macedonia: KMP6-0086976

PAPER ID: cest2023_00014

Low-cost and rapid paper-based microfluidic device for wastewater surveillance at low-resource settings

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ABSTRACT

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes respiratory illness and gastrointestinal infections, with viral material being excreted in feces (and surviving within sewage for several days). Here, we propose a low-cost and user-friendly paper-based microfluidic device incorporating reverse transcription loop-mediated isothermal amplification (RT-LAMP) for the detection of SARS-CoV-2 and influenza. Qualitative results were displayed by a UV torch, observed with naked eyes or recorded using a mobile phone camera. The paper-based platform could complete the concentration, extraction, amplification and detection of viruses in wastewater within 1.5 hours, with a detection limit as low as 10 copies μL-1. The device was used for on-site detection of SARS-CoV-2 and influenza virus in wastewater samples from four quarantined hotels at London Heathrow Airport, showing results comparable to those obtained using reverse transcription quantitative polymerase chain reaction (RT-qPCR) assays. Our platform enables rapid detection of viruses without the need to send wastewater samples to centralized laboratories, providing a high-resolution data set for highly responsive measurement for the pandemic. The platform can be used as a public health early warning tool for various applications in community settings and shows great potential for rapid and on-site wastewater surveillance at low resource settings.

KEYWORDS: SARS-CoV-2, paper microfluidic, wastewater surveillance, early warning

PAPER ID: cest2023_00458

Monitoring Soil Water Content Using Iot Time And Frequency Domain Reflectometry Sensors

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ABSTRACT

Soil moisture is considered a crucial climatic parameter. Understanding and predicting variations in surface temperature, precipitation, drought, flood and the effects of future climate change need a thorough knowledge of soil moisture fluctuations. Furthermore, quantification of soil water content, one of the two variables that describe soil moisture, is essential to provide an accurate estimate of crop water needs, which is a crucial element in maximizing the effective use of water resources in agriculture. This study presents the development of an integrated monitoring programme of soil water content within the whole range of unsaturated zone using custom-made system that uses time and frequency domain reflectometry (TDR and FDR) probes to monitor complex hydrologic processes taking place in the unsaturated zone, including return flow to the atmosphere via evaporation, plant root uptake, and subsurface flow of groundwater. Signals logged by these sensors are recorded by an extensible and adaptable logging software component and are available both on premise and through a web application, facilitating their remote manipulation. For the purposes of this research a kiwi field was selected in the plain of Arta, which is located in the Epirus region, in the westernmost part of Greece.

KEYWORDS: time-domain reflectometry (tdr), frequency-domain reflectometry (fdr), iot, soil moisture, soil hydrology

ACKNOWLEDGEMENTS

This research is part of the Project “e-Pyrros:Development of an integrated monitoring network for hydro-environmental parameters within the hydro-systems of Louros-Arachthos-Amvrakikos for the optimal management and improvement of agricultural production” (MIS 5047059) and received financial funding from the Operational Programme “Competitiveness, Entrepreneurship and Innovation 2014-2020 (EPAnEK)”.

PAPER ID: cest2023_00320

SESSION 30- CITIZEN SCIENCE

Friday 1 September Afternoon

Analysing The Indicators And The Associated Recommendations Of Household Emission Calculators

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ABSTRACT.

Climate change and greenhouse gas emissions are some of the most noted topics of the last years. Carbon footprint calculators provide an interesting solution when it comes to informing people about the above topic. These calculators try to estimate the carbon footprint, the total amount of greenhouse gas emissions, based on information provided by the user that is related to various activities that may result in creating emissions. Some of the calculators also provide recommendations to the users, based on their results, in order to reduce their carbon emissions. This study provides a comparative analysis of the indicators used for calculating carbon footprint in available household calculators, as well as the recommendations provided for the users to reduce their footprint. The goal of this paper is to present the current state of household carbon footprint calculators regarding the data they require from their users in order for them to calculate their carbon footprint and any recommendation they may provide based on the results. This is achieved by analyzing a list of carbon footprint calculators that are freely available online and, specifically, the domains and indicators each calculator uses, along with the associated resulting recommendations.

Keywords: Carbon Footprint Calculators, Climate Change, Carbon Offset

PAPER ID: cest2023_00167

How Science-Society Interactions Design Post-Mining Territories: Transdisciplinary Patterns In Cevennes, France

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Abstract

In line with the European Union's guidelines, the context of a mining resurgence in metropolitan France plans the prospective opening or reopening of mines. In this general context, the politicization of the post-mining subsurface is sparked by this mining industry rebirth, linked to reminiscences of its mismanagements. Politically and socially, research advances on post-mining issues become strategic knowledge to legitimise such a position. We hypothesise that the knowledge produced in the research has a longer reach (a more robust social impact) when it is co-constructed with the inhabitants, thus leaving the confined field of science to fertilise concrete action on the territory. Based on three case studies in the Cévennes informed by a review of scientific literature and the media, semi-structured interviews with scientists and local inhabitants, and informal interactions, this paper argues that even though they were not designed as participatory, the research processes investigated have become so, *via* spontaneous interactions with local inhabitants. We analyse the circulation of knowledge during the research processes and its impacts on the learning of researchers and inhabitants involved and on the territory. A reflection concerning a typology of forms of transdisciplinarity ongoing, and their influence is outlined.

KEYWORDS: citizen science, transdisciplinarity, knowledge, post-mining territory

ACKNOWLEDGEMENTS

This work was supported by the Mineral Industry & Territorial dynamics Chair (http://www.industrie-minerale-territoires.fr/).

PAPER ID: cest2023_00256

Artificial neural network prediction of citizens' climate mitigation perception related to urban green infrastructure: The Case of Drama City in Greece

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ABSTRACT

Social perceptions and attitudes are important dimensions for the successful implementation of Green Infrastructure (GI) projects, as these are typically designed to improve environmental conditions and promote a green economy. This paper attempts to investigate social behavioral patterns of climate mitigation perceptions related to a complex and long-ongoing urban GI project in the city of Drama, which is located in northeastern Greece. A multilayer perceptron Artificial Neural Network (ANN) was developed and validated to identify the climate mitigation perception of Drama citizens with emphasis on Human Thermal Comfort improvement aimed through the GI project implementation. The study population consisted of 200 respondents of which 70% formed the training set and 30% the test set. The input variables included the level of information about the GI project, the education level, the residence location, the awareness about the importance of the GI expected effect on the aesthetics and the functional improvement of the area, job opportunities, and the quality of life improvement. The ANN had good accuracy (92.9%), precision (94.8%), and area under the curve (85.2%). Therefore, it can be a useful tool for communicating more efficiently the expected benefits of the urban GI project and increasing its social acceptability.

KEYWORDS: human thermal comfort, neural networks, urban green infrastructure, public perception, climate mitigation

Acknowledgments

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PAPER ID: cest2023_00489

From Awareness to Action: Environmental Education as a catalyst for change

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ABSTRACT

Environmental education has emerged as a transformative force in addressing pressing environmental challenges. This article explores the role of environmental education in catalyzing action and effecting positive change, with a focus on the transition from awareness to action. Drawing upon relevant literature on environmental education and citizen science, this article highlights the critical role of education in shaping individuals attitudes, knowledge, and behaviors towards the environment.Environmental issues, such as climate change and protection of marine environment, demand urgent action. Mere awareness without concrete actions falls short in addressing these challenges. Environmental education acts as a catalyst, bridging the gap between knowledge and action. It equips individuals with the necessary tools to understand, analyze, and engage with environmental problems (Jensen, 2002; Stibbe, 2016).Experiential learning methods, such as field trips and outdoor activities, contribute significantly to knowledge retention and attitude change. Case studies indicate that engagement in real-world environmental issues and participation in hands-on activities positively influence individuals' behavior towards sustainable practices. Furthermore, incorporating interactive and participatory methods, including group discussions, role-playing, and problem-solving exercises, enhances the effectiveness of environmental education interventions.Effective environmental education integrates interdisciplinary approaches, incorporating scientific, social, and ethical dimensions of environmental issues. It fosters critical thinking, problem-solving, and decision-making skills, empowering individuals to identify innovative solutions and take responsible action (Hungerford & Volk, 1990; Krasny & Bonney, 2005).Citizen science plays a vital role in environmental education, actively engaging individuals in scientific research. Citizen science initiatives provide opportunities for direct involvement, fostering a sense of ownership and promoting environmental stewardship (Bonney et al., 2009; Cooper et al., 2007).Environmental education cultivates environmental citizenship by nurturing a sense of environmental ethics, empathy, and a commitment to sustainable practices. Informed and engaged citizens advocate for environmental justice and policy changes at different levels (Chawla, 1999; Houston, 2011).Comprehensive and inclusive approaches are necessary for effective environmental education. It is crucial to reach diverse populations, including marginalized communities, and promote environmental literacy across age groups and socio-cultural backgrounds (Agyeman, 2013).Ultimately, environmental education serves as a catalyst for change by empowering individuals to become informed and active citizens in the protection of the environment. By instilling a sense of responsibility, promoting critical thinking, and nurturing a connection with nature, environmental education can inspire individuals to adopt sustainable behaviors and contribute to a more resilient and environmentally conscious society.

KEYWORDS: Environmental education, Citizen science, Marine environment, Environmental challeng, Participatory methods, Experiential learninges, Sustainable practices, Active citizens

PAPER ID: cest2023_00551

Designing Citizen Science tools towards increased awareness and participatory policy making for air quality: The Case of COMPAIR

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ABSTRACT

Despite the concept of citizen science being around for a few decades, it is still considered a non-traditional data source, especially in policy circles. Further efforts are needed to build its acceptability by decision makers at various levels of governance. Determined to make this happen, the COMPAIR project sets out to deploy advanced quality assurance measures in the form of distant calibration to make citizen science data policy-ready. Additionally, the project will engage the entire urban value chain in pollution monitoring and analysis, with a special focus on people from lower socioeconomic backgrounds. Local stakeholders will get access to comprehensive, accurate and easily accessible information on air pollution via three purpose-built digital tools: the Policy Monitoring Dashboard, the Dynamic Exposure Visualisation App, and the CO2 Calculator and Simulator. By leveraging data-driven insights from these tools, members of the quadruple helix community will be able to co-create appropriate measures and strategies to set smart cities on a more carbon-neutral footing and reduce air pollution to levels that are considered safe for all.

KEYWORDS: Citizen science, air quality monitoring, traffic monitoring, data visualisation, participatory policy making

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PAPER ID: cest2023_00204

Understanding Consumers' Water Consumption Preferences And Environmental Consciousness

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ABSTRACT

Water is arguably nowadays one of the most important commodities of increasing socio-economic and political value. Several studies have investigated the factors influencing consumers' perceptions of water quality and water service quality and conclude that are shaped by a constellation of factors; both internal and external. This work is focused on identifying basic trends in consumer's preferences for drinking water. In particular, the main purpose of this work is to investigate a potential correlation between the behavior of consumers choosing drinking water tap or bottled, and their socio-demographic characteristics or/and their ecological consciousness towards major environmental challenges that clearly effect the availability and quality of drinking water. To address the research objective, a mixed methods approach was followed in a specific case study area in Greece. Data were obtained from a survey conducted on a random selected sample of 407 consumers in a period between June and September 2022 in the City of Kilkis. Multivariate data analysis was performed to explore the significant factors associated with consumers' choice of drinking water and identify consumer segments with similar consumption behavior based on their socio-demographic characteristics and their attitudes towards environmental issues. A Focus Group Discussion with local experts and policy makers was also useful towards gaining insight. Results demonstrate that the socio-demographic characteristics do not affect consumers purchasing behavior towards drinking water. On the contrary, there is a correlation between consumers' choice of drinking water and their ecological consciousness. Additionally, cluster analysis was used to distribute consumers with similar behavior towards drinking water and two groups were identified: (1) the *"Bottled water drinkers"* and (2) the *"Tap water (unfiltered) drinkers"*. The findings can be very useful for all stakeholders involved, as it can contribute to improvements in water management and in consumer services. Finally, public acceptance of future innovative approach towards water reuse might be further stimulated.

KEYWORDS: drinking water, bottled water, purchasing behavior, ecological consciousness

ACKNOWLEDGEMENT

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Urban Residents' Perceived Risk And Green Agricultural Products Consumption Decision: A Case Study In China

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ABSTRACT

With the continuous improvement of people's living standards, they pay more attention to food safety and their intention of green consumption is growing.[1] Green agricultural products marked by health, safety and nutrition have become the choice of many consumers.[2] Although green agricultural products are popular in the market and supported by policies, they still face some problems in the actual market, which affects consumers' trust in green agricultural products. For example, when it comes to consumers, it's hard to distinguish green produce from regular produce. In order to obtain the market, producers of green agricultural products may break their trust and replace green agricultural products by ordinary ones. Once consumers know that, they will lose their trust in green agricultural products, which would greatly dampen the enthusiasm of green consumption.[3] Therefore, how to enhance consumer confidence in green agricultural products and reduce consumers' perceived risk of green agricultural products is the key to improve consumer willingness and behavior.[4] Based on the theory of perceived risk and planned behavior, this paper builds a model, including perceived risk dimensions of time risk, functional risk, financial risk and psychological risk, and mainly analyzes the influence of individual attitude, perceived risk and subjective norms on consumption intention and behavior.[5] 298 consumers in Tianjin were surveyed to obtain the primary data. The empirical results show that, time risk, functional risk, financial risk and psychological risk all have a significant negative impact on residents' consumption intention; personal attitude and subjective norm have significant positive influence on consumption intention, and consumption intention affects consumption behavior to a large extent.[6] The more knowledge and trust consumers have about green agricultural products, the more willing they will be to consume. Being in a certain interpersonal network, consumers also tend to follow the purchasing behaviors of people around them, so as to obtain a sense of belonging in the group. Concerns about the functional realization of green agricultural products is a major risk in consumption. Concerns about the functional realization of green agricultural products become a major risk in consumption. If the price of green agricultural products is too high compared with ordinary agricultural products, beyond the ability of daily consumption, residents will turn to other alternative products and reduce the pursuit of green agricultural products.Concerns about the functional realization of green agricultural products become a major risk in consumption. With the understanding and perceived risk of green agricultural products, consumers generate green purchase intention during consumption process, and directly affect the generation of green purchase behavior.Therefore, To ensure human food safety, assuring the quality of green agricultural products to strength the supervision of the whole industry chain; improving the circulation efficiency of green agricultural products to improve after-sales service; reducing the production cost of green agricultural products to achieve high quality prices; doing a good job of product publicity to create a green atmosphere are needed to pay attention to further promote the green production and consumption of agricultural products.

KEYWORDS: Urban residents' perceived risk; green agricultural products; planned behavior theory

PAPER ID: cest2023_00399

Citizens Awareness Energy Park. The value of knowledge sharing and energy science in local communities.

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ABSTRACT

Universities often act as a link between local communities and innovative research activities. In this context, this study explores the design of a Citizens Awareness Energy Park (CAEP) for demonstrating and disseminating knowledge to the local community. The CAEP aims in demonstrating applications of renewable energy and energy-saving technologies. Through this work, the behavioural and attitudinal change related to energy use and environmental protection issues related to the energy transition are promoted. The study was implemented in the Municipality of Ilion and consisted of three stages. Initially, a research questionnaire was developed and distributed to citizens to record their awareness on contemporary energy issues. Next, selected renewable energy technologies were sized and sited in an existing open space in the Municipality of Ilion. Finally, citizens actively participated in environmental pollution measurements in the "citizen science" practice framework. The study's results identified the possibilities and difficulties of creating an effective CAEP, while assessing the critical commitment factors of the actors (e.g., citizens, local enterprises, municipal authorities, etc.) involved.

KEYWORDS: social attitude, energy transition, citizen science

ACKNOWLEDGEMENT

We want to thank the mayor of Ilion Mr Nikos Zenetos for the support and undivided help he offered us, as well as the Municipal Councillor Mr. Fotios Markopoulos and the Deputy Mayor of Technical Services Mr. Georgios Feredinos.

PAPER ID: cest2023_00339

SESSION 31- CIRCULAR ECONOMY AND BIOECONOMY
Friday 1 September Afternoon

Mapping The Path Of An Inclusive Transition Towards A Circular Economy: Local Accelerator Hubs As Enablers Of Circular Business Model Innovation?

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ABSTRACT

The global economy remains predominantly linear, with only 7% circularity, making regions crucial players in promoting circular business model innovation. Local accelerator hubs (LAHs) have the potential to establish collaborative environments that bring together diverse stakeholders to facilitate an inclusive transition to a circular economy. Effective cross-organizational and cross-sectoral collaboration, supported by robust circular economy partnerships, is vital for identifying and scaling innovative solutions. This paper examines the role of regional LAHs in fostering responsible and circular business innovation by presenting a comparative case study of four European LAHs. Employing experimental action research, this paper delves into the intricacies of circular business model innovation processes to provide valuable insights.

KEYWORDS: circular business model innovation, circular economy, local accelerator hubs, cross-sector collaboration, inclusive transition

ACKNOWLEDGEMENT

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PAPER ID: cest2023_00289

Circular Economy: Assessment of Circularity in Olive Oil Mills

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ABSTRACT.

A central issue for academics and politicians regarding the circular economy in the last few years has been the evaluation and monitoring of the circularity level, so that conclusions can be drawn about how the implemented policies have been transitioning toward sustainability. Even though the research community has been working extensively on this subject, there has not been a consensus on what indicators to use to measure circularity in the agri-food industry so far. The aim of this paper is to highlight the circular economy (CE) indicators used in the agri-food sector, based on scientific literature and practice, so as to identify those that could assess circularity in olive oil mills. Furthermore, the project aims to develop a tool that will be able to assess the success of CE strategies and remove some of the ambiguity surrounding CE in practice. Due to the uncontrolled disposal of waste from olive mills, the Mediterranean countries that produce the majority of olive oil have to cope with major environmental issues, so the transition to a CE in olive oil industry is essential.

KEYWORDS: circular economy in olive oil mills, circularity assessment, indicators of circular economy

PAPER ID: cest2023_00011

Circular Bioeconomy In The Sustainable Biotransformation Of Agri-Food Residues And Waste

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ABSTRACT.

This paper explores the potential of sustainable biotransformation of agri-food residues and waste into a spectrum of marketable ingredients for food and feed and other bio-based products (biochemicals, biomaterials) which is at the heart of the bioeconomy. With over 80% of land covered by farms or forests and marine areas supporting fisheries of global importance, the EU is largely self-sufficient in most agri-food, forestry and some marine products. Based on available data, it is estimated that the European bioeconomy has an annual turnover of around €2 trillion and employs over 22 million people, around 9% of the total EU workforce. Its sectors have a strong potential for innovation due to their connection to a wide range of sciences and technologies, as well as local knowledge. Given that the transition from non-renewable to renewable resources is an important innovation aspect of both the circular economy and the bioeconomy agenda, the exploitation of the synergy between the two concepts in ensuring a more productive and efficient use of resources is also evaluated. There is an uneven distribution of activities associated with the development of sustainable circular bioeconomy in EU member states, which has an unwanted impact on the achievement of both European and national objectives.

KEYWORDS: bioeconomy, biotransformation, agri-food residues and waste, bio-based products

ACKNOWLEDGEMENTS

This work was supported by National Program for Rural Development 2014-2020 through the Agency for Financing Rural Investments within the Ministry of Agriculture and Rural Development, project no F 16 1 A 0000 0118 316 00001/2021 and the Program NUCLEU within the framework of the National Research Development and Innovation Plan 2022-2027, carried out with the support of Ministry of Research, Innovation and Digitalization, project no: 23020101.

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The Transition To A Circular Economy Through The Development Of A Waste Management Strategy: The Case Study Of Sotira Municipality

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ABSTRACT

The production of solid waste has significantly increased globally as a result of the ever-growing population. The management of solid waste is a difficult task that is fraught with economic, administrative, and social difficulties. According to the World Bank in 2020, the world was estimated to generate 2.24 billion tons of solid waste and is expected to increase to 3.88 billion tones in 2050. Thought Circular Economy (CE) model, is given emphasis of managing resources more efficiently for the benefit of the long-term economic and environmental sustainability, in order to reduced waste to a minimum by reusing, repairing, refurbishing, and recycling existing materials and products. Applying the reduce, re-use, recycle, and recover concepts as a part of the circular economy is a significant strategy to lessen the environmental impact of solid waste generation. The present study deals with the analysis and evaluation of the Municipal Solid Waste management system implemented by the Municipality of Sotiras, which is located in the Eastern Region of Famagusta District in Cyprus. The existing waste management of the municipality consists twice a week mixed waste collection from household and transferred to Koshis Treatment Plant (2900 tons of mixed waste for 2021) and once a week door to door collection for recyclable materials (149tns for 2021). Through the compositional analysis it turns out that more than 30% of the products were green waste, yard waste and fruits vegetables which can be composted, 10-20% were Food waste, and more than 20% were recyclable materials. To establish a sustainable system within the context of waste management and the circular economy, the municipality must enhance its waste management service and implement new tactics, as demonstrated by this study. The results show that, however ineffectively, individuals are engaged in each local authority's current waste management strategy.

KEYWORDS: circular economy, waste management, composition anaylisis

PAPER ID: cest2023_00046

Nitrogen & Phosphorous Removal via Anaerobic / Anoxic-Aerobic Processes and Struvite Formation in Mall Wastewater: Performance of Retrofitted Full-Scale Plants

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ABSTRACT

With the new standards on nitrogen (N) and phosphorous (P) in wastewater discharges from industrial, commercial and municipal wastewater, there is a need for better wastewater treatment systems. Moreover, with the presence of such N and P in wastewater, struvite formation leading to clogging of pipes has also been a problem in wastewater treatment systems. This study aimed to improve N and P removal from mall wastewater through retrofitting with the inclusion of anaerobic/anoxic process prior to the existing aerobic process and recirculation of part of the effluent from aerobic process to anoxic tank in order to achieve ammonification of organic nitrogen, nitrification and denitrification in the whole system. The recovery of struvite, which is magnesium ammonium phosphate (MgNH4PO4), is also expected to be another pathway via which N and P can be removed from the wastewater. Seven mall wastewater treatment plants were monitored. Both the previous and new system include chlorination as a final treatment. The treatment performance with respect to the removal of N and P of the new retrofitted system is better than the system where the biological treatment process was mainly aerobic. Better levels of organic matter, oil and grease, total suspended solids (TSS), surfactant and fecal coliform were also achieved. The levels of N and P in the effluents of the anaerobic/anoxic process has become so low that precipitation of struvite via magnesium dosing is not feasible. Struvite formation already occurs at the mixing tank after anaerobic/anoxic tank. The new wastewater treatment system, with reduced aeration requirements, where N and P were removed by nature based bacteria and without the use of large dose of chemicals becomes a cost-effective solution for a cleaner environment.

KEYWORDS: anoxic, denitrification, nitrogen, mall wastewater phosphorous, mall wastewater, struvite

PAPER ID: cest2023_00137

Investigation Of Customer Behavior Regarding Circular Fashion: A Case Study Of Cyprus

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ABSTRACT

Humans can't function without energy, nutrition, and clothing. Each one plays a fundamental role in amplifying global warming, CO2 emissions, resource depletion, and the shaping of social norms. Value estimates for the global fashion industry range from $1.5 trillion in 2020 to an estimated $2.25 trillion in 2025, demonstrating a persistent rise in demand (Papamichael et al., 2022, 2023b). Overconsumption of textiles and clothing has been widely observed to have negative environmental effects due to consumer behavior (i.e. compulsive patterns, purchases, and disposal practices) and disposal mindsets of the consumers that are directly connected to fast fashion trends (Baier et al., 2020). Consumer behavior plays a crucial role in the success of circular fashion initiatives. Circular fashion aims to reduce the environmental impact of the fashion industry by creating a closed-loop system where waste is minimized, and materials are reused, recycled, refurbished, remanufactured etc (D'Adamo et al., 2022; Papamichael et al., 2023a). Consumers can support this movement by making conscious choices, such as buying second-hand or upcycled clothes, repairing and maintaining their clothing, and recycling or donating items they no longer use. Additionally, consumers can support brands that incorporate circular principles in their design and production processes, such as using sustainable materials and minimizing waste. By adopting a circular mindset and making sustainable choices, consumers can contribute to a more sustainable and environmentally friendly fashion industry (Koszewska et al., 2020).However, several barriers prevent consumers from adopting sustainable fashion practices. One of the primary barriers is the lack of awareness and education as consumers, therefore, citizens, are not familiar with sustainable fashion, its benefits, or how to identify sustainable products. Additionally, sustainable fashion is often associated with high prices, which can be a barrier for consumers who have limited budgets. Moreover, the fast-paced nature of the fashion industry, with new trends and collections constantly emerging, can make it challenging for consumers to keep up with sustainable options (Abbate et al., 2023; Guillot, 2022).Another significant barrier is the lack of availability of sustainable fashion products. Sustainable options are often limited, and consumers may not have easy access to them. Additionally, sustainable fashion products may not be available in the same variety and styles as fast fashion, making it challenging for consumers to find sustainable alternatives that fit their personal style. Finally, some consumers may not prioritize sustainability when making purchasing decisions. Other factors, such as price, convenience, and aesthetics, may take priority over sustainability. Additionally, some consumers may not feel that their individual actions can make a significant impact on the environment, leading them to prioritize other factors over sustainability (Baier et al., 2020; Ellen MacArthur Foundation, n.d.). Overall, while consumer behavior plays a crucial role in promoting sustainable fashion, several barriers prevent consumers from adopting sustainable practices. Addressing these barriers through education, accessibility, and availability of sustainable products, and shifting consumer priorities towards sustainability can help promote a more sustainable and environmentally friendly fashion industry (Eliades et al., 2022; Kirchherr et al., 2018).As a result, this study employs questionnaires to inquire into textile disposal practices in Cyprus, as well as consumers' willingness and ability to pay for labeled or non-labeled circular products (i.e. clothes made from waste) and the correlation between these queries and extraneous factors (i.e. educational level, age, income etc.). When it comes to clothes, shoes, and any fashion product (labeled and unlabeled), there is a significant gap between what consumers are willing to pay and what they are able to pay. In order to create targeted strategies and business models that are tailored to the characteristics of the island, the results of this study aim to uncover the most important statistics regarding the disposal of apparel in Cyprus (Gazzola et al., 2020). Further research is required to investigate and reveal additional key variables that influence consumers' willingness to pay for specific sustainable apparel products in specific markets. Understanding the level of consumer knowledge regarding sustainable and circular fashion will facilitate the transfer of knowledge and understanding of the impact of their purchases on all three pillars of sustainability (environment, economy, society).

KEYWORDS: circular fashion, sustainable fashion, customer behavior, circular economy, Cyprus

PAPER ID: cest2023_00120

A New Trend For Urban Planning: The Vision And The Challenges

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ABSTRACT

The world population is expanding rapidly, causing a number of economic, environmental, and social consequences including crowd roads, higher traffic demand, and longer travel times to basic services. More than two-thirds of the world's population will live in cities by 2050. The 15-minute city concept promotes for cities where everyday destinations are within a short walk or bicycle ride. Walking to daily destinations not only reduces the environmental impact of transportation, but it is also associated with a variety of positive effects on individual psychological and physical health, as well as social capital. The idea of a 15-minute city offers an excellent, straightforward, flexible, and widely accepted perspective of urban living that has recently emerged around the world. Public schools, green spaces, libraries, super markets, department stores, employment locations, basic healthcare, and areas for entertainment are examples of services that could be found inside the 15-20 minute city. The goal is to establish dynamic and liveable communities, boost the economy, encourage social cohesiveness and sustainable development, and improve citizens' health and well-being. This research focuses on identifying the major opportunities and challenges to ensure that the concept of a 15-minute city can be applied to urban planning to reduce energy use in cities and air emissions in order to address climate change.

Keywords: 15 minutes city, urbanization, urban planning, sustainable development

PAPER ID: cest2023_00195

Enhanced Hydrogen Production Rates In Microbial Electrolysis Cell Using Biocatalyst

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ABSTRACT

Energy consumption around the world has increased significantly and depleting reserves pose a major concern. Green energy sources are the need of the hour to counter fuel scarcity and soaring prices. Hydrogen production through a microbial electrolysis cell (MEC) is an effective and green technology. It is a bio-electrochemical system where microbial oxidation of organic feed at the anode and reduction of protons to Hydrogen at the cathode takes place. To derive hydrogen evolution reaction (HER) over the cathode, an externally applied voltage of 0.2V is required which is very nominal in comparison to the voltage required for water electrolysis.

In the present study, the reactor digestate-derived biochar biocatalyst was evaluated for its impact on the process parameter enhancements. The bio-catalyzed single-chambered MEC (BC-SC-MEC) in a batch mode at an applied voltage of 0.8 V resulted in higher COD removal efficiency and hydrogen production rates at 30 ± 2 °C (Fig.1). The COD removal of 78%, with Coulombic efficiency of 60% and cathodic hydrogen recovery of 52 % was reported in BC-SC-MEC, while SC-MEC resulted into COD removal of 72%, coulombic efficiency of 55% and cathodic hydrogen recovery of 48% were reported. These results support the claim of boosted hydrogen production in the bio-catalyzed MEC for enhanced energy recovery.

KEYWORDS: electro-hydrogenesis, microbial electrolysis cell, biochar, bio-catalyst, hydrogen evolution reaction

PAPER ID: cest2023_00466

Green Hydrogen Production Via Hydrothermal Gasification Of Green Hydrogen Production Via Hydrothermal Gasification Of Anaerobic Sludge: A Case Study On Lesvos Island

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ABSTRACT

Due to the continuous depletion of fossil fuels and their simultaneous increasing cost, all the focusing on the latest years has turned to the renewable resources such as biomass wastes to obtain energy (Chen et al., 2013). Biomass wastes characterized for their high moisture content and the need for pre – drying before their utilization for conventional thermochemical processes were necessary thus consuming a lot of energy (Chen et al., 2013) but with Hydrothermal processes such as Hydrothermal Carbonization (HTC), Liquefaction (HTL) and Gasification (HTG) which can promise the conversion of the biomass like sludge into valuable products without pre drying (Chen et al., 2020). According to Bodur et al., (2023) HTL and HTG processes can produce carboxylic acids, phenols, ketones, furfurals etc. at lower temperatures under 300°C and at higher temperatures hydrogen and methane gasses respectively. Factors such as temperature, pressure, feedstock characteristics, total solids and residence times have primary influence on the yields of the products of Hydrothermal processes (Chen et al., 2020).

This study focuses on the valorization of anaerobic sludge by means of hydrothermal gasification and studies the main production pathways of green hydrogen. Experiments took place in a Parr reactor of 1 L with different operational

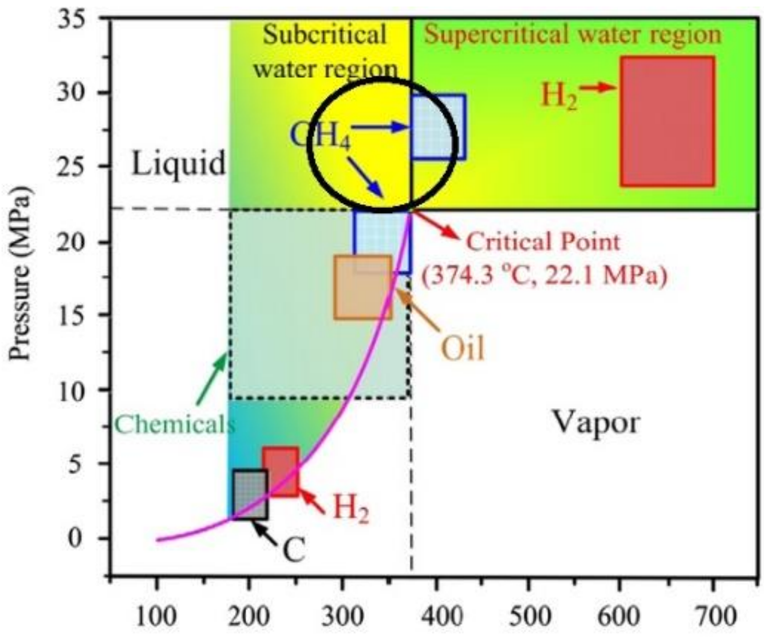

***Figure 1** The point of HTL/HTG conditions that this study focused (He et al., 2014).*

temperatures and fillings percentages of anaerobic sludge under Hydrothermal Gasification conditions in order to estimate the fate of the produced gasses inside the reactor and to determine the precise point at which hydrogen production begins. Specifically, the temperatures ranged from 310 °C to 380 ° and the residence time for each experiment was 2 hours. The produced gasses flowed through a tar trap for cleaning and then collected into Tedlar bags. The analyses of the gasses performed in a novel plasma Gas Chromatographer. Other analyses for the characterization of the liquid products included, pH measurements, Chemical Oxygen Demand (COD) measurements, Total Phenolic Content (TPC), and for the solid product characterization Total Solids (TS) and Volatile Solids (VS) measurements also performed. The evolved pressures of the experiments reached up to 151.6 bar. The COD values of the liquid products decreases with the increase of temperature until 300°C and increases again at higher temperatures the COD, highlighting carboxylation processes that increase the quality if the liquid products. Similarly, for higher temperatures above 340°C favor the production of hydrogen in high percentages. The pH rates of the liquid products of each experiment are heavily influenced by the concentration of the VFAS. This study presents the application of hydrothermal gasification as a novel pathway for the production of green hydrogen for liquid biowaste and aims to be used as an intermediate step in order to expand this application to other liquid bioresources on Lesvos island.

KEYWORDS: Hydrothermal Gasification, Anaerobic Sludge, GC analysis, Hydrothermal Liquefaction, Hydrogen

PAPER ID: cest2023_00572

SESSION 32- WASTE MANAGEMENT AND TECHNOLOGIES
FRIDAY 1 SEPTEMBER AFTERNOON

NEVER LET A GOOD CRISIS GO TO WASTE

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ABSTRACT

The International Energy Agency has made clear that "*the world is in the midst of the first truly global energy crisis, with impacts that will be felt for years to come*". This "threat" has triggered great "mobility" in the waste sector, as many present wastes as an important part of a both feasible and sustainable potential solution. The European Waste Management Association (FEAD) recognizes that the waste management sector "*is not [yet] at its full capacity of producing and saving energy*" and that "*it can play a 'fundamental role' in ending the EU's dependence on Russian fossil fuels*". Several options are being put on the table, starting from targeted recycling and recovery operations up to advanced waste incineration, while the term "waste" in waste-to-energy concepts is being broadened including even nuclear wastes, along with industrial and municipal wastes. Some specialists consider the prevailing global conditions in the energy sector as a great driving force to speed up the transition away from fossil fuels utilizing wastes, while others point out the existence of traps and risks along the way. In Germany, for example, there has been a great concern about plans made to backtrack on environmental protections by increasing nitrogen-oxide emissions by one third and eventually abandoning limits altogether in waste incinerators, including cement plants, to shore up power supplies. Decisions and actions need to be made carefully but also fast, as the crisis is already here. And in this crisis, the "never let a good crisis go to waste" approach seems to be more than meaningful.

KEYWORDS: energy, crisis, waste-to-energy, recovery

PAPER ID: cest2023_00592

Improved Storage And Handling Of Fine Recycled Concrete Aggregates By Accelerated Carbonation: Towards A Quantification Method

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ABSTRACT

The fines fraction generated by crushing of concrete waste for production of recycled concrete aggregates amounts to 40 - 60 mass-%. Technically, fine recycled concrete aggregates (0 - 2 mm, fRCA) may be employed as a sand substitute in new concrete products. This is, however, hampered by the materials tendency for bridging/caking during storage in open stockpiles or silos. Here we investigated whether the reactivity of fRCA can be decreased and, hence, its storage and handling be improved by accelerated carbonation. Carbonation experiments were conducted in a pilot-scale rotating drum reactor (void volume V0 ~ 75 L) at around unity CO_2 partial pressure (re-dosing setpoints - 50 hPa and + 50 hPa in-vessel differential pressure) over reaction times of one hour. Re-dosing cycles and thermogravimetric analysis served to quantify the CO_2 uptake by fRCA. Penetration resistance and sieve passage against control samples served to quantify the effect of carbonation on the bridging tendency of fRCA. Compared to control samples, carbonated fine RCA formed more brittle crusts upon exposure to ambient conditions. Thus bridging/caking of fRCA may be prevented by accelerated carbonation prior to storage. Consequences of the use of carbonated fRCA as a sand substitute in concrete are subject of ongoing investigation while test methods to assess the effects on handling and storage properties are under consideration.

KEYWORDS: construction and demolition waste, recycled concrete aggregates, concrete fines, accelerated carbonation

PAPER ID: cest2023_00265

Survival And Antioxidative Responses In Oligochaetes Exposed To Concrete Demolition Debris Leachates

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ABSTRACT

The increasing global population mandates structures to facilitate the needs of growing urbanization. Most of the world's population is expected to live in cities by 2050. Thus, inadequate infrastructures are being replaced, leading to demolition and the generation of concrete debris. Millions of tons of construction waste are generated globally, especially in megacities (Wu et al., 2016). Concrete waste and debris are transported to landfills, recycled, or left where generated, becoming a significant environmental problem. Data on the toxicity caused by particles and associated leachates from concrete demolition waste on biota are limited (Kobetičová and Černý, 2017). Environmental risk assessment employing ecotoxicology methods is essential in gauging the ecological impacts and aiding in developing strategies to dispose of or reuse these materials safely. The present study aimed to investigate the toxicity of leachates from concrete waste collected from an accurate demolition site, considering the effect of particle size. The study aimed to a) assess oligochaete survival with exposure to leachate from various concrete particle sizes (< 1 mm, 0.5 - 1 cm, and 2 - 5 cm) at various dilutions (0x to 1000x) in the presence and absence of a substrate and b) measure related antioxidative responses as catalase (CAT) activity. Three species of oligochaetes (*Enchytraeus crypticus*, *Tubifex tubifex*, and *Lumbriculus variegatus*) were used, representative of terrestrial and aquatic environments, to compare the toxicity of the leachate based on their particular sensitivities. Leachates were prepared according to Swedish standard SS-EN 12457-4 (SIS, 2003). Exposures were conducted similarly to Pflugmacher et al. (2020a), and CAT was assessed according to Scopetani et al. (2020).

Leachate from the smallest concrete particles affected the oligochaetes most, potentially due to the increased surface area facilitating releasing more toxicants (Hillier et al., 1999). The alkaline pH of the leachate and the potential leaching of heavy metals may have played a role in the mortality of the oligochaetes. *E. crypticus* was the least affected of the three test species. Exposure in the presence of a substrate yielded reduced toxicity, with fewer mortalities and a corresponding reduced antioxidative response based on the activities of CAT. Sediments were previously shown to buffer the effects of toxicants potentially via adsorption or dilution (Pflugmacher et al., 2020).

The data generated in this study illustrate the importance of adequate handling and recycling of concrete and demolition waste in minimizing adverse effects on the environment, especially oligochaetes, and in so doing, preserving biodiversity.

KEYWORDS: Concrete debris, demolition, antioxidative response, mortality

PAPER ID: cest2023_00214

Promoting Circularity And In-Situ Reuse Of Construction & Demolition Waste On Redevelopment Of Potentially Contaminated Sites: The EU Experience

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ABSTRACT

Construction and demolition wastes (CDW) is one of the major waste streams in EU and globally. Although circular economy is definitely the way to move forward and make our society more sustainable, this cannot be achieved if at the same time we do not sufficiently protect the environment and the human health from the exposure to hazardous substances due to uncontrolled reuse or recycling of wastes, such as CDW, that may turn into continuous diffuse sources of contaminants.Typical cases of CDW containing hazardous substances are those generated by the redevelopment of industrial and commercial sites, where land uses are usually changed to accommodate more sensitive activities, such as housing or leisure facilities. Although some countries have already sufficiently robust frameworks, this is not always the case, even in the EU. The new EU Soil Strategy that came in force in 2021 and the new EU Soil Health Law that is expected the following months is also a part of the puzzle that should be taken also into account. Also, the sustainability criteria as defined in the delegated ordinance amending the EU taxonomy ordinance must be considered in such projects in future.This study investigates the CDW management approach of the most advanced EU countries and the challenges that we are going to encounter in the near future in this very interesting topic.

KEYWORDS: Construction & Demolition Waste (CDW), reuse, soil contamination, leaching test, aggregates, circularity.

Paper ID: cest2023_00417

Circular Economy Potential In Waste Reuse And Preparation For Reuse (Pfr): Insights From Social Media Data Mining

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ABSTRACT

The transition from a linear to a circular economy that supports environmental sustainability and human health requires effective waste management and treating waste as a potential resource, as emphasized in SDG 12, 'Responsible Consumption and Production' (Ranjbari et al., 2021; Pires & Martinho, 2019). Waste management aims to promote waste prevention and the application of a waste management hierarchy that prioritizes reduction, preparation for reuse (PfR), and recycling (Pires & Martinho, 2019). Circular economy models prioritizing waste prevention at the top are seen as a promising alternative to disposal-oriented linear economic systems (Tisserant et al., 2017; Zacho et al., 2018). The Lebanese waste crisis of 2015 demonstrated the challenges of solid waste mismanagement, which had major effects on air quality and public health. Approximately 459 tons of solid waste were disposed of daily in open dumps in Lebanon in 2014; it is estimated that 290 tons were open burned, while 169 tons were deposited into existing dumps (El Mir et al., 2021). Understanding reuse directives applied in Lebanon is needed to address a prevention-oriented management scheme properly. In recent years, research on waste management toward circular economy goals has been increasingly conducted, covering circular economy indicators for waste management, waste management drivers toward a circular economy, and the waste hierarchy index (Ranjbari et al., 2021). Although reuse and preparation for reuse (PfR) are the most important waste prevention strategies, their potential regarding the circular economy and climate change has been underexplored. In parallel, the emergence of new technologies, such as the Internet of Things, Big Data, and Artificial Intelligence (AI), is one of the key enablers for wider adoption and accelerated transition to a circular economy (Kristoffersen et al., 2019). AI methodologies, such as information retrieval from social media networks, have not yet been scoped for the context of a circular economy. Contributions to waste management have been limited in the literature.This research aims to address two objectives: 1) Explore the most accepted waste category to be reused and the current reuse directives on Lebanese social media platforms 2) Develop a theoretical framework for the reuse of the most category prior to entering the disposal stream, while understanding the social, economic, environmental and health implications. AI methodologies such as information retrieval and machine learning (ML) are used, and more than 1000 images from Lebanese Instagram thrift shop accounts were scraped using the Selenium library and Instagram's Application Programming Interface. A classifier was trained on this dataset through transfer learning models to assign one of seven waste categories (textile, clothing & shoes, furniture & home appliances, toys, books & movies, electronics, cosmetics & medicine) for each image.The results indicate that textiles, clothing, and shoes are the most reused waste category. It is vital to ensure sustainable reuse management for both the sellers and consumers due to the negative environmental impact of textile waste, including greenhouse gas emissions, land and water pollution, and depletion of natural resources (Pensupa et al., 2018). The environmental impact from the generation and consumption patterns identified is quantified and contributes to the international literature on waste management and circular economy goals. Finally, the research highlights the potential of AI methodologies like information retrieval from social media networks for waste management and the transition to a circular economy.

KEYWORDS: waste management, reuse, recycling, circular economy, Lebanon, machine learning, thrift shops, climate change

Paper ID: cest2023_0378

Exploring The Consumers' Behaviour Towards Storing, Repairing And Second-Hand Purchasing Of Mobile Phones In Greece.

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ABSTRACT

The proliferation of waste electrical and electronic equipment (WEEE) poses a significant environmental challenge, driven by technological advancements and reduced production costs. In particular, mobile phones have gained tremendous popularity worldwide, but their short lifespan has significantly contributed to the exacerbated electronic waste crisis. In this paper, a study on the behavior of Greek consumers towards storage, replacing, repairing and second-hand purchasing of mobile phones is presented.

KEYWORDS: weee, consumer behaviour, storing, repair, second hand

PAPER ID: cest2023_00472

Production of hydrogen and geopolymers from end of life photovoltaic panels

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ABSTRACT

Photovoltaic panel waste is expected to rise rapidly as installed modules approach their end of life. Recovery and reuse of valuable components such as semiconductors is crucial. Crystalline silicon panel derived waste reacts with alkali producing hydrogen gas and metasilicate structures in the solution which can be used as geopolymerization activator. In this work the prospect of utilizing 1st generation crystalline silicon panel waste for geopolymer activation with simultaneous hydrogen production is examined. Preliminary test results show that 1.55±0.05L of hydrogen gas can be produced from 1g of recovered semiconductor (Si). The resulting metasilicate solution is used for fly ash geopolymer activation. After 7 days of curing, the compressive strength of the generated geopolymer samples reached 19.5±0.5 MPa, indicating that this zero-waste reuse pathway can be viable after optimization.

KEYWORDS: end-of-life photovoltaic panel, hydrogen production, geopolymer activation, metasilicate precursor, silicon alkaline reaction.

ACKNOWLEDGEMENTS

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CEST 2023

Heavy Metal Assessment in Vineyard Sludge. Copper Lixiviation And Recovery Studies.

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ABSTRACT

The use of copper-based compounds to prevent fungi diseases in vineyards have contributed to copper (Cu) accumulation in soil, vegetation and waste, causing a serious environmental and agro industrial problem (EFSA, 2013). In this concern, one of the main issues is the waste generated both during and after wine production. This waste must undergo through aerobic/anaerobic digestions, so a safe disposal is possible. As a result, a main final sludge waste is generated. This sludge is characterised by the presence of significant nutrients for soil fertilisation and regeneration, so the return of sludge to vineyard soils would provide a sustainable solution for this waste. However, its hazardous Cu content (and zinc (Zn) as a concomitant residue) hinders its use in soils. The risk associated to its use, does not depend on the total heavy metal content but to the retention phases and metal speciation present in the sludge, which will determine the mobility and bioavailability of the metals. The use of sewage sludge in agriculture has increased in the last decade in the European Union (EU), with a usage rate of more than 40% (Mackie et al. 2012). The sludge may only be used in agriculture in accordance with Directive (86/278/CEE)(European Commission 1986) and in order to achieve the EU guidelines on healthy soils and adaptation to climate change for 2030 (European Commission 2021). In this work, Cu and Zn availability assessment is determined by applying sequential speciation methodologies(Wang et al. 2022) to determine both the risk associated with the use of this sludge as a soil improver and fertiliser, and the metal distribution in the sludge phases (operational speciation) to accomplish for a most appropriate and environmentally safe treatment process for its use. Also, Cu and Zn recovery processes is presented to provide a Circular Economy solution.

KEYWORDS: sludge, copper, zınc, specıatıon, waste management

PAPER ID: cest2023_00257

Key determinants of Food Waste production in a German hospital: A quantitative analysis of patient food waste behavior during hospitalization

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ABSTRACT

Food waste in public institutions is linked with valuable nutrients loss, financial costs and environmental impacts. The aim of the study is to explore the basic pathways of food waste production in a German hospital and to identify the key parameters that influence the output. The study was performed during 2 days, to all hospitalized patients (n=80) in 3 wards (medicine, otolaryngology, surgical) of the hospital. The FW output (plate leftovers and unserved food) were measured by analyzing each patient's plate leftover for the 3 served meals: breakfast, lunch and dinner. The FW was analyzed quantitatively and qualitatively by a) weighting the plate FW by food nutrient category and b) calculating the calorie content of the plate FW. Statistical analysis was performed on patient demographic data and personal food behavior in order to identify the key determinants of the observed food waste production. The results indicated lunch as the major source of FW production and the menu type as the key determinant of the measured FW

KEYWORDS: food waste; hospital; feeding operation system; patients' nutrition

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Study On Selective Extraction Of Calcium From Blast Furnace Slag And Its Effective Utilization

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ABSTRACT

Blast furnace slag (BFS) is a by-product generated in the iron making process. The BFS has been discharged in large quantities and mostly reused as raw materials for cement, roadbed, and concrete aggregate. However, the amount of use of BFS in these fields tends to be saturated. Therefore, exploring new utilization of BFS becomes increasingly important. In this study, the conditions for selective extraction of calcium from BFS were explored, and effective utilization of the extract and extraction residue was investigated. The main component of BFS is calcia (CaO), but it also contains large amounts of silica (SiO2) and alumina (Al2O3). By setting the conditions appropriately, we have succeeded in selectively extracting calcium from the BFS. It was found that the extraction residue had micropores and a high specific surface area (74.5 m2/g). The BFS before calcium extraction had little adsorption capacity for methylene blue, but the extraction residue had high adsorption capacity. Furthermore, we have successfully developed a process to synthesize ettringite from the extract. Calcination of the ettringite yielded metaettringite which had a high adsorption capacity for borate.

KEYWORDS: Blast furnace slag; Recycle; Adsorption

PAPER ID: cest2023_00064

Pretreatment of Agro-Industrial Wastes with Basidial Fungi Strains for Effective Delignification of Lignocellulosic Wastes

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ABSTRACT

Lignocellulosic biomass, including agro-industrial wastes, is an ideal cheap and abundant source of glucose for ethanol production. The complex structure of lignin makes it difficult to hydrolyze the biomass cellulose to sugars and other organic compounds. In recent years, it has become more and more important to develop an environmentally friendly pretreatment method for delignification of plant residues. The aim of the present work was to study the delignification of agro-industrial residues by higher basidial fungi. Solid state fermentation (SSF) of 35 tested strains on wheat, rice and corn straw, potato above-ground mass (AMP) and sunflower lignocellulosic waste (SLW) showed different levels of oxidase enzyme production. In particular, laccase activity varied from 0.5 to 91.8 U/ml, and manganese peroxidase (MnP) activity from 0 to 2.1 U/ml, depending on the substrates and the type of the fungi. The best lignin destroyers were: *Trametes maxima* GK-02, *Ganoderma* sp. GV 51, *Pleurotus* sp. IN-93. The best delignification result was achieved with the strain *Pleurotus* sp. IN-93 in corn straw and wheat straw, from 17.8% to 7.7% and from 19.1% to 10.6%, respectively. In the case of delignification of the AMP, the amount of lignin decreased by 4.0-6.9%. *Trametes maxima* GK-02 was the most effective in case of SLW - lignin degradation from 19.7% to 10.6%.

KEYWORDS: Agro-industrial wastes, Basidial fungi, Pre-treatment, Fermentation.

PAPER ID: cest2023_00423

Revealing the Hidden Toxin of the Bottom Ashes from Open Municipal Waste Burning

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ABSTRACT

Bottom ashes caused by open waste burning (OWB) contain a large amount of metal, which can harm human health when exposed directly to humans or leached into the waterways. This study aims to reveal the metal in the bottom ashes and its potential health impact. Laboratory field studies which consist of replication of open burning practice and inductively coupled plasma optical emission spectrometry (ICP-OES) analysis, were used to answer the aims. It is found that the carcinogenic risks (CR) caused by arsenic (As) and cadmium (Cd) from food waste and paper burning are higher through the ingestion pathway. Besides, the hazard index (HI) shows a value of less than 1 for adults and children in all types of waste burning. However, a higher average value for HI is found in the children. This value means that children are the most vulnerable subject to the leaching of bottom ash through the waterways from OWB practices.

KEYWORDS: bottom ashes; metal speciation; open waste burning; risk analysis

PAPER ID: cest2023_00397

Mercury Bioremediation Using A Newly Discovered Strain *Rheinheimera Metallidurans* Sp. Nov. From A Waste Dumping Site

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A bacterium, named strain DCL_24^T, was discovered in the legacy waste at the Daddu Majra dumping site in Chandigarh, India. This novel strain exhibited resistance to inorganic mercury (mercuric chloride) up to 300 µM. It is a Gram-negative, facultative anaerobic, motile, rod-shaped bacterium, which can thrive at temperatures ranging from 4 – 30 °C (with an optimum at 25 °C), pH levels between 6.0 – 12.0 (with an optimum at 7.0), and salinity levels of 0 – 4.0 % (w/v) NaCl (with an optimum of 0.5 – 2.0 %). The 16S rRNA gene-based phylogenetic analysis revealed that DCL_24^T shared a 97.53% similarity with the closest type strain *Rheinheimera muenzenbergensis* E-49T. Insilico DNA-DNA hybridization and average nucleotide identity values showed 18.60% and 73.77%, respectively, between the genomes of DCL_24^T and *R. muenzenbergensis* E-49^T. With a DNA G+C content of 44.33 mol %, strain DCL_24^T represents a novel species within the genus Rheinheimera, and the name *Rheinheimera metallidurans* sp. nov. is suggested. The type strain is DCL_24^T (MTCC13203T = NBRC115780^T = JCM 35551^T). The study showed that DCL_24^T could efficiently volatilize and remove mercury, with around 92% of mercury removal observed within 48 hours, as demonstrated by X-ray film and dithizone-based colorimetric methods. The bacterium contained a mercury-resistant determinant *mer* operon, which includes *merA* (encoding the mercuric reductase enzyme), and transport and regulatory genes *(merT, merP, merD,* and *merR*). The relative expression analysis of *merA* at increasing concentrations of $HgCl_2$ confirmed the merA-mediated reduction of toxic Hg^{2+} into non-toxic volatile Hg^0. The phytotoxicity assay demonstrated the mercury toxicity reduction potential of DCL_24^T, using *Arabidopsis thaliana* seeds. The study concludes that DCL_24^T is a promising candidate for mercury bioremediation, but further research is required to assess its bioremediation efficacy under harsh environmental conditions observed in polluted sites.

Keywords:
Mercury, Bioremediation, Microbial biodiversity, heavy metal
Paper ID: cest2023_00426

SESSION 33- CIRCULAR ECONOMY AND BIOECONOMY

SATURDAY 2 SEPTEMBER MORNING

PROMETHEUS: Services, systems and methods for HEIs in the domains of Circular Economy, and Sustainable Development

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ABSTRACT

Prioritizing innovation and entrepreneurship is difficult for European Higher Education Institutions (HEIs), especially in the context of digital transformation. Despite fruitful partnerships, many HEIs struggle to interact with business leaders, share knowledge, and promote cross-border cooperation. The impact of research and teaching is hampered by a lack of institutional support, which limits opportunities for faculty and students.

Universities must allocate the necessary funds and recognize the value of knowledge exchange and collaboration with outside parties in order to address these problems. Effective knowledge exchange requires the development of strategic alliances with governmental organizations and private companies. Collaboration is facilitated, institutional reputation is improved, and funding is attracted through joint research initiatives, industry partnerships, and community engagement initiatives.

This paper presents the PROMETHEUS project which involves five HEIs and three research centers and enterprises across Europe, as a solution to the above mentioned lack, by developing and sharing capabilities in innovation and entrepreneurship related to digital transformation. PROMETHEUS focuses on institutional engagement and change, offering various services, systems, and methods to enhance Higher Education. These include schools, workshops, networking opportunities, digital platforms, and business accelerator programs.
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KEYWORDS: Digital Transformation, Innovation & Entrepreneurship, HEIs transformation, Entrepreneurship Acceleration Platforms

PAPER ID: cest2023_00240

Development Of Indicators For Performance Assessment Of Blue-Green Infrastructures

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ABSTRACT

The application of blue-green infrastructures in urban areas incorporate various benefits and is thus widely accepted today. However, while aspects of planning and construction are well approved, operation and maintenance are still lacking broad attention. To contribute to the progress in the field, this conference contribution provides a framework for developing related performance indicators and service levels based on an international and well-established European standard focusing on drain and sewer systems. While the standard focuses on grey infrastructure our preliminary results show the adaptability towards more innovative blue-green perspectives. Currently, our work is still on a more theoretic and conceptual level, but an ongoing case study application in a city quarter reconstruction site will show its practicability and support the development of suitable performance indictors and service levels for selected blue-green infrastructures. Finally, building on an existing European standard will make our work easily transferable and adaptable to other European countries and beyond.

KEYWORDS: nature-based solutions; operation and maintenance; stormwater management; EN 752

PAPER ID: cest2023_00013

A Truly Circular Process For Recycling All Main Raw Materials Of Waste Of Lcds Screens Of Smartphones

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ABSTRACT

A liquid-crystal display (LCD) screen is composed by two transparent glasses coated with indium-tin oxide (ITO) on it and crystal liquids (LCs) sandwiched between them. The current implemented recycling process usually adopts mechanical crushing or pyrolysis as the primary LCDs screens treatment step. However, the toxic (LCs) and valuable recyclable (Indium, In) materials are treated together and the In recovery rate is low. Furthermore, in a circular economy perspective, the recovery of glass and plastics from the LCD screens should be targeted too, to close the loop of the recycling chain.

Here, we propose a hybrid (physical plus chemical steps) method that removes the polymeric film (PF) attached to the ITO glass to recover the highest amount of In and also to recover the plastic fraction and the glass substrate. For that, the cut LCDs pieces were put in a water and ethyl acetate (1:5) mixture in a low-pressure reactor (1 hour at 180 ºC) for detaching the PF, separate it and dissolve the LCs in the solvent. Subsequently, a high In recovery yield (99.0%) was achieved from the ITO glass under microwave-assisted soft acid leaching conditions followed by continuous column ion-exchange technology (IET) to purify In from other metals impurities.

KEYWORDS: indium, critical raw material, lcd screens recycling

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Physical and Chemical Analysis of the Irrigation Water Polluted by the Anthropogenic Load of the Region

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ABSTRACT.

The problem of pollution of the irrigation water treatment is becoming more and more significant due to the increasing anthropogenic human impact on the ecosystem. Industrial development, especially in developing countries, leads to an increase in the concentration of heavy metals in wastewater and soils. Water is the main provider of most chemical elements through the plant root system, whose main function is to absorb water and inorganic nutrients that support the growth and development of the plant itself. As a result, crops irrigated with polluted water or grown on soils containing large amounts of heavy metals become unfit for consumption due to the high concentration of toxic elements in them. In the work a number of physical and chemical properties in irrigation water caused by climatic changes in the region are investigated. The main types of heavy metals in irrigation water samples that are not subject to decay, decomposition and degradation are considered. The calculated coefficients make it possible to determine the degree of irrigation water pollution stress factor.

KEYWORDS: water; heavy metals; ph; conductivity; turbidity.

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Use Of Recycled Construction And Demolition Waste As Substrate In Hybrid Constructed Wetlands For The Treatment Of Olive Mill Wastewater.

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ABSTRACT

The objective of this study was to evaluate the effectiveness of hybrid constructed wetlands (CWs) for treating olive mill wastewater (OMW) using recycled aggregates from construction and demolition waste as substrate material. The experiment was conducted at the outdoor research facility of the University of the Aegean in Mytilene, Greece. Three identical pilot hybrid systems were developed, consisting of a vertical subsurface flow CW and a horizontal subsurface flow CW. The first hybrid system (S1) was filled with recycled demolition waste, the second system S2 was filled with rock (ignimbrite) processing residues while the third system (S3) was filled with gravel for comparison. In all three pilot hybrid systems, four plants of *Atriplex halimus* were placed in each VF-CW, while four plants of *Scirpoides holoschoens* were placed in each HF-CW. The experiment lasted for 4 months with hydraulic loading rate 30 L/d. The effluent results from the hybrid systems showed that the hybrid system filled with the rock processing residues had higher removal rates for all examined parameters (COD=87%, Turbidity=99%, Total Phosphorus =75%, Total Phenols=95%).

KEYWORDS: olive mill wastewater; nature-based solutions for water; constructed wetlands; recycling

ACKNOWLEDGEMENTS: We acknowledge support of this work by the project “Center of Sustainable and Circular Bioeconomy [Aegean_BIOECONOMY]” (MIS 5045851) which is implemented under the Action “Reinforcement of the Research and Innovation Infrastructure”, funded by the Operational Programme "Competitiveness, Entrepreneurship and Innovation" (NSRF 2014-2020) and co-financed by Greece and the European Union (European Regional Development Fund).

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Buildings Sustainability on a Life Cycle Basis: Comparative evaluation between new construction and refurbishment of an existing building

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ABSTRACT

On a global basis, buildings consume about 60% of raw materials per weight and almost 1/3 of the global energy consumption quantities. For many years the most important issue determining the sustainability of a building has been the energy consumed during its operation. However, recently a trend has emerged towards the consideration of the building's energy use on a life cycle basis rather than only in their operation; thus, including the construction, operation and end of life phases.

The objective of the present work is to describe the development and the implementation of a methodology for the comparative environmental performance of a building between two alternative solutions; namely its new construction versus its refurbishment. The comparative evaluation is based on detailed estimation of two important magnitudes, that of the embodied energy and the embodied carbon.

The methodology has been implemented in one of the most emblematic buildings in Attica Region, the Piraeus Tower that is undergoing a total refurbishment. The methodology may be applied in other buildings of various types and uses and provide a useful decision support tool for the selection between re-construction or refurbishment, leading to more sustainable in environmental terms as well as more financially efficient developments.

KEYWORDS: embodied energy, embodied carbon, refurbishment, comparative evaluation

PAPER ID: CEST2023_00334

SESSION 34 ADVANCED OXIDATION PROCESSES

Saturday 2 September Morning

Can Peroxymonosulfate (PMS) be an alternative peroxide treatment for the mitigation of cyanobacteria harmful blooms (cyano-HABs)?

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ABSTRACT

Peroxymonosulfate (PMS), has already been utilized in the water treatment industry for the chemical oxidation and removal of xenobiotics because of its high efficiency and targeted oxidation. Although PMS has been used for treating cyanotoxins in DWTPs, there is limited information in the cited literature regarding its application on mitigating harmful cyanobacteria blooms in situ. Other peroxide compounds such as hydrogen peroxide (H2O2) have been extensively applied on cyanobacteria contaminated sites with varying efficiencies. However, high oxidant demand required for the complete remediation of contaminated sites can negatively affect non-targeted species (phytoplankton and zooplankton), imposing several limitations on H2O2 in-situ application. Herein, PMS was investigated, as an alternative peroxide compound for its algicidal properties on two Microcystis sp. and Aphanizomenon sp. and its toxicity on non-targeted zooplankton species (Echinogammarus veneris sp.). Surface water collected from Kouris Reservoir (Cyprus), was spiked with pure cultures and PMS doses of 1-5 mg/L (H2O2 equivalents) were added to monitor the destruction of cyanobacterial cells and identify the lethal concentration for both the cells and Gammarus species. The photosynthetic activity of cyanobacteria was monitored for up to 48 hours by capturing the instantaneous fluorescence and the quantum yield of the Photosystem II, while the zooplankton mortality was recorded at each time interval. PMS concentration was monitored through an in-house developed method (USPO patent application 2021). Treatment experiments showed that both species required as low as 3 mg/L PMS, while toxicity study on zooplankton showed that species are more sensitive to multiple than single PMS doses which is opposite to liquid H2O2. In general, single dosing of 5 mg/L PMS was sufficient to significantly reduce the photosynthetic activity of Microcystis and Aphanizomenon species, without affecting zooplankton wellness, proving that PMS in these concentrations can become a more targeted and environmentally friendly treatment alternative to liquid H2O2.

KEYWORDS: Peroxymonosufate, cyanobacteria, cyanotoxins, hydrogen peroxide

PAPER ID: cest2023_00292

Treatment of Leachate Wastewater with Fenton Process

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ABSTRACT

Leachate wastewater produced from landfill areas contains high organic contents and heavy metals. Because of high concentration of organic pollutants and heavy metals, it can cause toxic effects on the environment. Advanced oxidation processes can provide a suitable treatment for leachate wastewater due to hydroxyl radical formation. The most appropriate advanced oxidation process is Fenton Process to achieve high removal efficiency for the treatment of leachate wastewater.

The main objective of the study was to determine the most favorable levels of the parameters for the treatment of leachate wastewater. The effects of hydrogen peroxide, ferrous ion concentrations and reaction time on the oxidation of leachate wastewater investigated by using a statistical design. In the Box-Behnken statistical experiment design method, hydrogen peroxide, ferrous ion concentrations and reaction time were selected as independent variables. As the dependent variables, total organic carbon and color removal efficiencies were examined by keeping the pH constant.

As a result of the experimental studies, maximum total organic removal efficiency obtained as 50% at the optimum reaction conditions that H_2O_2 concentration was 40000 mg/L, ferrous ion concentration was 3000 mg/L, reaction time was 40 minutes. At these conditions, color removal efficiency also achieved as 84%.

KEYWORDS: landfill leachate, fenton process, box-behnken design

PAPER ID: cest2023_00326

Synergistic Effect In Hybrid Cavitation-Based Advanced Chemical Processes For Degradation Of Water Pollutants

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ABSTRACT

The present study concerns the oxidative degradation of water pollutants (namely BTEX, 1,4-dioxane, clofibric acid) using advanced chemical processes in combination with hydrodynamic cavitation (HC). The phenomenon of cavitation relies on the formation of gaseous cavities in liquid due to consistent pressure reduction with subsequent growth and eventual collapse of bubbles releasing a large magnitude of energy. The collapse of cavitational bubbles generates regions with extreme conditions (>5000 K, >1000 atm) – so-called "hot spots" sufficient for the rupture of organic structures and pyrolytic dissociation of water to yield $HO^•$, $H^•$, $HOO^•$ radicals (Gągol, 2018, Fedorov, 2022). Likewise, cavitation is capable to effectively activate oxidants and reductants to promote the generation of reactive radicals in advanced oxidation (AOPs) and advanced reduction processes (ARPs). In this study, BTEX, 1,4-dioxane and clofibric acid were treated in HC reactor equipped with Venturi tube at a cavitation number 0.27 in combination with persulfate (PS), percarbonate/ozone (SPC/O_3) and sulfite (SO_3^{2-}), respectively. The samples of BTEX and 1,4-dioxane were prepared by dispersive liquid-liquid microextraction and analyzed by GC-FID using internal standard method, while the concentration of clofibric acid was monitored in HPLC-UV-DAD. The degradation efficiency of BTEX exceeded 90% within 240 min, when HC was combined with PS, while $HC/SPC/O_3$ resulted in >99% of 1,4-dioxane degradation in 120 min (Fedorov, 2020, Fedorov, 2023). Furthermore, the addition of SO_3^{2-} in HC improved the degradation efficiency of clofibric acid by ~20% in 120 min. The increase of SO_3^{2-} concentration by 4.6 and 11.6 mM showed 35 and 43% of clofibric acid degradation, respectively. The hybrid HC/AOPs exhibited superior effectiveness compared to the cumulative effect of the individual processes, indicating a synergistic effect. The study of clofibric acid degradation over HC/SO_3^{2-} suggested the continuous investigation of the effect of operating parameters with the implementation of anaerobic conditions.

KEYWORDS: Cavitation, AOPs, ARPs, water treatment

ACKNOWLEDGMENTS

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Transformation Products Of Microcystin-RR With Reactive Species Produced By Radiolysis Of Water.

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ABSTRACT

Microcystins (MCs) are potent cyclic-peptide toxins produced by cyanobacteria during freshwater bloom episodes. They can severely impact drinking water supplies and recreational waters. More than 300 MCs are known today, which are toxic, mainly by inhibiting protein phosphatases. MC-RR is an important congener, as shown in several bloom episodes. There are still serious gaps of knowledge regarding the reaction pathways and transformation products of MCs with reactive species which have a role in advanced oxidation processes (AOPs) or in degradation processes in natural waters. In this study, we applied the principles of radiation chemistry of water to investigate the transformations of the less-studied MC-RR by a range of oxidizing (hydroxyl radical, superoxide ion, hydroperoxyl radical) and reducing (hydrogen atom, hydrated electron) species. We manipulated a steady-state radiation-chemical system using scavengers to investigate and quantify the effects of single species. We used high-resolution mass spectrometry combined with computational and visualization platforms to annotate MS features of transformation products and to compare the single-species reaction pathways. Our results contribute to risk assessment concerning the fate of MCs in water treatment processes and in the environment.

KEYWORDs: Microcystins, water radiolysis, reactive species, transformation products, LC-HRMS
PAPER ID: cest2023_00012

SESSION 35 SOIL AND GROUNDWATER CONTAMINATION AND REMEDIATION
Saturday 2 September Morning

Removal Of Heavy Metals From Real Mine Tailings Coupling Electrokinetic Soil Flushing And Bioleaching

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ABSTRACT

In the present work, polluted mine tailings from the abandoned Pb/Zn mine of *San Quintín* (Ciudad Real, Spain) have been treated by an innovative *in-situ* bioleaching process. Bioleaching uses the capacity of certain microorganisms of oxidizing iron and/or reduce sulphur which enhance the process of metal extraction due to the production of Fe^{3+} among other oxidizing agents. *In-situ* treatments, as electrokinetics (EK), allow the metal extraction and offer multiple advantages. EK use an electric field to mobilize species towards the soil thanks to the electromigration, electrophoresis and electroosmosis.

The aim of this work is to evaluate the coupling of bioleaching and EK for the removal of heavy metals from the mine tailings. An acid leching medium, produced externally by acidophilic autochthonous microorganisms, was used as the anolyte in the EK cell. Thanks to the EK transport phenomena, the oxidizing medium was transported to the cathode, leaching the heavy metals of the soil, while simultaneously the leached metals were removed through the cathode due to electromigration. Different voltages were studied (0.5, 1 and 1.5 V/cm), the best results were for 1.5 V/cm, and it was clearly observed the positive influence of using the bioleaching culture compared to a single EK reference test.

KEYWORDS: electrokinetics, heavy metal removal, bioleaching, mine tailings

ACKNOWLEDGMENTS

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PAPER ID: cest2023_00058

Chromium (VI) And Nickel Removal By Resin Supported Nanomagnetite: Column Experiments

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ABSTRACT

Magnetite is a mixed-valent iron oxide with magnetic properties, which is considered as an efficient adsorbent for the removal of Cr(VI) from the aquatic environment. However nanomagnetite possesses difficulties for in situ remediation applications due to clogging effects and high separation cost. For this reason a nanocomposite material consisting of nanomagnetite supported on a cation exchange resin, denoted as R-nFe_3O_4 was synthesized and was evaluated for chromates and nickel removal from contaminated waters under flow conditions. A column test was carried out using a glass column, with 1.80 cm internal diameter and ~7 cm length. The column was filled with 12.1 g of resin supported nanomagnetite. The efficiency of R-nFe_3O_4 was examined for mixed polluted streams with 1.25 mg L^{-1} concentration for both hexavalent chromium and nickel. The experiment was carried out using NaCl as background electrolyte and the pH of feed solution was around 3. The total amount of reduced Cr(VI) was equal to 10 mg, while the total amount of removed Ni was 20.2 mg. The adsorption of Cr(VI) was described by the Bohart–Adams kinetic model and the adsorption capacity per unit volume of sorbent bed was found equal to 690 mg/dm^3.

KEYWORDS*:* nanomagnetite, cationic resin, flow conditions, column tests, Cr(VI) removal.

PAPER ID: cest2023_00129

The Effects Of Plant Biostimulant And Mycorrhiza Applications On Industrial Hemp (*Cannabis Sativa* L.) Growth And Phytoremediation Performance

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ABSTRACT

Industrial hemp (*Cannabis sativa* L.) is a fast-growing lignocellulosic crop suitable for the phytoremediation of heavy metals, radionuclides, and organic contaminants on polluted marginal lands. The objective of this study was to evaluate the effects of plant biostimulant and mycorrhiza applications on the phytoremediation performance and growth of industrial hemp under greenhouse conditions. A 4-month pot experiment was performed in a Completely Randomized Design with six treatments (replicated three times): control (untreated), biostimulants B1 and B2 i.e., protein hydrolysates and fulvic/humic acids, respectively, mycorrhiza (M), and two biostimulant-mycorrhiza combinations, namely B1 × M, and B2 × M. Treatments affected plant height and number of leaves. Mycorrhiza application resulted in 30 and 37% higher fresh and dry aboveground biomass, respectively, compared to control plants. This treatment increased Cd accumulation; B1 and B2 × M increased Ni uptake (≥50%) when compared to the untreated plants. Significant were the effects of treatments on the accumulation of Pb, Zn, and Sb on plant shoots. Further research is required to evaluate more combinations of biostimulants, mycorrhiza and other natural environmentally friendly tools to optimize the use of industrial hemp and other multipurpose lignocellulosic crops for phytoremediation purposes.

KEYWORDS: phytoextraction; protein hydrolysates; humic acids; lignocellulosic crop; heavy metals

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Evaluation of phytotoxicity of landfill leachates after treatment with UV radiation based processes

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Abstract. The aim of the present work was to evaluate the phytotoxicity of treated landfill leachates. For the abatement of the organic load of the samples, homogeneous (UV/Fenton) and heterogeneous (UV/TiO_2) photocatalysis took place. The phytotoxicity tests were performed using *Sorghum saccharatum* seeds. Germination index (GI) was calculated and the treated leachates were evaluated for their suitability as a potential source for irrigation. Homogeneous photocatalysis showed an enhanced removal of COD and TOC, compared to the heterogeneous photocatalysis, and thus the seed germination was improved when UV/Fenton process was applied.

Keywords: landfill leachate, phytotoxicity, advanced oxidation process, UV radiation

Acknowledgements

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PAPER ID: cest2023_00513

Environmental Effects on the Fate and Co-Transport of Pesticides and Microplastics in Soils Irrigated with Wastewater

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ABSTRACT

In this paper we report results from a series of kinetics and isotherms experiments under different conditions (salinity, organic carbon, and temperature) that were conducted in order to determine the equilibrium time and the sorption response of typical biodegradable microplastics in comparison to non-degradable microplastics to three common pesticides present in wastewater. Moreover, we investigated the molecular mechanisms involved in this sorption via characterization using Fourier Transform Infrared Spectroscopy and Nuclear Magnetic Resonance. Finally, we also present results from soil column experiments designed to facilitate understanding the key and fundamental processes of MPs transport in saturated soil influenced by aging and sorption under various scenarios.

KEYWORDS: Microplastics, pesticides, sorption, groundwater, transport in soils

ACKNOWLEDGEMENTS

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Using CO_2- Induced Magnesium Carbonate As Environmental Friendly Additives For Petroleum Decontamination Sandy Soils

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ABSTRACT

Chemical pollutants, including petroleum contaminations causes soil pollution due to improper transportation, leakage, or storage. In choosing the appropriate method and materials, paying attention to environmental issues, availability and cost-effectiveness of the used method is particularly important. In the current research, the ability of various environmentally friendly materials as absorbents of petroleum pollutants and their effect on sandy soil has been studied. Mineral additives including zeolite and perlite as well as magnesium carbonate produced by carbon dioxide released from industries have been selected as absorbents of petroleum pollutants. In the first stage of the research, the amount of absorption of oil pollutants (i.e., diesel and kerosene) has been investigated by different additives. The results showed the high absorption capacity of all three additives as well as magnesium carbonate absorbed more than 90% by weight of diesel pollutant, which is the highest absorption percentage among the additives, and compared to the absorption percentage of soil (26.5%). In addition to the significant amount of absorption of oil pollutants, magnesium carbonate can be considered by researchers and engineers as an environmentally friendly adsorbent due to the use of carbon dioxide released from industries in its production process.

KEYWORDS: soil petroleum contamination, co_2 capture, magnesium carbonate

PAPER ID: cest2023_00361

Cultivation Of Milk Thistle In Pb-Contaminated Urban Soils

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ABSTRACT

In order to remediate heavy metal-contaminated soils of urban areas, we conducted an experiment using a pharmaceutical phytic species such as milk thistle (*Silybum marianum* (L.) Gearn.). The experiment was carried out using two different soil samples (one acid and one alkaline) from urban areas varying in their physicochemical attributes along with Pb levels. In every soil sample we applied three levels of contamination, 150, 300 and 450ppm Pb. Then, estimates of the available-DTPA extractable and pseudo-total concentrations of lead (Pb) were accomplished. Also, assessments of metal transport to different parts of milk thistle from the Pb-contaminated soils were conducted. The results of this experiment revealed that the highest concentration of Pb was found in underground part of the plant, also the Pb movement was higher in acid soil sample than in alkaline.

KEYWORDS: phytoremediation, potentially toxic elements (ptes), lead, silybum marianum

PAPER ID: cest2023_00392

Cultivation Of Fiber Crops For Sustainable Soil Remediation And Biobased Raw Material Production For Industrial Uses

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ABSTRACT

The contamination of agricultural soils with toxic metals is an escalating issue, posing hazards to both wildlife and human populations across vast land areas. The objective of the FORTE project is to address this issue by cultivating industrial hemp, flax and kenaf on contaminated mining and agricultural lands. This approach serves a dual purpose: (i) remediating the soil and (ii) generating biomass for industrial applications. The project aims to acquire practical knowledge regarding the cultivation of these crops in heavy metal and metalloid contaminated sites, thereby contributing to the development of phytoremediation technology using fiber crops in real field conditions. Additionally, it will foster the generation of innovative materials. An economic analysis, and environmental and social impact assessments will support the sustainability and the optimization of the value chain of produced bioproducts, namely particleboards and insulation panels, and will ensure the implementation of best practices and efficient operations throughout the life cycle of these evaluated products.

KEYWORDS: phytoremediation, soil pollution, uptake, fiber crops, bioproducts

PAPER ID: cest2023_00474

Novel Applications Of Molecular Biology To Aid In Environmental Bioremediation.

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ABSTRACT

Bioremediation of environmental heavy metal contamination presents a valuable tool for an effective and low-cost method of containing and minimizing the harm of heavy metal contaminations. However, many common bacteria used in this application such as *Acidothiobacillus ferroxidans do not have intrinsic rsistances to environmental heacvy metal. In this paper an attempt was made at using the traJ gene to trasnfer a plasmid containing antibiotic resistance and a mutated from of the rusticyanin protein as a test for future insertions of heavy metal resistance genes. While this was unsucessful important insights into the mechanistic requirements of conjugative gene trasnfer in A. Ferroxidans were identified.*

KEYWORDS: *A. Ferroxidans*, traJ, Rusticyanin, ABSTE, Iron

PAPER ID: cest2023_00215

A FIRST INSIGHT OF Hg OCCURRENCE IN THE HELLENIC VOLCANIC ARC

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ABSTRACT

Mercury is a highly toxic element with both natural and anthropogenic sources to the marine environment, with implications to ecosystems and human health. It is recognized as a priority pollutant by the European Environmental Legislation and the United Nations Environmental Program (UNEP). The complex geodynamic and geological setting of the Hellenic Volcanic Arc (HVA) in Greece, reflects in a great variety of geochemical compositions for many thermal fluid manifestations and leads to the necessity of studying them separately.The present paper is a preliminary presentation of Hg levels in aquatic samples from Methana peninsula, Kos and Nisyros islands and Yali islet. These study areas are affected by active fault zones which characterized as pathways of elevated heat flow. Samples were collected along the coastline, both from thermal springs and swallow-waters hydrothermal vents and analyzed for Total mercury (THg), trace metals (TM) nutrients, total alkalinity (At), Dissolved Oxygen (DO) and physicochemical parameters where measured in situ.The concentrations of THg were quite variable, ranging from 3.48 to 278.53 pM (mean 32.56 pM), while in Kos spotted the highest (278.53 pM) with no values exceeding the limit set by the WFD (70 ng /l or 349.02 pM). It appears to have a strong positive correlation with nutrients, DO, while strong negative one with pH and At. In the area of Nisyros – Yali the measured THg falls in between the other sites , while in Methana is the lowest levels with strong positive correlation with salinity, conductivity and pH and negative with DO and temperature. Strong positive correlation of THg was with Li, Al, Mn, Fe, As, Sr, Cd in every sample area.We hypothesize that underwater hydrothermal activity may constitute a considerable Hg source to the oceans, as fluids from thermal waters are often brackish to saline due to marine intrusion into the coastal aquifer. As a result, more research is required in these areas in order to determine the amount of Hg contribution to the oceans by the type of volcanism and tectonic activity, as well as the positive correlations between Hg and TM such as As, Cd, Mn and Fe.

KEYWORDS: *mercury (Hg) , Hellenic Volcanic Arc, thermal springs, hydrothermal fluid*

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SESSION 36 Emerging pollutants
Saturday 2 September Morning

Wide-Scope Target And Suspect Screening Of Antibiotics In Effluent Wastewater From Wastewater Treatment Plants In Europe

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ABSTRACT.

The occurrence of antibiotics in the environment could lead to the development of antibiotic resistance in bacteria, which could trigger a public health crisis. The occurrence of 676 antibiotics and main transformation products (TPs) was investigated in the effluents of 48 wastewater treatment plants (WWTPs) from 11 countries (Germany, Romania, Serbia, Croatia, Slovenia, Hungary, Slovakia, Czechia, Austria, Cyprus, and Greece) using target and suspect screening. Target screening involved the investigation of antibiotics with 40 reference standards. Suspect screening covered 676 antibiotics retrieved from the NORMAN Substance Database (antibiotic list on NORMAN network). Mass spectrometry fragmentation patterns and retention time index predictions of the studied antibiotics were established for their screening by liquid chromatography – high resolution mass spectrometry using NORMAN Digital Sample Freezing Platform (DSFP). In total, 47 antibiotics were detected in effluent wastewater samples: 32 detected by target screening and 15 additional ones detected by suspect screening. Ecotoxicological risk assessment was performed based on occurrence data and predicted no effect concentration (PNEC). The assessment involved the derivation of frequency of appearance (FoA), frequency of PNEC exceedance (FoE) and extent of PNEC exceedance (EoE). Risk characterization revealed 5 antibiotics of environmental concern (azithromycin, erythromycin, clarithromycin, ofloxacin and ciprofloxacin). The median of daily load of antibiotics to freshwater ecosystems by a WWTP was 0.59 g. The detection of antibiotics in wastewater effluents across countries indicates the widespread presence of antibiotics in the ecosystems of Europe, which may trigger unwanted responses including antibiotic resistance. This requires systematic monitoring and establishment of emission limits in the regulatory context.

KEYWORDS: Antibiotics, wide-scope target screening, wide-scope suspect screening, ecotoxicological risk assessment, antibiotic resistance.

PAPER ID: cest2023_00074

Decreased Soil Water Content Effects on the Toxicity of Triclosan to Oilseed Rape (Brassica napus L.)

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ABSTRACT.

Due to the rising amounts of antimicrobial agents in the environment and the lack of knowledge on their ecotoxicity, there is growing concern regarding their effects on the environment. One of the most widely used antibacterial compounds in both personal care and pharmaceutical products is triclosan (TCS), which is also a commonly detected emerging organic contaminant in the environment. Physiological or morphological endpoints of whole-organism analysis are typically used in reported studies of TCS toxicity to terrestrial plants. To identify underlying toxicity mechanisms, more in-depth investigations of TCS-induced effects at the biochemical plant level are required. Furthermore, climate change is an issue that is becoming more and more serious and might have a significant impact on life on the Earth. The influence of climate parameters on the ecotoxicity of antimicrobials, particularly TCS, is little understood. The main objective of this study was to evaluate drought effect on triclosan toxicity to oilseed rape (*Brassica napus* L.). Brassica napus were grown in TCS-contaminated soil (10-400 mg kg^{-1}) under different soil water contents (5% and 30% SWC). *B.napus* morphological (dry weight, length of the roots and shoots), biochemical indicators (the activity of enzymes), and the damage of oxidative stress (lipid peroxidation) were detected. Drought enhanced the negative effect of triclosan on the above-ground part of *B. napus* and led to oxidative stress.

KEYWORDS: Triclosan, Climate change, Brassica napus

PAPER ID: cest2023_00076

Antineoplastic Drugs In Surface Waters:Presence, Exposure, And Risk.

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ABSTRACT

Antineoplastic drugs are highly toxic pharmaceuticals used during chemotherapy. Their presence in surface waters has been reported worldwide, increasing environmental and human health concerns. This work estimates the risks from the exposure of humans to antineoplastic drugs via surface waters in a worldwide perspective. Three different scenarios were considered: (i) dermal contact with surface waters, (ii) accidental ingestion of surface waters and (iii) drinking potable water captured from rivers, assuming no further degradation. All but tamoxifen, for which an extraordinarily high average dermal absorbed dose (AD_{abs}) was found, the AD_{abs} were always lower than the average daily potential dose (ADD), whether ingested inadvertently or voluntarily (potable water produced from contaminated surface water). To determine whether there would be any risk for humans from their exposure to antineoplastic drugs, the AD_{abs} and ADD were contrasted with the Permitted Daily dose (PDE). The third exposure scenario revealed these compounds' presence in worldwide surface waters could represent a risk to children, if the highest concentration reported worldwide for cyclophosphamide in surface waters is considered. Even for the remaining antineoplastic drugs/exposure settings, health hazards might arise from synergistic effects and/or prolonged exposures.

KEYWORDS: surface waters, cytotoxics, cytostatic drugs, risk assessment, human exposure.

PAPER ID: CEST2023_00083

Growth And Biochemical Responses Of Earthworms (*Dendrobaena Veneta*) Exposed To Tetracycline

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ABSTRACT

Veterinary antibiotics have received growing attention in recent years as emerging terrestrial contaminants. Livestock, animal manure and slurry land application are the main routes for veterinary antibiotics to enter the soil environment. Widespread use and distribution of tetracyclines poses a serious risk to soil dwelling organisms. Being soil keystone species, earthworms perform a number of essential functions in the soil and occupy important position in the terrestrial food chain. However antibiotic effects on earthworms are still poorly understood. Earthworms *Dendrobaena veneta* were exposed to tetracycline for 56 days. Mortality, body weight, and biochemical responses including the activity of antioxidant enzymes (catalase, superoxide dismutase, gluthathione-S-transferase) and oxidative damage (lipid peroxidation) were investigated. Tetracycline did not induce acute lethal toxicity to *D. veneta*, though impaired weight growth, antioxidant enzymes system and induced oxidative stress.

KEYWORDS: antioxidant system, earthworms, mortality, growth, tetracycline

PAPER ID: cest2023_00080

Feature-Based Molecular Networking And *In Silico* Structure Annotation/Classification Of Lc-Hrms Data Unfold The Chemodiversity Of Cyanobacteria In Environmental Samples.

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ABSTRACT

Freshwater cyanobacteria are prominent sources of structurally diverse natural compounds. Bioactive cyanometabolites are particularly relevant to water quality and public health protection. Non-targeted analysis (NTA) by liquid chromatography - high resolution mass spectrometry (LC-HRMS) is applied to expand the range of detected and identified metabolites. However, data analysis is challenging and subjected to limitations arising from the availability of experimental or library-based mass spectra. We present an HRMS data analysis workflow using state-of-the-art computational tools that we have applied to analyze samples from cyanobacteria blooms in Greek lakes. Pre-processing of data was carried out in MZmine3 (feature detection, deconvolution, alignment, deisotoping, gap filling). Processed data were exported in GNPS for feature-based molecular networking - FBMN and annotations based on public GNPS libraries. In parallel, feature lists were processed in SIRIUS and its associated tools, for de novo molecular formula annotation, database search, prediction of compound classes using molecular fingerprints, and ranking of candidates using fragmentation trees. Results were visualized and further explored in Cytoscape, to enable annotation propagation. Such workflows substantially expand the chemical space of annotated cyanometabolites at structural and compound-class levels, and the discovery of new compounds which are not included in libraries.

KEYWORDS: Cyanobacteria metabolites, MZmine3, GNPS, SIRIUS, LC-HRMS

ACKNOWLEDGEMENTS

We warmly thank the developers of GNPS, MZmine3, SIRIUS, Cytoscape (refs. 6-14) for maintaining these open platforms and tools for the benefit of the community.

We are grateful to Prof. Ryszard Lobinski, Prof. Joanna Szpunar and Dr. Simon Godin of IPREM-CNRS, Univ. of Pau, for providing us access to the LC-HRMS system used in this study.

PAPER ID: cest2023_00128

Lateral And Vertical Variations Of Pharmaceutical Contaminants In Natural Aquatic Systems

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ABSTRACT

The detection of pharmaceuticals and personal care products (PPCPs) in environmental matrices raised concerns over their short- and long-term effects on the ecosystem. Wastewater is the primary carrier of PPCPs to the environment in highly urbanized regions. In the Philippines, Manila Bay serves as a drainage basin for most of the streams of surrounding urban cities, hence, a cumulative drainage basin for effluents transported downstream. Water samples from the surface and the bottom layers of Pasig River mouth and Manila Bay were collected for PPCP analysis. Pharmaceuticals and pharmaceutical-related compounds, such as carbamazepine, clarithromycin, diclofenac, anhydroerythromycin, acetylsulfamethoxazole, trimethoprim were detected, as well as possible untreated wastewater tracers like caffeine and acetaminophen. Total concentrations were higher in Pasig River compared to Manila Bay due to the dilution of river water entering a bigger water body. Vertical variations in PPCP concentrations in Pasig River are not significant. In contrast, the top layer of Manila Bay is more contaminated compared to the bottom potentially due to stratification. Differences in PPCP profiles show how variable contaminants depend on external factors. The presence of PPCPs in natural systems highlights the need for more stringent and targeted wastewater management.

KEYWORDS: emerging contaminants, antibiotics, ppcps, surface waters, coastal waters

ACKNOWLEDGEMENT

The authors would like to acknowledge funding from the National Science Foundation (PIRE-HEARD, Award no. 1545756). Help by Kristine Salanap, Ronald Lloren, and Chris Carl Toyado in the field are also acknowledged.

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Functionalized Covalent Organic Framework For Separation And Enrichment Of Perfluorinated Compounds In Environmental Waters

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ABSTRACT

In this work, a novel ionic COFs (Fe_3O_4@EB-ICOFs) was obtained through hydrothermal method. The material exhibited large surface area, ionic property, magnetic responsiveness. It can be used as magnetic solid phase extraction (MSPE) adsorbent. Combined with MSPE-HPLC-MS, a method for the determination of perfluorinated compounds in environmental water was developed. The method has several advantages, such as excellent linearity and repeatability, low limits of detection, et al. The possible adsorption mechanisms has also been discussed.

KEYWORDS: Perfluorinated compounds, Environmental water, Magnetic solid-phase extraction, ICOFs

PAPER ID: cest2023_0360

Determination Of Trace Bisphenols Through Magnetic Solid-Phase Extraction With Mof-Cof Composite

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ABSTRACT

A novel magnetic composites (Fe_3O_4@TAPB-COF@ZIF-8) was designed and synthesized. It was characterized by Fourier Transform Infrared spectra (FT-IR), Energy dispersive X-ray spectroscopy (EDS), etc. The material can be used as magnetic solid phase extraction (MSPE) adsorbent to capture bisphenols. With the help of HPLC, a green and effective method to quantify bisphenols in food samples was established. It can be applied to the analysis of actual samples. Additionally, the possible adsorption mechanisms has been discussed.

KEYWORDS: Magnetic solid-phase extraction, Bisphenols, High-performance liquid chromatography, composites

PAPER ID: CEST2023_00364

SESSION38- ENVIRONMENTAL MANAGEMENT AND POLICIES

SATURDAY 2 SEPTEMBER -MORNING

Exploring The Development Of Effective Measures In Order To Reduce Key Pressures Under Descriptor 8 Of The Marine Strategy Framework Directive

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ABSTRACT

According to the MSFD, EU Member States had to identify the measures to achieve or maintain good environmental status in their marine waters and update them accordingly. The present work explores the development of effective measures aimed at the reduction of key pressures under Descriptor 8 Contaminants. Programmes of Measures (PoMs) established by Greece in 2017 for the implementation of the MSFD are analysed to identify the prevention measures needed to reduce the likelihood of exceeding the degree of perturbation of ecosystem components resulting from pressures generated by human activities and demands for ecosystem services. Moreover, the mitigation or recovery measures aiming to reduce the likelihood and magnitude of not achieving or maintaining GES will be identified. Adapted to environmental management, the Bow-tie analysis integrates the assessment of environmental risk (risk management standard IEC/ISO 31010) with an assessment of the prevention and mitigation measures needed to reduce the uncertainties of achieving environmental objectives, i.e., Good Environmental Status. Management coordination measures, monitoring measures, economic incentives, awareness and stakeholder involvement are needed to ensure the effectiveness of measures implemented and of PoMs as a whole. Existing legislation and related policies are analysed and the consistency between EU/national legislation is evaluated.

KEYWORDS: EU Policy, MSFD, PoMs, Bow Tie.

PAPER ID: CEST2023_00051

Assessing Wind Farms Projects With The Use Of Multicriteria Methods And Stakeholders Analysis

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ABSTRACT

The use of wind potential and the protection of biodiversity are two conflicting aspects that arise in the development of wind energy projects, generating conflicts between different stakeholders. The aim of this study is to develop a methodology for assessing the suitability of existing wind farms in mountainous areas with the combined use of Analytical Hierarchy Process (AHP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method and Stakeholders Analysis. The application is carried out in the Regional Unit of Ioannina. Twelve assessment criteria have been considered in the analysis and fourteen selected stakeholders have participated in their pairwise comparisons. Four different alternative scenarios are formulated based on the power/interest matrix of stakeholder mapping. The prioritization of the existing wind farms is finally carried out with the use of TOPSIS method for each alternative scenario. The results showed that, for two scenarios the ideal wind farm is located in Variko, while for the other two, the ideal wind farm is located in Katara. The proposed methodology is able to promote spatial energy planning, emphasize the key components of the decision problem, and award participating decisions through a multi-stakeholder traceable and transparent assessment procedure.

KEYWORDS: ***AHP, Participated decision-making process, TOPSIS, stakeholders mapping, wind farms***

PAPER ID: cest2023_00350

15-Minute Cities: A Literature Overview Exploring International Planning Strategies

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ABSTRACT

The 15-minutes city (15mC) concept is a contemporary trend in urban planning which aims to improve the quality of life within the urban areas. The basic underlying idea is that all citizens have equal access to their daily needs within a short walk or bike ride from their houses. The main component that differs the 15mC from other neighborhood-centered approaches is proximity; that is, the proposition of relocating activities and services to the neighborhood level, hence localizing city life. The 15mC is included in international textbooks as a tool for cities to withstand the climate change. This paper provides an overview of the 15mC concept by reviewing the planning strategies of cities worldwide that have adopted this city vision to increase the well-being and the sustainable development. Methodologically, the study focuses on four case cities and their strategy on becoming 15mC. The analysis focus on understanding how the 15mC can adjust to different urban environments, depending on their needs. Finally, the paper presents the basic attributes of the case-studies and the overall positive impacts resulting from the 15mC concept.

KEYWORDS: 15-min city, x-minute city, proximity, land use planning

PAPER ID: cest2023_00391

Assessing The Implications Of IMO 2020 On Tanker Vessels' Chartering And Employability Prospects With A Focus On The Installation Of Sox Scrubbers

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ABSTRACT

As from January 1, 2020 the limits, which were coined as IMO 2020, of sulphur in fuel oil used on board vessels operating outside emission control areas was reduced from 3.50% m/m (mass by mass) to 0.50% m/m. Those limits are set out in Annex VI of the International convention for the Prevention of Pollution from Ships (MARPOL) is an attempt by International Maritime Organization (IMO) to reduce sulphur oxide produced by ships. To be noted that in the designated emission control areas (the Baltic Sea are, the North Sea are, the North American are, and the United States Caribbean Sea area) the maximum sulphur limit is 0.10%. One of the ways of complying with the IMO 2020 limits is by installing an exhaust gas cleaning system (scrubber) – others being switching from high-sulphur fuel oil (HSFO) to marine gas oil (MGO) or distillates; using very low sulphur fuel oil (VLSFO) or compliant fuel blends; use of sulphur free fuels. The installation of a scrubber ensures use of HSFO without breaching the IMO 2020 limits. Considering the importance and necessity of complying with IMO's regulations, this paper will assess the implications of IMO 2020 on tanker vessels' chartering, by way of the charter party provisions ensuring compliance, as well as the implication on their employability prospects. Particular emphasis will be put on the installation of scrubbers and the emergence of two-tier (or multitier) chartering market for tanker vessels. Aim of this paper is to provide a concise, yet comprehensive, view on the topic.

KEYWORDS: IMO 2020, Tankers, Scrubbers, Multitier chartering market

PAPER ID: cest2023_00040

Contemporary Assessment Of International Maritime Organization's Carbon Intensity Indicator Requirement On Tanker Vessels' Chartering And Employability Prospects

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ABSTRACT:

Carbon Intensity Indicator (CII) is one of the measures adopted by International Maritime Organization (IMO) in June 2021 during the 76th session of the Marine Environment Protection Committee (MEPC) for the reduction of carbon intensity of international shipping, taking effect from January 1, 2023. The CII consists an operational rating system that measures the efficiency of a vessel in grams of CO2 by cargo carrying capacity in nautical miles (g CO2/t-nm). Starting with the pertinent data for 2019 as reference and with a reduction of 1% per annum from 2020 to 2022 and thereafter of 2% per annum from 2023 to 2026, each vessel's CII shall be calculated each year and a rating ranging from A to E will be assigned to the vessel. If a vessel gets a rating of D or E corrective actions will need to be implemented. Considering that the CII rating is affected by factors (such as, for example, the distance sailed, the fuel used, time in port, whether the vessel is loaded or ballast) that depend on operational and/or commercial considerations of the parties involved, vessels' chartering will be affected by way of the provisions in the charter party regarding the need to abide by the CII requirements as well as by any implications on vessel's employability prospects due to vessel's attained CII rating. Aim of this paper is to provide a concise, yet comprehensive, assessment on the topic and offer suggestions for further analysis.

KEYWORDS: CII, Chartering, Tankers

PAPER ID: cest2023_00039

Enabling Sustainability And Resilience In Industries Through The Value Chains' Circularity And Digitalisation

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ABSTRACT

Living for the last decades in a linear world has emerged the necessity for resources reduction, reuse, and recycling, leaving behind the "take-make-waste" economic model and jumping over towards a cyclical ecologic system. Especially for the industrial environments, the efficient management of resources, the need for prevention and the circular designing and planning, have shown the path towards alternative approaches, new technologies and services, and cutting-edge solutions. Digitalisation technologies (Digital Twins, big data analysis, etc.), secondary raw materials, circular supply chains, integrated sustainability frameworks and standards, Digital Product Passports, are some of the solutions, services and tools that assemble to facilitate a green and digital transition, considering the circular economy aspects, and targeting to resiliency and sustainability. Under this scope, three industries focus on transforming their supply chains into circular, green and sustainable ones using advanced traceability approaches. The ordinary supply chains of a citrus juice company in Greece, the processes of managing Waste Electrical and Electronic Equipment (WEEE) for magnets and Carbon Fiber Reinforced Polymer (CFRP) for drones, are assessed using the Sustainability Balanced Scorecard, to empower the business opportunities, to enhance traceability and lead to sustained value chains.

KEYWORDS: industrial value chains, sustainability, resiliency, circularity, digitalisation

ACKNOWLEDGEMENTS

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PAPER ID: cest2023_00568

The Development and Implementation of an Environmental Coastal Observatory focused on semi-enclosed Gulfs

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ABSTRACT.

The structure of a Coastal Observatory for the North Aegean Sea is described in this work. The Observatory AEGIS is focused on the semi-enclosed Gulfs of the islands of Lemnos and Lesvos, with emphasis on the Kalloni Gulf. The Observatory includes both an observing and a forecasting component, and incorporates a three-stage forecasting system composed of three numerical domains, one extending throughout the North and Central Aegean Sea, the second covering the sea around Lesvos island, and the third composed of very high-resolution models of the three Gulfs, of Gera and Kalloni in Lesvos and Moudros in Lemnos island. The observational component includes a meteorological / oceanographic mooring deployed in the middle of the Kalloni Gulf and sea-level gauges at the Kalloni and Gera Gulfs, while submarine telephone cables extending across the Straits of the above Gulfs permit the measurement of net exchanges with the open sea. The above observations enable the validation of the forecasts of the Gulf-level models, while the North-Central Aegean (large-domain) forecasts employ data assimilation to achieve high forecasting skills. The implementation of biochemical models will enable to assess the impact of anthropogenic interventions in these very sensitive areas.

Keywords: semi-enclosed, North Aegean, Coastal Observatory

ACKNOWLEDGEMENTS

The development and implementation of the AEGIS Coastal Environment Observatory has been supported by the projects “Infrastructure Development to support Blue Growth in the North Aegean: Coastal Environment Observatory (AEGIS)” (MIS 5021550) funded by the Operational Programme «North Aegean 2014-2020», and “Coastal Environment Observatory and Risk Management in Island Regions AEGIS+” (MIS 5047038), implemented within the Operational Programme “Competitiveness, Enterpreneurship and Innovation” (NSRF 2014-2020), co-financed by the Hellenic Government (Ministry of Development and Investments) and the European Union\

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SESSION 39- ADVANCED OXIDATION PROCESSES SATURDAY 2 SEPTEMBER -MORNING

Applicability Of Sulfate Radical Based Advanced Oxidation Processes For Drinking Water Treatment

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ABSTRACT

Natural Organic Matter (NOM) is a complex mixture of organic compounds that are naturally present in water sources. NOM itself is not toxic, but its presence can have negative impacts on the quality of drinking water. It is important to remove NOM from drinking water sources through various treatment processes, such as coagulation, sedimentation and filtration, in order to ensure that the water is safe and aesthetically pleasing for consumption. “Advanced Oxidation Processes” is one of the promising treatment technology to remove NOM in drinking water sources. The aim of this study is to examine the effects of sulfate radical ($SO_4^{\bullet-}$) based photochemical oxidation process (persulfate/UV-C) on the efficiency of organic carbon removal from drinking water sources. In the present study the effect of the initial oxidant concentration on the total organic carbon (TOC) removal efficiency, residual oxidant concentration, alteration of pH and UV_{254} were examined. Moreover, particle size distribution (PSD) analysis was applied to determine treatment efficiency of each particle size during oxidation process. All experiments were conducted in raw water that originated from a drinking water treatment plant located in İstanbul. According to the experimental studies, it was observed that organic carbon was effectively removed (55%) during the reaction time of 60 minutes by using PS/UV-C at an initial oxidant concentration of 1.0 mM. According to PSD analysis, all particles are smaller than 450 nm and approximately 60% of them were removed by using PS/UV-C process. In experimental studies, decreasing of pH (from 8.3 to 6.5) and UV_{254} (from 0.097 to 0.013) shows that degradation of TOC. In conclusion, sulphate radical-based photochemical advanced oxidation processes can effectively provide degradation of organic carbon in natural waters.

KEYWORDS: Advanced oxidation processes, drinking water treatment, organic carbon degradation, persulfate, UV-C light.

PAPER ID: cest2023_00188

Photocatalytic Nanofiltration Reactor For Agricultural Wastewater Purification And Reuse

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ABSTRACT

The agrofood industry utilizes a large amount of pesticides for improving the agricultural production. Nevertheless, the presence of pesticide residues in agro-wastewater can cause adverse impact on water reservoirs and have harmful effects on human health. Conventional wastewater treatment methods are inefficient to confront pesticides, therefore intensive actions are required for their elimination. Herein, a novel pilot-scale photocatalytic nanofiltration reactor (PNFR) was designed and fabricated for the demands of agricultural wastewater purification and reuse, relying on a previous engineering study of a patented photocatalytic membrane reactor concept. The PNFR pilot unit consists of multi-channeled photocatalytic nanofiltration monoliths, prepared via a wash-coating technique. Additionally, the rector hosts a high number of polyvinylidene fluoride porous hollow fibers stabilized with TiO_2 photocatalyst nanoparticles. The active surface of the photocatalytically reactor effectively irradiated by an elegant illumination system is capable to produce up to 1.2 m^3/day clean water. The experimental evaluation was performed involving various concentrations (6-55 ppb) of the frequently detected Acetamiprid (ACT) and Thiabendazole (TBZ) pesticides in fruit-industry wastewater, in different feed flow rates and transmembrane pressures. In about 2 h, 95% of the wastewater was recovered, while the amount of ACT and TBZ was reduced by 25 and 42%, respectively.

KEYWORDS: Pesticides; Titania; PNFR; Agricultural wastewater treatment

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Pilot Scale Investigation Of An Advanced Photo-Electro-Chemical Oxidation Process For Treatment Of Effluents From Pesticides Manufacturing Plants

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ABSTRACT

This paper reports on the effectiveness of an innovative hybrid advanced oxidation process-scheme aiming to degrade recalcitrant organic compounds in industrial effluents for further sustainable final treatment. Following bench-scale experimental work, a pilot unit was developed combining two advanced oxidation processes, based on in-situ production of powerful hydroxyl radicals (·oh); i.e., *electrochemical anodic oxidation (ao)* employing boron-doped diamond (bdd) electrodes and *photochemical oxidation via h_2o_2 photolysis under uv-c irradiation (h_2o_2/uv-c).* The pilot-unit was operated, in a pesticides manufacturing plant, treating colored effluents characterized by high, recalcitrant organic load. The effect was examined of key process parameters, including current density, h_2o_2 concentration, recirculation flow rate and processing time, on system performance, mainly regarding organic-matter mineralization and discoloration rate. For the aforementioned effluent organic load, applying a near-optimal set of process-parameter values (i.e. 40 ma/cm^2 current density, 0.6 w/l uv-c dose, 'on-line' dosing of approx. 1140 mg·l^{-1}·h^{-1} h_2o_2 and 8.4 l/min recirculation flow rate), toc and color removal reached 71% and 93%, respectively. The effectiveness of the combined ao/h_2o_2/uv-c process, mainly due to high utilization of injected h_2o_2 (approx. 80-90%), is judged as very satisfactory, considering that the treated effluents meet the standards for safe disposal to local biological effluent-treatment plants.

KEYWORDS: industrial wastewater treatment, recalcitrant organic pollutants, hybrid advanced oxidation processes, anodic oxidation, uvc/h_2o_2

ACKNOWLEDGEMENTS

This work has received financial support through the project: ceresis – contaminated land remediation through energy crops for soil improvement to liquid biofuel strategies, funded from the european union's horizon 2020 research and innovation programme under grant agreement (project no. 101006717).

PAPER ID: CEST2023_00322

Synthesis Of Iron And Nitrogen Co-Doped Biochar For The Activation Of Peroxymonosulfate To Degrade Sulfamethoxazole

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ABSTRACT

In this study, iron and nitrogen co-doped biochar (Fe-N-BC) was synthesized by a facile pyrolysis process of mixed walnut shell, melamine, and iron(III) chloride, and then the biochar (BC), nitrogen-doped biochar (N-BC), and iron-doped biochar (Fe-BC) also were prepared as a control. The Fe-N-BC demonstrated an excellent degradation performance (0.5 min^{-1}) for sulfamethoxazole (SMX) in the presence of peroxymonosulfate (PMS) compared with BC (0.026 min^{-1}), N-BC (0.038 min^{-1}), and Fe-BC (0.33 min^{-1}). Ultra-high performance liquid chromatography in conjunction with high-resolution mass spectrometry (UHPLC-QTOF-MS) was also used to identify the transformation products of SMX during the degradation process, and the predicted toxicity results from Toxicity Estimation Software Tool (T.E.S.T) exhibited that the overall toxicity of the degradation products lower than SMX.

KEYWORDS: iron and nitrogen co-doped biochar; peroxymonosulfate; mechanisms; toxicity.

PAPER ID: CEST2023_00352

The Activation Of Peroxymonosulfate By Phosphate For The Abatement Of Micropollutants: The Significant Contributions From Reactive Phosphate Species

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ABSTRACT:

In the SO4•−-based advanced oxidation processes (SR-AOPs), peroxymonosulfate (PMS) was widely explored due to its susceptibility to activation. Phosphate, a prevalent ion in wastewater, is the most commonly used buffer solution to mimic the neutral pH, which was also found to accelerate the degradation of micropollutants (MPs) in PMS-based systems. Thus, the mechanisms of forming reactive species to degrade MPs through the activation of PMS by phosphate were worth investigating. Specifically, the reactions between different forms of phosphate and PMS were studied by the density functional theory. In the phosphate/PMS system at pH = 8, the steady-state concentrations of reactive phosphate species (RPS, namely H2PO4•, HPO4•−, and PO4•2−), •OH, and SO4•− were kinetically modeled. The contributions of 1O2, •OH, SO4•−, and RPS to the degradation of selected MPs by were compared, and RPS selectively attacked MPs with electron-donating moieties (such as phenolic groups). Additionally, the degradation pathways of bisphenol A, diclofenac, ibuprofen, and atrazine in phosphate/PMS were proposed according to the detected transformation products. The cytotoxicity of treated MPs by phosphate/PMS was measured via CCK-8 assay in HepG2 cells to assess the possible environmental implications. For the phosphate/PMS process, the significant influence of Cl− on the degradation of MPs was evaluated, and the special reaction between Cl− and PMS and the role of reactive chlorine species were investigated. Finally, real phosphate-rich wastewater was utilized as a matrix with additions of bisphenol A and PMS to assess the applicability of the phosphate/PMS system in phosphate-rich scenarios.

KEYWORDS: Peroxymonosulfate, Sulfate radicals, Reactive phosphate species, Micropollutants, Wastewater treatment

PAPER ID: cest2023_00317

Applicability of Advanced Oxidation Processes for Treatment and Recovery of Washing Machine Effluent

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ABSTRACT

In this study, it was successfully shown that Advanced Oxidation Processes (AOPs) are a feasible method to treat laundry wastewater originating from washing machines. Wastewater characterization from different stages of wastewater discharge was analysed and advanced oxidation processes including O_3, H_2O_2, O_3/H_2O_2, O_3/UV-C, H_2O_2/UV-C, and O_3/H_2O_2/UV-C were applied to determine the most efficient AOP, by analysing chemical oxygen demand and methylene blue active substances content of treated laundry wastewaters. It was shown that H_2O_2/UV method yielded the best chemical oxygen demand and methylene blue active substances reduction rates among other methods. Optimization studies also revealed that under optimum conditions with filtration, chemical oxygen demand and methylene blue active substances content of wastewater discharge during the last rinsing stage of the washing cycle can be reduced by 95% and 98%, respectively. Results also demonstrated that treatment by advanced oxidation processes greatly reduced the rate of microorganism growth AOP-treated wastewater comparing to raw wastewater. To have a more sustainable washing process, the total water consumption of the washing machine can be reduced by recycling the treated laundry wastewater using the advanced oxidation processes.

KEYWORDS: Advanced Oxidation Processes, laundry wastewater, washing machine, hydrogen peroxide, recycle

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This study was conducted within the framework of university-industry collaboration and experimental studies are done in R&D laboratories of Arçelik R&D Directorate at Çayırova Campus

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Photocatalytic Treatment of Hospital Secondary Wastewater in a Pilot Scale for the Removal of Residual Pharmaceuticals

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ABSTRACT
The present study deals with the application of heterogeneous photocatalysis in pilot compound parabolic solar (CPC) reactor for the advanced treatment of hospital secondary wastewater effluent treatment using TiO_2 and g-C_3N_4 catalysts. Degradation followed first order kinetics with the corresponding rates ranging from 0.018 and 0.013 LkJ^{-1} for citalopram and O-des-Venlafaxine to 0.039 and 0.044 LkJ^{-1} for venlafaxine and amisulpride, respectively. The treatment was followed also by EEM-fluorescence as well as toxicity (Microtox) and risk assessment.
KEYWORDS: tio_2, g-c_3n_4, pharmaceuticals, photocatalysis

ACKNOWLEDGMENTS: This research is co-financed by Greece and the European Union (European Social Fund- ESF) through the Operational Programme «Human Resources Development, Education and Lifelong Learning 2014-2020» in the context of the project, "Chemistry and Technologies for Pollution Control and Environmental Protection-CTePCEP", MIS: 83218

PAPER ID: cest2023_00464

Synthesis Of $Lacu_xni_{1-X}O_3$ Perovskite Materials For Application As Heterogeneous Photocatalysts And/Or Catalysts For Persulfate Activation

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ABSTRACT

In today's era, the ever-growing human population and extensive industrialization lead to increased needs for clean and/or potable water, as well as for recycled wastewater. However, several studies report that a multitude of "emerging contaminants" (ECs) are detected at trace concentrations (a few μg L^{-1} to ng L^{-1}) not only in treated wastewater but also in environmental water matrices. Therefore, it becomes evident that the processes applied in conventional wastewater treatment plants (WWTPs) do not remove such compounds at sufficient levels, leading to their introduction and accumulation in the aquatic environment through the effluents. As a result, the development and application of new eco-friendly methods, which will be able to remove/degrade various dangerous pollutants is of great priority. Advanced oxidation processes (AOPs) are techniques capable of successfully degrading a plethora of ECs through the *in-situ* production of reactive species ($HO^{\bullet}$, $O_2^{\bullet-}$, $^1O_2$ etc.), even leading to their mineralization. Of the many AOPs which have been developed, those that focus on the formation of sulfate radicals (SR-AOPs) through the activation of oxidative compounds (persulfate or peroxymonosulfate ions) [1] are of particular interest. Specifically, the produced $SO_4^{\bullet-}$ have some advantages over the more common $HO^{\bullet}$, such as higher half-life period and ability to form in a wider pH range [2]. While many works have focused on the production of $SO_4^{\bullet-}$ via homogeneous catalysis using transition metal ions (e.g., Fe^{2+}, Co^{2+}, Ni^{2+} etc.), the viability/applicability of such methods is highly questionable as they lead to secondary pollution due to the presence of the aforementioned heavy metals in the aquatic matrices from which their removal is difficult [3]. The present study focuses on the development of a sequence of $LaCu_XN_{1-X}O_3$ (X = 0, 0.25, 0.75, 1) perovskite materials, and their application in heterogeneous catalytic and photocatalytic processes. The materials were synthesized by a previously reported sol-gel method using an anionic surfactant as template [4]. Their morphological and physicochemical properties were investigated thoroughly using various characterization techniques (SEM, EDS, FT-IR, DLS etc.). Also, their bandgap was determined via DRS using the Kϋbelka-Munk function. The photocatalytic and catalytic performance of $LaCu_XN_{1-X}O_3$ perovskites towards persulfate activation was evaluated using phenol/phenolics (10 mg L^{-1}) as model pollutant in lab-scale experiments. Finally, the combined photocatalytic/catalytic potential of $LaCu_XN_{1-X}O_3$ perovskites was studied through photocatalytic experiments in the presence of persulfates. The results showed superior degradation capabilities as in some cases, complete removal of phenolics (10 mg L^{-1}) was achieved in less than 20 minutes. In each applied process, it was observed that substitution of Cu with Ni leads to increased (photo)catalytic activity of the perovskite material. In conclusion, this study provides insight into the potential applications of ABO_3 perovskites in the field of AOPs. However, more studies need to be carried out in order to evaluate their stability, reusability and overall environmental impact.

KEYWORDS: AOPs, ABO_3 perovskites, persulfate activation, photocatalysis, phenolics degradation

PAPER ID: cest2023_00465

The potential of an emerging technology of UV/sodium percarbonate for water and wastewater treatment

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ABSTRACT

Sodium percarbonate (SPC) can be a reagent alternative to the well-known oxidant of hydrogen (H2O2) peroxide regarding the special properties of SPC, such as shock inertia, low price, and long storage time. Substituting liquid H2O2 with SPC under the irradiation of UV (UV/SPC) is an emerging technology in water and wastewater treatment, of which treatment kinetics, degradation mechanisms, and potential biological impacts remain unclear. In this study, UV/SPC was applied to remove bisphenol A (BPA) from aqueous solutions. The reaction physiochemistry and mechanisms were investigated, the primary reactive species and transformation products were identified, and the biological responses to system effluent were evaluated with in-vivo assays on Escherichia coli (E. coli). Comparison was conducted between UV/SPC process and UV/H2O2 process to assess the application feasibility of UV/SPC in practice. Results show that the removal efficiency of BPA in both systems was similar. Hydroxyl radical (1.82 x 10^-14 M) and carbonate radical anion (2.3 x 10^-12 M) were two primary reactive species in the UV/SPC. The 2nd order rate constant of carbonate radical anion oxidation of BPA was determined to be 2.23 x 10^8 M-1 s-1. BPA transformation products from the treatment of UV/H2O2, UV/SPC, and UV/SPC/t-BuOH were detected to elucidate the reaction pathways. Toxicity results indicate that the effluent of UV/H2O2 display more inhibition on the cell growth, cell division, and cell healing of E. coli. This study contributes to the knowledge pool of the photochemistry of UV/SPC for BPA degradation, generates valuable toxicologic data for risk evaluation of UV/SPC, and demonstrates the promising prospect of UV/SPC in water and wastewater treatment.**KEYWORDS:** biomass, hotels, circular economy

KEYWORDS: advanced oxidation processes, UV/percarbonate, carbonate radical anion, kinetics and mechanism, toxicity

PAPER ID: cest2023_00348

SESSION 40- ENVIRONMENTAL HEALTH
SATURDAY 2 SEPTEMBER -MORNING

A Smart Integrated Platform For Leakage Detection On Water Supply Network In Aigio Town

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ABSTRACT

Non-revenue water (NRW) is the volume of water participating in urban water supply processes that does not generate revenues for the water utility company, and it is divided into water losses and unbilled consumption. In the era of sustainable water resources management, the reduction of NRW is among the main objectives of both national and regional management plans; especially to cope with the losses. In this frame, the Municipal Enterprise for Water Management of Aigialeia (DEYA.A) and the Research Laboratory of Smart Technologies, Renewable Energy Sources & Quality (UNIWA) collaborate in the project entitled "Smart system for Leak Detection for water supply Network of Aigio" with the purpose of controlling water leakage, which now reaches around 48% of the total water supply in the study area. This paper describes the main objective of the project, which is the development of a smart system for leakage detection in the internal network of Aigio City. Particularly, the system's components as well as the implementation scheme of the project are presented, and overall analysis serves the municipality's new water saving strageties that may lead to an estimated amount of 600000 m^3 of water saving per year.

KEYWORDS: Non-revenue water, water supply network, water leakage, water supply monitoring, Aigio

ACKNOWLEDGMENTS: The research project entitled "Smart system for Leak Detection for water supply Network of Aigio" is co-funded by the Program "Water management" of EEA Grants 2014-2021, with the contribution of Iceland, Liechtenstein and Norway, and the Greek Public Investments Program. Authors would like to thank the Municipal Enterprise for Water and Wastewater of Aigio for the provision of available data regarding water consumption

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A Height-Diameter Model For Urban Tree Species Management In The City Of Drama, Northern Greece

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ABSTRACT

Urban greening consist an integral element of the environment in modern cities, providing a series of significant benefits for the local citizens. The physical attributes of the urban trees are closely related to the ecosystem services provisioning levels and the total height (*h*) is one of the most important dimensions along with the diameter at breast height or stem diameter (*dbh*), the crown length (*cl*), the height to live crown (*hlc*) and the crown width (*cw*) at tree level. Using a large dataset of *n*=2357 well-documented urban trees clustered in 44 different species in Drama City, Northern Greece, a single-level linear mixed-effects (*lme*) model was developed for the prediction of the total height using species as a grouping factor. The analysis clearly showed that the proposed model explained more than 75% of the total tree height variation using a power-type function to stabilize the error's unequal variance. The proposed approach is an innovative method compared to the generalized least-squares models (*gls*), leading to new perspectives as far as urban green modeling is concerned.

KEYWORDS: Tree allometry, linear mixed-effects models, urban green management, ecosystem services, street trees.

ACKNOWLEDGEMENTS

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Development And Application Of A LC-HRMS Method For The İdentification And Quantification Of Cecs Concern İn Urine

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ABSTRACT

Chemicals are everywhere in our daily lives, and we encounter them through various pathways. Human biomonitoring (HBM) is commonly used to understand our exposure to these chemicals. Traditionally, HBM focused on a limited number of chemicals analyzed with specific instruments. However, recent advancements in high-resolution mass spectrometry (HRMS) have allowed for a more comprehensive analysis of the chemical exposome. This study aimed to validate a methodology using HRMS to accurately profile exogenous chemicals and their metabolites in urine samples. Five extraction protocols covering different chemical classes were evaluated for their effectiveness in terms of extraction recoveries, linearity, sensitivity, and reproducibility. The best protocol was then validated (e.g., recoveries generally in between 60-120%, or lower matrix effect) and applied to analyze over 2,000 chemicals in 10 real human urine samples. Using the HRMS approach, 36 chemicals (e.g., plastic additives, UV-filters or pharmaceuticals) were identified and semi-quantified, demonstrating the effectiveness of the methodology. Interestingly, the laborious deconjugation step was deemed unnecessary as HRMS yielded comparable results without it, while also successfully identifying other metabolites.

KEYWORDS: Human biomonitoring (HBM), Non-target, Method validation, Deconjugation, Glucuronidation.

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The Chemical Exposome In Brain Cancer: An Exploratory Study

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ABSTRACT

Diffuse gliomas are a highly heterogeneous and aggressive brain tumours with poor prognosis and survival and few established risk factors. Environmental exposures are suspected in the pathogenesis of these tumours; however, results of existing studies are limited and inconsistent, particularly for exogenous organic chemicals, with no available characterization of the chemical exposome of these tumours. Also, better understanding of phenotypic differences in tumour types is needed in order to improve clinical decision making and provision of personalised treatment recommendations. In this proof-of-concept study we analysed 33 glioblastoma samples (Bellvitge Glioma Cohort (BGC), Spain, 2005-present), including 16 methylated and 17 non-methylated tumours combining HRMS-based wide-scope target and suspect strategies. Forty-six exogenous chemicals were identified in the tumour tissue samples (31 confirmed with standard) including a variety of industrial chemicals (e.g. plastic additives or perfluorinated compounds), personal care products and pharmaceuticals. Our findings provide novel evidence on the presence of these chemicals in brain tissue, highlighting the need for comprehensive evaluations of their potential effects in the tumour pathogenesis. Finally, after applying metabolomics methods we observed clear differences in the profiles of endogenous chemicals among the studied glioma subtypes, and identified possible biomarkers. These chemicals have potential to be determined in a non-invasive manner, either by LCHRMS-based blood analysis or using complementary techniques (proton magnetic resonance (1H-MRS)). These are inspiring results since methylation is a strong independent predictor of survival as well as tumour response to chemotherapy for glioblastoma. Indeed, its non-invasive and pre-surgical determination would have a major impact on patient management. Our preliminary data is suggestive for the potential of nontargeted exposome methods to find new valuable biomarkers for diffuse gliomas diagnostic and prognostic stratification.

KEYWORDS: Glioma, Environmental exposure, High resolution mass spectrometry (HRMS), organic chemicals, non-target analysis.

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The Chemical Exposome In Maternal Blood And Placenta And The Potential Use Of Sewage Sludge To Prioritize Hazardous Substances

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ABSTRACT

Chemicals are part of our daily lives and we are exposed to numerous chemicals through multiple pathways. Relevant scientific evidence contributing to the regulation of hazardous chemicals require a holistic approach to assess simultaneous exposure to multiple compounds. Currently, the main way to obtain data on the exposure to organic chemicals is through human biomonitoring, that requires very complex and costly sampling campaigns. Finding efficient proxies to predict the risk of chemical exposure in humans is an urgent need to cover large areas and populations at a reasonable cost. We conducted a study to characterize the human chemical exposome in maternal blood and placenta samples of a population-based birth cohort in Barcelona (2018-2021, n>300). Ultimate HRMS-based approaches were applied including wide-scope target, suspect (for >2300 and >10000 chemicals, respectively) and non-target screening. More than sixty chemicals were identified including pesticides, personal care products or industrial compounds, among others, in the range of ng/mL and ng/g. In parallel, sewage sludge from the wastewater treatment plants serving the residence areas of the studied population were also screened, showing correlations with the type and concentrations of chemicals found in humans. Our findings were suggestive for the potential use of sewage sludge as a proxy of the human exposure and its application in early-warning systems to prevent chemical threats.

KEYWORDS: Sewage epidemiology, Placenta, Blood.

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Computational Fluid Dynamics (CFD) Analysis Assisted by Portable Sensing Devices for Precise Assessment of Indoor Environmental Conditions

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ABSTRACT

Indoor air quality has become an emergent issue for human health since burdened outdoor environments, stagnant air conditions and indoor human activities (cooking, cleaning, etc.) increase the pollutant concentration. Some of the pollutants that interest the most for indoor environments are PM2.5, CO_2, CO, VOCs, and NO_2. These are measured by a wearable sensor- kit that is constructed by Applied electronics lab (APEL). Various working scenarios are set, such as human presence/absence and doing some indoor activities to measure the pollutants concentration in each case. Three kits are used and two of them are placed in the enclosed space and one close to the human body (wearable-kit). Most of the time it is noticed higher pollutant concentrations in enclosed space than those measured in atmospheric air by other local sensors. Along with the experiments, the enclosed space is computationally reconstructed and simulated for Computational Fluid Dynamic (CFD) analysis. The momentum, mass transport phenomena were coupled and solved using Ansys CFX software. The same cases were tested and compared with the experimental measurements. Conclusions such as the poor quality of indoor space under various flow conditions and at specific hours during the day have been noticed, as well as the assessment of human exposure have been performed to improve the indoor environment.

KEYWORDS: indoor air quality, sensor wearable kit, CFD analysis, human exposure

ACKNOLEDGEMENT

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Antibiotic Susceptibility of *Erwinia amylovora* Isolates from Fire Blight Diseased Pomaceous Fruit Trees in Georgia

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ABSTRACT

Fire blight, caused by the bacterial pathogen, *Erwinia amylovora* is a devastating disease of fruit trees belonging to the *Rosaceae* family. The most susceptible species are apple, pear and quince. The economic loss caused by bacterial blight of fruit trees is manifested both in crop loss and rapid destruction of entire orchards. It is difficult to control fire blight as the *E. amylovora* has significant survival capacity. The goal is to study the antibiotic susceptibility of the *E. amylovora* Georgian isolates. Dozens of the pathogen isolates were obtained and identified from the fire blight diseased apple, pear and quince trees in eastern Georgia. Susceptibility of these isolates towards eight antibiotics: streptomycin, penicillin, tobramycin, erythromycin, kanamycin, ofloxacin, trimethoprim and tetracycline by disc-diffusion method have been studied. The majority of *E. amylovora* isolates from different regions of eastern Georgia are sensitive to tobramycin, kanamycin, ofloxacin, tetracycline and streptomycin, with the exception of isolates ## 6052, 6053 8892, which express some resistance to streptomycin. The absolute majority of the *Erwinia amylovora* isolates are resistant to penicillin and trimethoprim, while the susceptibility to erythromycin is variable.

KEYWORDS: Fire blight, *Erwinia amylovora*, antibiotic susceptibility

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Coaggregating *Delftia Acidovorans* Facilitates The Metabolic Activity Of Partner Bacteria In Drinking Water Biofilms

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ABSTRACT

Although bacterial coaggregation has already been identified as a key mechanism in the multispecies biofilms development in diverse environments, little is known about this highly specific type of cell-cell interaction in aquatic systems. In this study, a strain of *Delftia acidovorans* isolated from drinking water (DW) and previously described with coaggregation ability, was studied for its role in biofilm development. Single and dual-species biofilms, of *D. acidovorans* and the DW representative bacteria *Citrobacter freundii* and *Pseudomonas putida*, were grown in 96-well microtiter plates and characterized in terms of metabolic activity. In addition, to prove that *D. acidovorans* can facilitate the metabolic activity of other bacteria, single biofilms were formed in the presence of *D. acidovorans* cell-free supernatant (CFS). The metabolic activity was higher when comparing single with dual-species biofilms. Furthermore, in the presence of CFS, it was evident an increase in the metabolic activity of *C. freundii* and *P. putida* biofilms. These results suggest the production of extracellular metabolites by *D. acidovorans*, that possibly act as public goods. That said, the presence of coaggregating species, namely *D. acidovorans*, in biofilms appears to create a functional cooperative microbial community, providing a favorable metabolic opportunity for partner bacteria.

KEYWORDS: Bacterial fitness; Cell-cell interaction; Coaggregation; Public goods.

Funding

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End-phase Rehabilitation Assessment of Boracay Island Using Microbial Parameters as Indicator of Water Quality

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ABSTRACT

The tourism-dependent Boracay island continued to accommodate tourists reaching a peak of >2 million in 2017 after nearly breaching through the island's ecological threshold in 2012. Anthropogenic pressures resulting in poor water quality and disturbance of wetlands forced the authorities to close the island and undergo rehabilitation from April 2018 to December 2019. Inland and offshore water quality were assessed during the final phase of rehabilitation, although the sewerage system at this time was not yet completed. Microbial parameters from water samples collected offshore, nearshore, and inland were analyzed for total coliform (TC), *Escherichia coli* and *Enterococcus spp.* using the IDEXX™ Colilert-18™ and Enterolert™ systems. The end-of-pipe drainage at the Dead Forest Drainage (DFD) yielded the highest concentration in microbial parameters recorded at >100,000 MPN/100 mL. Microbial loads were higher in the lagoons, wetlands, and the well used for drinking. In most inland sites, the permissible microbial concentrations were exceeded based on the Philippines' Department of Environment and Natural Resources Administrative Order 2021-19. Despite the distance from the shore, TC, *E. coli* and *Enterococcus spp.* were detected even 3 km offshore with values ranging from 20 to 56,775 MPN/100mL, 20 to 11,199 MPN/100mL and 10 to 892 MPN/100mL respectively.

KEYWORDS: coliforms, wastewater, water quality, carrying capacity, anthropogenic disturbance

ACKNOWLEDGEMENTS

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SESSION 41- Emerging pollutants
Saturday 2 September -morning

Assessing The Effect Of An Innovative Radio Frequency Sludge Pretreatment On Removal Of Pharmaceuticals Of Ibuprofen And Diclofenac In Advanced Anaerobic Digestion

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ABSTRACT

The detection and reduction of emerging contaminants in wastewater sludge have become a global priority for the protection of the environment and human health. Despite being the most widely utilized sludge stabilization option, anaerobic digestion (AD) has limited effectiveness against many pharmaceutical products, including ibuprofen (IBP) and diclofenac (DCF). These emerging contaminants are known as endocrine disrupting compounds. This study, for the first time, investigated the effect of an innovative and energy-efficient radio frequency (RF) sludge pretreatment system, operated at a frequency of 13.56 MHz, on the fate of IBP and DCF during advanced AD. Biochemical methane potential (BMP) assays, operated under thermophilic and mesophilic conditions, were used to assess the AD performance of thickened waste activated sludge (TWAS) spiked with target compounds (IBP and DCF) with and without RF pretreatment. A new analytical method was developed for quantifying target analytes in TWAS and BMP content samples by an ultra-high-performance liquid chromatography/triple quadrupole mass spectrometer. Results indicated that none of the control BMP assays utilizing un-pretreated TWAS, regardless of incubation operating temperature applied, were able to remove IBP from BMP content sludge samples. However, IBP was reduced effectively in BMPs utilizing RF-pretreated TWAS with an average removal efficiency of 14 ± 2% under thermophilic conditions. These BMP assays achieved 26% additional improvement in IBP destruction compared to its respective control. Similarly, RF pretreatment coupled with AD moderately impacted DCF removal. Average DCF removals of 15 ± 4% and 9 ± 5% were accomplished from thermophilic and mesophilic pretreated BMPs, respectively. These pretreated BMPs attained up to 17% higher DCF reduction in digested sludge over their respective controls.

KEYWORDS: emerging contaminants, ibuprofen, diclofenac, anaerobic digestion, radio frequency sludge pretreatment.

ACKNOWLEDGEMENTS

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Effects Of Parabens Exposure On Drinking Water Bacteria

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ABSTRACT

Parabens are considered emerging contaminants that are frequently detected in water sources. Besides being detected in drinking water (dw) at residual concentrations, their effects on dw microbial quality and safety have been disregarded so far. This work assesses for the first time the impact of methylparaben (mp), propylparaben (pp), and butylparaben (bp) on selected bacteria isolated from dw: *acinetobacter calcoaceticus* and *stenotrophomonas maltophilia*. Although the minimum inhibitory concentrations (mics) values obtained were found to be much higher (200 - 400 mg/l) than concentrations of parabens found in the environment, parabens induce bacterial membrane modifications at environmental concentrations (15 µg/l). Overall, parabens caused an increase in the total surface hydrophilicity of both bacteria, being this effect more pronounced for mp and bp on *s. Maltophilia*. Dual-species biofilms grown on polypropylene (ppl) and high-density polyethylene (hdpe) and exposed to mp (15 µg/l) were found to be more metabolically active (198% and 98%, respectively) than non-exposed biofilms. Even though, mp (15 µg/l) was able to reduce the cell growth rate of *a. Calcoaceticus* from dual-species biofilms. The overall results show that parabens induce modifications in bacterial community characteristics and behaviour, which may compromise the safety of dw.

KEYWORDS: drinking water, parabens, bacterial community, biofilms

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Assessing The Performance Of An Integrated Column System Containing Zero Valent Iron Nanoparticles And Sodium Persulfate Solution For The Removal Of Emerging Contaminants From Different Wastewater Matrices – Identification Of Transformation Products

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ABSTRACT

The occurrence of micropollutants in the aquatic environment has raised the scientific concern because of their continuous discharge, their bioaccumulation and their potential adverse toxicological impacts on both aquatic organisms and human health. The present study has been focused in the assessment of the performance of an integrated column system in terms of the removal efficiency of selected micropollutants as a post-treatment step for different effluent matrices: an anaerobic membrane bioreactor (AnMBR), an upflow anaerobic sludge blanket reactor (UASB) followed by microfiltration, a sand filter after treatment of a septic tank followed by a saturated vertical wetland and a conventional tertiary treatment system. The system consists of a nanocomposite material, which is called R-nFe and includes zero-valent iron nanoparticles (nZVI) hosted into a strongly acidic cation exchange resin, and a sodium persulfate solution (PS) at a concentration of 1 mM, while the influent pH is acidic and the contact time 2.2 min. In addition, the transformation products of diclofenac and bisphenol A are being investigated. To the authors' best knowledge, this is the first time that the synergistic action of nZVI with PS is evaluated for the removal of micropollutants under continuous real wastewater flow with different matrix characteristics.

KEYWORDS: micropollutants, nano zero valent iron, sodium persulfate, post-treatment, transformation products

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Potential Contaminants And Risk Assessment In The Meriç-Ergene Basin Under The EU Water Framework Directive

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ABSTRACT

The European Union's Water Framework Directive (WFD) 2000/60/EC provides a strategic solution to deal with chemical pollution in rivers. The directive encompasses monitoring and detection of priority pollutants and specific contaminants found in surface waters. An increase in the number of compounds to be monitored may pose a challenge. Hence, it is crucial to prioritize pollutants that require immediate action in the short, medium, and long term based on capacity reports submitted by relevant industries in high-pollution basins. As a consequence of this, prioritizing studies in basins has gained significance in terms of the process of planning the monitoring of chemicals that call for immediate action and lowering the expenses associated with monitoring. According to prioritized strategies, a number of studies for the Meriç-Ergene basin were conducted. Based on the findings of the study, it is recommended to monitor a total of 81 contaminants in the Meriç-Ergene basin in Türkiye.

KEYWORDS: pollutants, river basin, water framework directive

PAPER ID: cest2023_00324

Fate Of Nitrofurans: Photochemistry, Transformation Products And Toxicity Evaluation In Surface Water Systems

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ABSTRACT

Nitrofurans (NFs) consist a group of broad-spectrum antibiotic compounds provided as a basic dietary supplement in livestock husbandry as swine farms, beekeeping and aquaculture. Among nitrofurans furaltadone (FTD) is an antibiotic with a protective effect against bacterial and protozoan infections. Its application has been restricted in EU since 1993 followed by other NFs, as it exhibited toxicological effects in human. However, NFs are still supplied in many developing countries to date, because of high effectiveness and low cost. In this research, the photolytic behavior of NFs in aquatic environment as well as the photochemical transformation products were investigated using a solid phase extraction method coupled with UHPLC- LTQ/Orbitrap HRMS analysis. This study was conducted in distilled, lake, river and sea water under natural and artificial solar irradiation. The determined half-life times demonstrated that this process is the main degradation path of NFs in natural aquatic systems, compared to hydrolysis which presented negligible impact. Furthermore, the mechanism of NFs photodegradation in aqueous environment was exploited based on MS-MS data, indicating that hydrolysis, cleavage of carbon-nitrogen bond, and denitration etc are the dominant photochemical reactions. In addition, acute toxicity evaluation of NFs and photoproducts was performed, using Vibrio Fischeri as tested species. Finally, this study has as ultimate aim the investigation of the fate and impact of NFs and their transformation products, so in surface waters as in the related living organisms.

KEYWORDS: furaltadone, nitrofurans, photolysis, degradation, LC-LTQ/Orbitrap MS, toxicity

PAPER ID: cest2023_00340

Cometabolic Removal Of Ibuprofen, Diclofenac And Ciprofloxacin Driven By Glycerol Fermentation In An Acidogenic Biofilm Reactor

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ABSTRACT

The presence of pharmaceuticals in wastewater has increasingly become a public health issue globally due to the potential impacts it can cause on the environment and public health. In this study, we sought to analyze the cometabolic effect of glycerol fermentation on the removal of ibuprofen (IBU), diclofenac (DCF), and ciprofloxacin (CIP). The results indicated a positive effect of the glycerol addition on the removal of these compounds: without GOH – 65%, 35%, and 25%; with GOH – 91%, 48%, and 45%, respectively for IBU, DCF and CIP. A significant increase in the production of volatile fatty acids, especially propionate and valerate, was observed during the glycerol fermentation, which may have favored the prevalence of fermentative bacteria, as well as the production of specific microbial enzymes active in the biotransformation of the microcontaminants. Glycerol proved to be a good alternative supplementation in wastewater treatment systems to optimize the pharmaceutical compounds removal, in addition to the fact that it is a by-product of the biodiesel production with high availability on the market in many parts of the world.

KEYWORDS: antibiotic, anti-inflammatory drugs, emerging pollutants, pharmaceutical compounds, volatile fatty acids.

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Determination Of The Effect Of Environmentally Relevant Ph Values On The Toxicity, Uptake & Biotransformation Of Propranolol In Zebrafish Embryos By LC-HRMS

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ABSTRACT

The release of emerging contaminants (such as pharmaceuticals) into aquatic ecosystems has become an issue of concern among scientists. Most of them as well as their transformation products (TPs) are frequently detected in the aquatic environment mainly due to insufficient removal by wastewater treatment plants (WWTPs) and may bioaccumulate in aquatic organisms causing adverse effects.

Most pharmaceuticals belong to the group of ionizable organic compounds (IOCs), and their mode of action depends on the pH values of the surrounding exposure medium. IOCs are substances that can exist in an aqueous phase in both the ionic and/or neutral form. Neutral species permeate more easily through membranes, so the neutral form of a substance increases uptake and bioaccumulation and thereby toxicity. The ratio of neutral or ionic form is determined by pH value. Although slight variations in the pH can cause considerable changes in the uptake and the toxicity, until now, the pH-effect has not been rigorously considered in risk assessment.

Propranolol (PRO) is an IOC, while it is the most common nonselective lipophilic β-blocker. Propranolol is a weak base and is utilized for cardiovascular disease treatments. Propranolol has been detected widely in effluents of WWTPs (due to inefficient removal), in rivers in low concentrations, and in aquatic organisms. Different aquatic organisms are reported to respond to the concentrations of propranolol in the range of ng L-1, such as daphnids, marine mussels, and zebrafish.

Zebrafish (Danio rerio) embryo (ZFE) has been considered a well-characterized experimental model organism in the fields of molecular genetics and developmental biology. It is also a very promising model organism for toxicokinetic experiments since it poses similar biotransformation systems to mammals.

The objectives of this study were to study the toxicity of the β-blocker Propranolol in zebrafish embryos, and to assess the potential pH-effect on the acute toxicity, uptake, and bioaccumulation of PRO. In addition, the identification of biotransformation products (bio-TPs) of PRO in ZFE was a major objective. Finally, we aimed to examine if biotransformation data could be used in a complementary way to the internal concentration (C_{int}) of the parent compound, for a holistic interpretation of toxicity at different pH values.

For this purpose, the fish embryo toxicity test (FET) with ZFE was conducted according to the OECD 236 Guideline at three different pH values, and the LC_{50} values of PRO were determined. For the extraction of PRO in ZFE samples, organic solvents were added, and a bead-beating homogenization process using the Cryolis Evolution homogenizer (Bertin Technologies, France) was followed. The ZFE extracts were analyzed by RPLC and HILIC in both positive and negative ionization modes using LC-HRMS. A target-screening approach was followed for the identification of PRO, whereas identification of tentative bio-TPs was performed through in-house developed suspect and non-target screening workflows.

Through this study, the toxicity of PRO was investigated. The internal concentrations (C_{int}) in ZFE were determined and the potential bioaccumulation of PRO was evaluated by determining the bioconcentration factors (BCFs). Moreover, different biotransformation products (bio-TPs) were detected in the ZFE extracts. The biotransformation of PRO by zebrafish embryos, as well as the contribution of bio-TPs to the concentration of the parent compound was extensively studied. Finally, a potential biotransformation pathway of PRO in zebrafish embryos was proposed.

KEYWORDS: Propranolol, toxicity, pH-values, zebrafish embryos, internal concentration, bioconcentration, biotransformation, LC-HRMS

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Novel polymer-based MALDI matrices: exploring their potential for low molecular weight compound detection, utilizing MALDI-HRMS analytical platforms.

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ABSTRACT

Upon its development (Karas et al., 1985), Matrix-Assisted Laser Desorption Ionization (MALDI) mass spectrometry (MS) has long been leveraged by researchers for the detection of larger biologically relevant molecules, such as, proteins, glycans and peptides (van Kampen et al., 2011, Shariatgorji et al., 2012). Analysis of small molecules such as metabolites with MALDI, however, particularly in the case of imaging, is lately of increasing importance for various applications, such as biological and clinical research. This is mostly owning to the fact that imaging of a tissue sample can provide insightful information on the spatial distribution and abundance of biological relevant molecules, involved in the biology of diseases, and lead to the discovery of new biomarkers (Vaysse et al., 2017, Chungtai and Heeren, 2010, Giampà et al., 2016).One of the most crucial parameters, affecting the MS signal, and hence the MALDI analysis, is the matrix type choice (Giampà et al., 2016, Horatz et al, 2021). The matrix usually crystallizes with the sample's analytes, absorbs the laser energy, thus causing the desorption and then ionization of the analytes (Shariatgorji et al., 2012). Classic matrices commonly employed in MALDI techniques are generally small organic molecules (SOMs) that exhibit prerequisite characteristics for MALDI analysis, e.g., strong laser irradiation absorption (Horatz et al., 2021). Some examples are α-Cyano-4-hydroxycinnamic acid (α-CHCA), 2,5-Dihydroxybenzoic acid (2,5 – DHB), 9-Aminoacridine (9AA), Sinapinic acid (SA) etc. Classic MALDI matrices have been previously successfully utilized in low molecular weight compound (LMWC) imaging techniques of various classes, such as lipids (Fu et al., 2019), metabolites (Bhandari et al., 2015) and others. One of the biggest drawbacks of employing SOMs as matrices, however, is the hindrance and complication of analyte detection in the lower mass ranges. This is mostly attributed to the fact that the small organic compounds can desorb and be ionized, thus providing large interfering matrix-related background signals (fragments, clusters etc.) at the m/z mass range of the analytes of interest (Horatz et al, 2021, Horatz et al., 2018, Smirnov et al., 2004), thus interfering with their detection. For this reason, MALDI analysis of small molecules has, for a long time, been considered problematic or even non-feasible.One of the strategies developed to overcome the aforementioned problem, is the exploitation of matrices that exhibit a higher molecular weight than the range of interest. Such compounds for example are porphyrins and conjugated polymers (Qiao and Lissel, 2021). Hitherto, a handful of polymeric matrices have been applied to LMWC MALDI analysis, providing promising results (Horatz et al, 2018, Horatz et al., 2019). More specifically K. Horatz et al., successfully applied poly{[N,N'-bis(2-octyldodecyl)-naphthalene-1,4,5,8-bis- (dicarboximide)-2,6-diyl]-alt-5,5'(2,2'-bithiophene)} (PNDI(T2)), poly(3-dodecylthiophene-2,5-diyl) (P3DDT), poly{[2,3-bis(3-octyloxyphenyl)quinoxaline-5,8-diyl]-alt-(thiophene-2,5-diyl)} (PTQ1), and poly{[N,N'-bis(2-octyldodecyl)-isoindigo-5,5'-diyl]-alt-5,5'(2,2'-bithiophe -ne)} (PII(T2)), for the detection of standard LMWC analytes. All matrices were found to be MALDI silent, as well as rare dual-mode matrices, providing results comparable to those obtained by employing classic MALDI matrices. Additionally, P3DDT was also successfully used as an imaging matrix for rat tissue morphology visualization (Horatz et al., 2018). Accordingly, K. Horatz et al. efficiently employed newly synthesized amorphous polymers for the detection of LMWC such as reserpine and coumaphos. The acquired results of the study demonstrated the good performance of these copolymers as matrices and their potential as dual-mode, MALDI silent matrices. The measured intensities of LMWCs with these co-polymers as matrices also proved to be equal or higher when compared to those of the semicrystalline polymers tested (Horatz et al., 2019). The above-mentioned results highlight the appealing and promising potential of polymer exploitation as matrices in MALDI-MS workflows. However, the application of polymer-based matrices remains not fully explored yet.

Hence, the aim of this study was to: 1) further investigate the potential of various polymers for efficient LMWC (e.g. pharmaceuticals) ionization and detection, 2) directly compare the acquired results with those obtained from classic matrices applications (e.g., 2,5-DHB, α-CHCA) and finally, 3) develop high resolution mass spectrometric (MALDI-HRMS) analytical protocols and workflows for small molecule analysis. For this purpose, newly synthesized and characterized polymer-based MALDI matrices were developed. These matrices were designed to effectively absorb the laser wavelength of interest and demonstrate other desired physicochemical properties. The ionization potential of these matrices on various LMW analytes was tested on a ground steel MPS 384 plate, on a timstof flex (Bruker, Germany) instrument. Different sample preparation protocols and instrumental parameters were tested in order to choose the conditions that yield the optimum results. The results showcase the potential of polymeric matrix applications for future detection of LMWCs, as well as bottlenecks that might need to be taken into consideration in MALDI-HRMS workflows.

KEYWORDS: LWMCs, MALDI-HRMS, polymer-based matrices, small molecule analysis

PAPER ID: cest2023_00520

SESSION 43- Agroforestry, Forest and Agricultural Sustainability
Friday 1 September -Afternoon

Tolerance Mechanisms And Adaptive Strategies Of *Moringa Oleifera* (L) During Germination And Precocity Seedling Growth Under Hydroponics Water Stress

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ABSTRACT

In order to highlight the potential tolerance and/or resistance of *Moringa oleifera* (L), to drought during two weeks of germination *in vitro*. Osmotic water stress was induced under semi-controlled conditions. The plantlets water potential (Ψ_H) was reduced by adding the polyethylene glycol (PEG-6000) solution. Four water potentials were measured: 0 (control), -2; -4 and -6 MPa. Results showed different forms of such variations in a range of physiological traits were explored: A slight decrease in the germination speed, accompanied by an increase in the latency time, as the Ψ_H decreases. However, compared to controls, significant reductions ($p<0.05$) of 27.8% and 77.5%, respectively were recorded for growth of radicles and epicotyls of young *M. oleifera* seedlings after two weeks. Similarly, compared to controls high accumulation of compatible solutes such proline and proteins was observed with an increase rates estimated to 55%, and over 100%. In addition, by comparing cationic ions profiles of control seeds to the treated ones, we registered that the latter have the possibility of more cations accumulating such as K^+, Ca^{2+} and Mg^{2+} which would have roles of osmoregulation. Moreover, *M. oleifera* (L) had the capacity to maintain or even improve its oxidative status by increasing total polyphenols activities, total antioxidant capacity, catalase and ascorbate peroxidase.

***KEYWORDS: in vitro* germination, growth, osmoregulatory and antioxidant activity**

PAPER ID: cest2023_00315

Solar Parks Effect On Soil Properties: Initial Results

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Abstract:

Solar power generation in Greece has only been increasing since the 1980s to become the main source of renewable energy. Today, around 4.1 million m^2 of Greek land is covered by solar parks. This article starts with a literature review on how the photovoltaic panels impact their environment and on the different existing management solutions. The panels modify at some extent their environment, creating a new microclimate potentially favoring new species (Armstrong et al., 2016). To increase land use value, some solar parks are part of an agrivoltaic system, being grazed or associated with crops (Kumpanalaisatit et al., 2022). Others can be managed into a haven for pollinators (Blaydes et al., 2021). The second part of this article is about research led on three Greek solar sites from different areas, more or less recent, grazed or not. The research focuses on identifying the soil properties under and outside of the panels' zone. In some sites, differences in pH and humidity between these two parts of the park have been identified, soil being more humid and acidic under the panels.

KEYWORDS: MULTIPLE LAND USE, SOIL PH, ORGANIC MATTER, GRAZİNG

Acknowledgment

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PAPER ID: CEST2023_00316

Assessment of sustainability of extensive livestock farming in Central Greece (Evrytania prefecture) using S.W.O.T Analysis

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ABSTRACT

Animal husbandry, both in Greece and worldwide, is under constant threat, being at the center of multiple crises: wars, droughts, pandemics, successive economic crises. The increase in the prices of livestock inputs, especially after 2020, has tested and highlighted the strengths of the various livestock systems, bringing to the fore the need to make political decisions and choices, in the direction of the production of sufficient and quality products and also for the benefit of the producers and the development of the regional economy. For this purpose, we utilize the S.W.O.T analysis (Strengths, Weakness, Opportunities, Threats) focusing on the prefecture of Evrytania in Central Greece.

KEYWORDS: livestock, extensive farming, swot analysis

PAPER ID: cest2023_00335

Preliminary results of climate effect on phenology of honeydew producing insects of fir trees and the production of fir honey in Evritania - Greece

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ABSTRACT.

In a 3-year program (2019-2021) the production of fir honey in the prefecture of Evritania, the most mountainous prefecture of Greece, was studied. The production of fir honey is influenced by the condition of the tree, the phenology of the honeydew producing insect, the beekeeper's management of bee colonies, while the main regulator is the weather conditions. The weather conditions of each year affect not only honey production, but also the well-being of bee colonies and the survival of honeydew producing insects. Our effort is to correlate the biological cycle of the insect, its honeydew secretion, and the development of beehives with climatic factors, to isolate the most critical of them in honey production. A specific identification of these impacts is required, so that appropriate solutions can be proposed to safeguard beekeeping activity in Evritania in relation to environmental changes.

KEYWORDS: honeydew producing insects on *abies* spp., p*hysokermes* spp., fir honey, climate crisis.

ACKNOWLEDGMENT

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PAPER ID: CEST2023_00420

Composting Animal Mortalities: An effective method for Agro-Silvo-Pastoral Systems utilizing natural zeolite

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Abstract
Animal mortalities management is a challenging and ecologically concerning issue in Agro-Silvo-Pastoral systems. Conventional methods used are not environmentally friendly, are likely to disperse disease to human and animals and do not promote the circularity of livestock units. The absence of national and European legal frameworks further compounds the problem, largely due to pathogen concerns. Composting animal mortalities as an innovative solution in Europe can address these challenges by safeguarding natural resources, reducing pollution, and enhancing soil organic carbon and nutrient recycling. This study proposes a composting methodology for managing animal mortalities and green wastes (prunings), offering significant benefits to Agro-Silvo-Pastoral systems. Two composts were prepared using sheep mortalities and green wastes (GWs). Clinoptilolite (natural zeolite) was added to one of the two composts to improve the properties of the final product. Comparing compost properties with EU standards for safe compost use as soil amendments indicates that the zeolite-compost can be freely utilized for plant growth, land rehabilitation, and carbon sequestration without any limitation. The research findings demonstrate advantages for Agro-Silvo-Pastoral systems, including improved mortalities management, enhanced soil properties, and increased soil organic matter content.

KEYWORDS: composting, animal mortalities, green wastes, clinoptilolite, circular economy.

PAPER ID: cest2023_00531

Understanding the Dynamics of Soil Microbiomes for the Implementation of Sustainable Agricultural Practices

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ABSTRACT

Applying organic residues as organic amendments (OAs) to improve soil quality and fertility has a long history. However, we still do not fully understand the role of OAs in modifying soil biotic characteristics. To fill this knowledge gap, we performed a laboratory experiment and a seven-year field trial investigating the dynamics of soil microbiomes after OA incorporation. Our laboratory experiment investigated the effects of compost organic matter (OM) and compost microbes on soil microbiomes and how they subsequently influenced wheat growth. Our field trial aimed to uncover the compost-induced changes in the potential interactions between soil microbes. Combing laboratory and field experiments provides valuable insights for designing and implementing sustainable agricultural management with organic residues.

KEYWORDS: ORGANIC AMENDMENTS, SUSTAINABLE AGRICULTURAL PRACTICES, SOIL MICROBIOMES, LABORATORY EXPERIMENT, FIELD TRIAL

PAPER ID: CEST2023_00369

SESSION 44- Water and wastewater treatment and reuse
Saturday 2 September Afternoon

Hydrophobic Phase Inverted Polyethersulfone Mixed Matrix Membrane for Water-in-Oil Emulsion Separation

Abuhasheesh Y. H.[1], Hegab H. M.[1], Wadi V. S.[1], Naddeo, V.[2], Al Marzooqi F.[1], Banat F.[1], Aljundi H. I.[3,4], Hasan, S. W.[1,*]

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ABSTRACT

The limited access to clean water sources and the severe consequences of oil spills on the environment are of significant concern. Membrane technology showed superior performance to the other conventional techniques due to its higher performance, lower cost, ability to separate emulsions, and being more environmentally friendly. Emulsified water/oil emulsions are highly stable and have a small droplet size, hence are more challenging to separate than water/oil mixtures. Herein, hydrophobic iron oxide-oleylamine (Fe-Ol) nanomaterial was prepared and used to fabricate polyethersulfone (PES) mixed matrix membranes (MMMs) using non-solvent induced phase separation (NIPS). A similar procedure was used to fabricate pristine PES. The performance of the membranes in emulsion separation was tested using a dead-end vacuum filtration setup and a 1 vol.% water-in-n-hexane surfactant stabilized emulsion. The use of the hydrophobic Fe-Ol nanomaterial enhanced the separation efficiency of the membranes. The 1.5 wt.% PES/Fe-Ol MMM exhibited a 97.4% separation efficiency and a high filtrate flux of 1020 L/m^{2}h (LMH), hence, showing great potential in the application of water-in-oil separation.

KEYWORDS: Membrane technology, Fe-Ol nanomaterial, hydrophobicity, oil-water, separation.

PAPER ID: cest2023_00097

Polylactic Acid/Functionalized CNTs Mixed Matrix Membrane for Oil Water Separation

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ABSTRACT

Proper treatment of oily wastewater before its discharge is necessary to abide by the environmental regulations and reutilizing the treated oily wastewater in relevant applications. Membranes have been shown to be promising with a strong potential in oily wastewater treatment with significant research being carried out to improve its properties and performance. Membranes offer significant benefits, such as high removal efficiency and low power consumption, but mainly suffer from fouling. In this work, hydrophilic functionalized CNTs/polylactic acid (fCNTs/PLA) mixed matrix membranes are proposed for efficient oil-water separation for the treatment of oily wastewaters. Results showed that adding a small percentage of the fCNTs improved emulsion permeability by 75% with 100% rejection of oil. Characterization of the membranes were tested using Scanning Electron Microscope (SEM) and thermogravimetric analyzer (TGA). With the biodegradable and biocompatible characteristics of PLA, this study provides a promising development and application of green, sustainable membranes for the separation of oil from oil water emulsions.

KEYWORDS: Polylactic acid, fCNT, oil-water, separation, membranes.

PAPER ID: cest2023_00105

Selective Adsorption Of Multi-Dye Ions By Citrus Peel: Characterization, Performance, Regeneration

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ABSTRACT

The irrefutable harmful components of wastewater originating from the textile industry are dyes. For this reason, it is accepted as an important environmental and health problem. A large number of natural adsorbents have been used for the efficient removal of industry-sourced dyes. In this study, removability was investigated of methylene blue (MB) and reactive black-5 (RB-5) which are used as dyestuffs in many industries by using Citrus Peel (CP), which is an environmentally friendly, economical, and easily accessible adsorbent with high removal potential. For this purpose, the batch adsorption method was applied to remove dyes from industrial synthetic wastewater. The main parameters affecting the adsorption process such as initial dye doses, citrus peel amount, pH, and contact time were studied in single, double, and triple combinations. Scanning Electron Microscopy (SEM), and Fourier Transform Infrared Spectroscopy (FTIR) were used to determine the properties of the Citrus Peel surface before and after adsorption. Citrus Peel was regenerated after loading with dyestuffs and its reusability was investigated. The results obtained show that the removal efficiency of raw Citrus Peel is highly dependent on the dye types and reveals that it can be an effective adsorbent to remove these dyes.

KEYWORDS: Adsorption, Citrus Peel, Dyestuff, Color removal

PAPER ID: CEST2023_00019

Technologies for the Removal of Microplastics from Wastewater: A Short Review

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ABSTRACT

One of the major routes of microplastics (MPs) to the environment is through the wastewater treatment plants' (WWTPs) discharge to water bodies. Due to their dimensions (< 5mm), MPs tend to be ingested by aquatic species, and eventually, may cause adverse impacts to the environment and to human health. This paper aims to compare different existing and potential technologies for the removal of MPs from wastewater, in terms of removal mechanisms, removal efficiencies, and the current scale of application. In addition, the effects of the presence and accumulation of microplastics in different wastewater treatment systems are reviewed. The MPs that accumulate in the wastewater sludge may also enter the environment through the disposal or reuse of biosolids. However, most of the recent reviews of the removal of MPs in wastewater focused on technologies for the removal from the liquid phase. This paper also seeks to review proposed technologies for the removal of microplastics from wastewater sludge. Finally, the challenges in the application of these strategies for removal are also highlighted in this brief review.

KEYWORDS: microplastics removal, wastewater treatment, wastewater sludge, microplastics accumulation

Paper ID: cest2023_00553

Evaluation of physico-chemical factors affecting Wastewater-Based Epidemiology of SARS-CoV-2 in a southern Philippine sewershed

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ABSTRACT

Wastewater-Based Epidemiology as a complementary Public Health Surveillance tool in Davao City proved useful as the basis of further improvements in disease surveillance. Weekly sampling from November to December in 2020 identified 91% sewer water samples with SARS-CoV-2 RNA despite the lack of reported positive clinical cases in areas identified as moderate to high risk for COVID-19 transmission. Detections of SARS-CoV-2 N, RdRP, and E genes concentrated from PEG-NaCl precipitation method and analyzed using RT-PCR were evaluated in conjunction with physico-chemical and fecal parameters, particularly coliform count, flow rate, surface water temperature, salinity, and total dissolved solids. The physico-chemical parameters provide insight on the preservation of organic matter and residence time of the waters that can impact the recovery of SARS-CoV-2. From whole genome sequencing, single nucleotide polymorphisms (SNPs) were detected and spatially clustered in areas with high population density and mobility. The mutations include previously reported and not yet detected to which the SNPs P383L and V21L in wastewater were detected a month before they were reported from clinical surveillance. Refining the sewershed map is highly recommended and is currently surveyed in more detail. For future improved WBE, the sites were narrowed down to fast flowing channels in densely populated areas with more established sewer lines.

KEYWORDS: low-sanitation areas, low-income country wastewater-based surveillance, untreated wastewater, sewershed, COVID-19

ACKNOWLEDGEMENTS

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PAPER ID: cest2023_00229

Development and Application of a novel anaerobic/aerobic/anoxic process in municipal wastewater treatment utilizing intracellular carbon sources

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ABSTRACT

Municipal wastewater treatment plants (WWTPs) face a significant challenge in controlling treatment costs while meeting increasingly stringent wastewater discharge standards. To address this challenge, A novel anaerobic/anoxic/aerobic (AOA) process has been proposed. In this study, long-term nutrient removal and microbial community variations were investigated in the AOA systems of different scales, including three laboratory-scale systems, one pilot-scale and one full-scale systems. In the AOA system, nitrogen removal exceeded 50% was carried out in the post-anoxic zone via endogenous denitrification driven by intracellular carbon sources. The synergistic effect of denitrifying bacteria (DNB), anaerobic ammonium oxidation (anammox) bacteria, and fermentative bacteria (FB) enhanced nitrogen removal. Advanced nutrient removal was successfully achieved in the AOA process under different environments and influent quality. Under a low influent carbon-nitrogen ratio, the effluent total nitrogen (TN) concentration was 3.6-8.7 mg/L, with a TN removal efficiency of 71-95%. Total phosphorus (TP) concentration in effluent of 0.2-0.3 mg/L was also achieved. Moreover, compared to the widely used anaerobic/aerobic/anoxic (AAO) process, the AOA process reduced 60% of energy consumption by aeration and recirculation. In conclusion, the AOA process has the potential for practical implementation and provides an economical and efficient nutrient removal process for municipal wastewater treatment.

KEYWORDS: wastewater treatment, advanced nutrient removal, anaerobic/aerobic/anoxic, energy saving, endogenous denitrification

PAPER ID: cest2023_00383

Management of Table Olive Wastewater (TOWW) in Turkey

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ABSTRACT

Table olive is very important agricultural product for Turkey. It has a great market share in the country and also have high export potential. Management of table olive wastewater (TOWW) is an emerging and important issue, since large volumes of TOWW are discharged with high concentrations of organic matter, phenolic compounds, suspended solids, alkalinity, and conductivity. Current practices in many countries are the storing the wastewater in evaporation ponds or discharging to municipal wastewater treatment plants, if the ratios are relatively acceptable. Application of evaporation ponds in Turkey is not suitable, because of high population densities in olive production areas and high prices of land. Plus, generally the locations of the production plants are far away from the sewerage systems. Those facts impose the planners and engineers to develop technological treatment based technological in-site solutions for the management of TOWW. In order to perform proper treatment methods, the quantity and quality of wastewater should be known first. However, it is not an easy job, because neither producer provides reliable information nor there is enough information in the literature. In the paper, a questionnaire survey carried out app.30 firms located in the Akhisar Olive and Olive Derivatives Specialized Organized Industrial Zone (AZIOSB) The questionnaire helped to project the data on wastewater generation as well as the processing techniques of table olives. Plus, the sampling studies for quantity and quality of the wastewater are conducted at the main outlet of the AZIOSB, and accordingly treatment alternatives for TOWW are discussed.

KEYWORDS: Table olive wastewater, olive processing, TOWW treatment, evaporation, biologic treatment, chemical oxidation

PAPER ID: cest2023_00242

Purification of municipal wastewater by electrocoagulation process

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ABSTRACT

In this work, the performance of electrocoagulation (EC) processes was investigated under currently defined operational conditions for the purification of municipal wastewater. The experimental removal efficiencies for COD, BOD, total P, turbidity and TSS were 55%, 60%, 79%, 89% and 86%, respectively for aluminum electrodes. For iron electrodes removal efficiencies of above-mentioned water quality parameters (COD, BOD, total P, turbidity and TSS) were 62%, 65%, 83%, 97% and 90%, respectively. In addition to, microbiological parameters showed great promise from the aspect of microbiologically safe reuse of purified wastewater for irrigation.

KEYWORDS: wastewater, electrocoagulation, water reuse

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Mass-Transfer Processes Of Toxic Hexavalent Chromium Adsorption Onto Food Waste Adsorbent

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ABSTRACT

Heavy metal pollution caused by industrial operations is a global environmental issue. Chromium, used in chrome plating, textile dyeing, wood preservation, and metal fnishing, is classifed as a highly toxic agent to humans and other living organisms. To minimize health risks, these contaminant should be removed from the aquatic ecosystem. In the present study, a bioadsorbant was fabricated from vegetable waste biomass : potato peels (PP) was tested for the adsorption of toxic hexavalent chromium [Cr(VI)] from simulated wastewater. Due to the health effects associated to Cr(VI) toxicity, it is mandatory to treat chromium-bearing wastewaters before disposal in to the environment to avoid consequent health problems. The research of cheaper, locally available and renewable materials as precursors for producing activated carbon with comparable functionalities to the commercial product. The purpose of this study is to highlight vegetable waste and to examine the efficiency of potato peels towards the removal of hexavalent chromium from aqueous solution. The physicochemical and textural characterization of the prepared adsorbent was accomplished by using available techniques. The influence of the operating parameters were investigated in batch mode. Eight bottles were used during the batch experiments under the following operating conditions: Mass of PP and PAC: 0.25 g to 1.5 g,time: 0-60mn, pH:2-12,initial concentration of Cr (VI) : 10-30mg/l, Temperature: 30 to 60°C. Adsorption kinetics was assessed by fitting the experimental data with the chosen kinetic models. The ability of potato peels to adsorb Cr(VI) ion was determined from the adsorption isotherms plots and the thermodynamic parameters were estimated. Furthermore, a comparison of the results obtained is carried out with commercial powdered activated carbon (PAC). The best removal efficiencies are obtained at pH of order 2 and 12 for PAC and PP respectively, an optimal mass of PP at 0,5 g and 1 g of PAC at 300 rpm. The most appropriate model is Langmuir model and the kinetics are the pseudo second order. The adsorption reaction is a chemisorption according to Elovich's model and the diffusion is extraparticle by Webber and Morris model. The results obtained from this study suggest that the adsorbent prepared from plant biomass could be an interesting low-cost adsorbent to remove chromium VI.

KEYWORDS: chromate vi, bioadsorbent, adsorption, kinetic, isotherms

PAPER ID: cest2023_00449

Rainwater collection and treatment on green roofs using aromatic plants in a Mediterranean region.

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ABSTRACT

For modern cities, green roofs provide important economic, environmental and social possibilities. They are a sustainable ecological technology. The present research study assesses the use of two substrates with different compositions for the growth of two aromatic plants (*Lavandula dentata* and *Origanum majorana*) in an extensive green roof implemented in a Mediterranean region (island of Lesvos, Greece). Growing substrates mixtures filled with perlite, vermiculite, expanded clay and compost, with the only difference in the amount of compost. Additionally, water runoff quality parameters -pH, turbidity, conductivity, COD and TP- and plant growth traits monitored during the experiment. The present research shows that aromatic vegetation combined with double amount of compost are suitable for green roofs located in countries of the Mediterranean region.

KEYWORDS: green roof, rainwater treatment, runoff quality, aromatic plants, substrates, Mediterranean climate

ACKNOWLEDGEMENTS

The research work was supported by "Center of Sustainable and Circular Bioeconomy [Aegean_Bioeconomy]" (MIS5045851), which is implemented under the Action "Reinforcement of the Research and Innovation Infrastructure", funded by the Operational Program "Competitiveness, Entrepreneurship and Innovation" (NSRF2014-2020) and co-financed by Greece and the European Union (European Regional Development Fund).

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SESSION 45- ENVIRONMENTAL HEALTH
SATURDAY 2 SEPTEMBER -MORNING

Noise footprint of tourist accommodations: a novel approach towards soundscape quality assessment

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ABSTRACT

Environmental noise is a global problem with multiscale consequences, affecting human well-being, environmental health and business efficiency. Several tourist accommodations aiming towards a more competitive and profitable business, produce the by-product of noise thus resulting in a higher noise footprint. The aim of this research is to propose an approach towards the assessment and calculation of the noise footprint of tourist accommodations. Three tourist accommodations located in Lesbos Island (North Aegean Greece) were studied. The transportational, functional, natural and recreational sound sources were assessed. Furthermore, the degree of background noise was included. Noise measurements were conducted using a calibrated sound level meter. The equivalent continuous sound level (L_{eq}) noise indicator levels for each type of source were obtained and analyzed. In order to assess the overall noise footprint a composite indicator based on the signal to noise ratio was shaped. Furthermore, noise maps were created in order to visualize the noise footprint extent of the hotels studied. The main findings of this research highlighted the seasonality of the resulting noise footprint. The promotion of natural and recreational sound sources contributes towards the new concept of net-zero noise and supports quiet and sustainable tourist accommodations.

KEYWORDS: Noise footprint; Net-zero noise; Noise map

PAPER ID: cest2023_00049

Iodine Biofortification Of Cabbage Plants Cultivating In Hydroponic System

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ABSTRACT

Iodine is an essential trace element in the human diet being involved in the synthesis of thyroid hormones. Iodine deficiency affects ca. 2.2 billion people worldwide, therefore it is an important challenge to find a plant-based source of iodine, which would provide the recommended dietary allowance.

In this work iodine biofortification of cabbage was studied cultivating plants in hydroponic system containing iodine in concentration of 0.01-1.0 mg/L as potassium iodide or potassium iodate. During the experiment plant physiological properties, biomass production, concentration changes of iodine- as well selected essential elements were investigated. In addition, chemical form of the accumulated iodine in root samples was also determined.

Results showed that iodine addition had no effect on the photosynthetic efficiency and chlorophyll content. Biomass production was stimulated by the iodide treatment in all dosages, while applying iodate this phenomenon was observed only in low concentrations, above 0.5 mg /L the yield was reduced. Increasing iodine concentrations in the nutrient solutions resulted in higher iodine content in all plant parts, the presence of iodide caused 2-7 times higher accumulation compared with the iodate treatment and it was established that in cabbage roots reductive reactions are dominant, iodate was converted to iodide.

KEYWORDS: iodine, biofortification, cabbage, nutrients

PAPER ID: cest2023_00170

Mapping Atmospheric Nitrogen Deposition Accumulated in Mosses Collected 2005, 2015 and 2020 in Germany

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ABSTRACT

High-quality emission and exposure data obtained through deposition modelling and biomonitoring, respectively, are essential for assessing compliance with emission reduction targets and for developing measures to reduce air pollution. Within this framework, this study shows how spatially differentiated exposure data can be obtained by monitoring and mapping the accumulation of atmospheric nitrogen deposition in mosses.
Mosses are particularly suitable for recording the accumulation of atmospheric substance inputs in large areas at relatively many locations. In Europe, this has been done every five years since 1990 as part of the European Moss Survey. In this framework, mosses were collected at up to 7312 sites in up to 34 countries and chemically analyzed for metals (since 1990), nitrogen (since 2005), persistent organic pollutants (since 2010) and microplastic (since 2015). The present investigation aimed at determining the nitrogen accumulated in three-year-old shoots from mosses collected in Germany in 2020 by quality-controlled sampling and chemical analysis according to the European Moss Survey Protocol (ICP Vegetation 2020). The spatial structure of the measurement values was analyzed by means of Variogram Analysis, and the respective function was used for Kriging-Interpolation. In addition to mapping the nitrogen values according to the international classification, maps based on 10 percentile classes were calculated. Maps for the Moss Survey 2020 data were compared with respective maps produced from the 2005 and 2015 Moss Survey data. Trends in Germany-wide nitrogen medians over the past three campaigns (2005, 2015 and 2020) show that nitrogen medians decreased by −2% between 2005 and 2015 and increased by +8% between 2015 and 2020. These differences are not significant and do not match the emission trends. Therefore, emission register data needs to be controlled by monitoring nitrogen deposition with technical and biological samplers and deposition modelling. Moss Survey data help to enhance the spatial resolution of deposition modelling with geostatistically validated maps and empirical factors for quantifying the filter effect of vegetation on deposition loads.

KEYWORDS: Bioaccumulation; Biomonitoring; Geostatistical analysis and estimation; Percentiles-based mapping

FUNDING

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PAPER ID: cest2023_00056

Mitigating the Environmental Impact of Construction Projects through Effective Pollution Management Strategies

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ABSTRACT

Construction initiatives can substantially contribute to air, water, and soil pollution, as well as soil degradation. These activities can have long-lasting negative effects on local communities and ecosystems. It is imperative to develop and implement effective construction pollution management strategies to address this issue. This study intends to investigate the various strategies that can be implemented to reduce the environmental impact of construction projects. It will concentrate on identifying the sources of construction-related pollution and determining how to regulate them effectively. Additionally, the research will assess the current status of construction industry pollution management practices and identify areas for improvement. In addition to a comprehensive literature evaluation, the research methodology will include surveys and case studies of construction projects that have effectively implemented pollution management strategies. The results of the study will be utilized to develop a set of best practices for construction pollution management, which will be presented to construction professionals in the form of a practical guide. The findings of this study will have significant ramifications for the construction industry, as well as for policymakers, regulators, and other constituents concerned with the environmental impact of construction activities. This study will contribute to the development of more sustainable construction practices that minimize environmental damage and promote long-term environmental health by highlighting the significance of effective pollution management strategies.

KEYWORDS: environmental pollution, construction management , Air Quality

PAPER ID: cest2023_00200

Socioeconomic status and public health in Australia: A wastewater-based study

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ABSTRACT

Analysis of untreated municipal wastewater is recognized as an innovative approach to assess population exposure to or consumption of various substances. Currently, there are no published wastewater-based studies investigating the relationships between catchment social, demographic, and economic characteristics with chemicals using advanced non-targeted techniques. In this study, fifteen wastewater samples covering 27% of the Australian population were collected during a population Census. The samples were analyzed with a workflow employing liquid chromatography high-resolution mass spectrometry and chemometric tools for non-target analysis. Socioeconomic characteristics of catchment areas were generated using Geospatial Information Systems software. Potential correlations were explored between pseudo-mass loads of the identified compounds and socioeconomic and demographic descriptors of the wastewater catchments derived from Census data. Markers of public health (e.g., cardiac arrhythmia, cardiovascular disease, anxiety disorder and type 2 diabetes) were identified in the wastewater samples by the proposed workflow. They were positively correlated with descriptors of disadvantage in education, occupation, marital status and income, and negatively correlated with descriptors of advantage in education and occupation. In addition, markers of polypropylene glycol (PPG) and polyethylene glycol (PEG) related compounds were positively correlated with housing and occupation disadvantage. High positive correlations were found between separated and divorced people and specific drugs used to treat cardiac arrhythmia, cardiovascular disease, and depression. Our robust non-targeted methodology in combination with Census data can identify relationships between biomarkers of public health, human behaviour and lifestyle and socio-demographics of whole populations. Furthermore, it can identify specific areas and socioeconomic groups that may need more assistance than others for public health issues. This approach complements important public health information and enables large-scale national coverage with a relatively small number of samples.

KEYWORDS: Wastewater-based epidemiology, Metoprolol, Atenolol acid, Venlafaxine, Sotalol, Sitagliptin

ACKNOWLEDGMENTS

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PAPER ID: cest2023_00516

Response of the Lichen *Evernia prunastri* to Exposure of Antibiotic

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ABSTRACT

Tetracycline antibiotics are one of the main groups of antibiotics widely used in medicine and a major environmental concern. However, the effects on non-target organisms are not well studied. Thalli of lichens artificially were exposed to high levels tetracycline to determine the impact on physiological parameters (integrity of cell membranes, photosynthetic efficiency, viability) and oxidative stress response (membrane lipid peroxidation). The results of the experiment showed that exposure did not affect the lichen membrane damage as indicated by unchanged values in conductivity. The potential photosystem II efficiency (F_V/F_M) was susceptible to the impact of antibiotics. The concentrations of TBARS were markedly increased with increasing concentration of tetracycline. The results of the study supplemented the knowledge on the effects of pollution on organisms, such as veterinary antibiotics, on lichens and provided a better understanding of the mechanisms of toxicity.

KEYWORDS: tetracycline, lichen, membrane permeability, chlorophyll fluorescence, oxidative stress

PAPER ID: cest2023_00342

A Presumptive And Interactive Map Of PFAS Contamination In Greece: A Tool For The Identification Of Possible Exposure Sources

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ABSTRACT

Per- and polyfluoroalkyl substances (PFAS) are emerging global contaminants that can have adverse environmental and human health effects. In recent years regulatory authorities have focused on setting stricter environmental limits and implementing precautionary principles. The extent and severity of PFAS contamination in Greece are still little known, despite the widespread occurrence of facilities that release the compounds. An assessment of potential sources of PFAS emission and population exposure in Greece was undertaken and the findings were used to create a presumptive and interactive map using QGIS software. Private and public industrial and governmental facilities including mining and landfill sites, wastewater treatment facilities, military bases, and airports, both on the mainland and on islands, were included. Contamination levels from existing studies in Greece were also mapped. The potential for population exposure was estimated based on the proximity of residence. This useful tool allows stakeholders and communities to rapidly and methodologically recognize possible sources, potential exposure, and public health risk, and can be expanded to incorporate future research.

KEYWORDS: per- and polyfluoroalkyl substances (PFAS)-presumptive map-interactive map-potential sources-contamination levels

PAPER ID: cest2023_00351

Spatial and temporal variability of Cadmium and Lead in Urban Soils of Thessaloniki (northern Greece).

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ABSTRACT

In this study, an investigation was carried out to record, document and monitoring the pollution caused by heavy metals in soil surface soils in the urban fabric of the city of Thessaloniki. During the years 2021 & 2022, surface soil samples were collected in the spring and autumn of each year. Soil and chemical analyses were conducted to determine the physicochemical properties of soil samples. The available and pseudo-total concentration of cadmium (Cd) and lead (Pb) was determined and the mean values for the two years of the study were calculated. Using Geographical Information Systems (GIS), thematic maps were built in order to study the spatial and temporal distribution of each metal. The statistical tools used should provide useful guidance for pollution surveillance and identification of potential sources of pollution in the study area.

KEYWORDS: urban spatial environment; heavy metals; potentially toxic elements.

PAPER ID: cest2023_00393

A Literature Review on the Benefits of Healing Gardens

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ABSTRACT

Healing gardens can be traced back to the Greeks at the end of the sixth century B.C. when they used healing centers in temples with the specific usage of natural spring water. Despite the well-known benefits of healing gardens, most healthcare facilities do not include them as part of their process to cure. Thus, this paper aims to explore and provide evidence for the potential benefits of healing gardens for health and well-being in healthcare facilities. Several important research has examined the advantages of healing gardens in hospitals. In addition, there has been an increase in the use of salutogenic and biophilic design approaches in healthcare environments over the last decade. Through a literature review and analysis of successful healing gardens, this paper demonstrates the importance of healing gardens for physical, mental, and emotional health and recommends their incorporation in healthcare facilities as a standard policy.

KEYWORDS: garden, biophilia, healthcare facilities, salutogenic.

Acknowledgments

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PAPER ID: cest2023_00401

The NORMAN Antibiotic Resistance Bacteria and Genes Database (NORMAN ARB&ARG): let's collaborate to manage risk of Antibiotic Resistance

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ABSTRACT

Antibiotic resistance (AR) has been identified as one of the biggest threats to global health and food security by the World Health Organization **[1]**. Therefore, it is vital to have data exchange platforms for studies of antibiotic resistance bacteria (ARB) and antibiotic resistance genes (ARGs) in the environment. The NORMAN Association has developed the NORMAN Antibiotic Resistance Bacteria/Genes Database (NORMAN ARB&ARG), which is the first open platform for exchange of occurrence data and analytical methods of ARB and ARGs that follows the FAIR (Findable, Accessible, Interoperable, Reusable) principles **[2]**. The FAIR principles are embraced by the European Union, authorities and agencies are transforming their data in a FAIR manner **[3]**. The present article provides an overview on the infrastructures of the database, the extraction of data from the database and the contribution of data to the database. In this study, the AR data from 3 studies performed in Asia were extracted and successfully imported into the NORMAN ARB&ARG **[4-6]**. The feasibility study demonstrates how the scientific community can share their data on investigation of AR to generate knowledge for mitigating AR pollution. AR data of the selected studies are available on the NORMAN ARB&ARG. The open and FAIR data on the database are of high potential of regulatory application, including the development of emission limit values of ARGs in effluent wastewater. The growth in sharing of data and analytical methods in investigation of AR could foster collaboration on risk management of AR worldwide, and facilitate the harmonization in identification and surveillance of critical hotspots of AR.

KEYWORDS: Antibiotic resistance bacteria, antibiotic resistance genes, wastewater treatment plants, antibiotics, FAIR (Findable Accessible Interoperable Reusable) data, emission limit values

PAPER ID: cest2023_00459

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SESSION 46- EMERGING POLLUTANTS
SATURDAY 2 SEPTEMBER -AFTERNOON

Synthesis of Two-Dimensional Nanomaterial Based Hybrid Membrane for Antibiotic Removal from Wastewater

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ABSTRACT

The presence of high concentrations of antibiotics in wastewater has paved the way for the development and spread of pathogens with antimicrobial resistance (AMR). Coupled with the global water stress, this leads to adverse effects on both the environment and human health. Conventional wastewater treatment plants lack antibiotic removal efficiency, hence untreated wastewater eventually finds its way into groundwater or surface water. Nanomaterial-based membrane technology has shown outstanding characteristics, particularly two-dimensional (2D) nanomaterials. In this study, graphene oxide (GO), MXene ($Ti_3C_2T_x$), and GO)/MXene composite (50% GO/$Ti_3C_2T_x$) membranes were fabricated by vacuum-assisted filtration for antibiotic removal from wastewater. The membranes' rejection and permeability were tested. Membrane hydrophilicity and surface morphology were evaluated through water contact angle and Scanning Electron Microscopy (SEM) respectively. When compared to pristine GO and $Ti_3C_2T_x$ membranes, the composite GO/$Ti_3C_2T_x$ membrane possessed a lamellar structure with a higher interlayer spacing and higher stability. Additionally, the fabricated membranes resulted in more effective tetracycline removal from water.

KEYWORDS: Antibiotic, Graphene oxide, MXene, Tetracycline, Two-dimensional materials, Membranes.

PAPER ID: cest2023_00101

Investigating the occurrence of >2,400 organic micropollutants in different tissues of Eurasian otters leveraging LC- and GC-HRMS techniques

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ABSTRACT

Anthropogenic activities are one of the main contributors to the introduction of organic micropollutants in the environment. During the past decades, the environmental research was focused on the detection of priority pollutants (PPs), for which mitigation measures have been applied due to their persistent, bioaccumulative and toxic (PBT) properties. However, recent findings suggest the significant presence of emerging contaminants (ECs) in various environmental compartments. These contaminants are not properly monitored or regulated, and they are linked with suspected detrimental effects on both human health and the ecosystem, and, therefore, are candidates for future regulation. Thus, their systematic monitoring is of high importance, due to their high detection frequency and potential harmful properties. Biomonitoring data can be used for risk assessment of pollutants and for substance assessment through the development of guidance in relation to exposure and bioaccumulation. As a result, it helps with the evaluation of the effectiveness of chemical regulations, to protect the environment, wildlife and human health. Apex predators, such as otters, are commonly used for biomonitoring studies of ECs, since they possess many key characteristics that make them ideal organisms for detecting and evaluating contaminants in the environment. The majority of the biomonitoring studies of organic micropollutants investigate only the presence of PPs, and focus solely on specific chemical classes, such as PFAS (O'Rourke et al. 2022). Thus, many organic micropollutants remain uninvestigated and the chemical exposure of biota species is not explored at a high extent.

The aim of this study is the determination of the chemical fingerprint of organic micropollutants, by applying generic sample preparation protocols for the extraction of LC and GC amenable compounds with different physicochemical properties and using LC- and GC- HRMS techniques and novel wide-scope target analysis protocols. In this framework, otter samples gathered from the United Kingdom were analyzed to investigate the occurrence of >2,400 organic micropollutants and their accumulation profile in seven different tissues collected during post mortem of road-killed otters, (muscle, liver, kidney, pelt, blood, fat and faecal samples).

In total 91 organic micropollutants, from different chemical classes, were determined. The dominant class were pharmaceuticals and their transformation products (TPs) (25%), following by PFAS and plant protection products (17%). 17 conventional (PFCAs, PFSAs) and new (e.g., 6:2 FTS, 6:6 PFPi) PFAS, as well as branched isomers of PFOA and PFOS were detected in all the different tissues. The most polluted matrix, in respect to the number of detected contaminants, was pelt, with 45 compounds identified, 35.6% of which were pharmaceuticals, antidepressants, and antipsychotic drugs. Therefore, this matrix, which could potentially be acquired non-invasively, may be of interest for the systematic monitoring of polar and semi-polar chemicals (including pharmaceuticals) in otter samples. 42 and 32 compounds were determined in the liver and kidney samples respectively in high concentration levels and with high % frequency of appearance. 32 compounds were rarely present in low concentration levels in faecal samples. 23 and 24 compounds, mainly PFAS, were detected in low concentration levels in the muscle tissue and blood samples, respectively. The least polluted matrix was fat tissue.

KEYWORDS: emerging contaminants, biomonitoring, otters, target analysis, HRMS

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Mitigating the impact of antineoplastic drugs on aquatic environment: nanofiltration as a promising tertiary wastewater treatment

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ABSTRACT

Pharmaceuticals known as antineoplastic agents are increasingly prescribed in the fight against cancer. This is causing some concern in the scientific community due their poor treatment in many conventional wastewater treatment plants and poor environmental biodegradability, posing a potential risk to eukaryotic organisms. Finding treatment solutions to prevent the entry and buildup of these compounds in the environment becomes urgent. In this study, ten antineoplastic drugs and one corticosteroid, five of which had never been examined before, were monitored in a real wastewater effluent and their removal using a nanofiltration pilot scale unit with a Desal 5DK membrane was evaluated. Average removals of 68±23% were attained for the eleven compounds, being the lowest one 30±10% for mycophenolate mofetil and the highest one 98.3±0.4% for megestrol. Except for cyclophosphamide, for which a high risk was estimated in the permeate, the remaining risks determined in the permeate for aquatic organisms from receiving bodies were low (capecitabine, mycophenolic acid and flutamide) or null. Phytotoxicity tests revealed that the permeate appears to have a lower negative impact on the growth of *Sinapis alba* plants' roots than the feed stream.

KEYWORDS: wastewater effluents, anticancer drugs, cytostatic drugs, nanofiltration, toxicity screening

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Rapid Adsorption Of Diclofenac By Polyaniline-Coated Carbon Nanofiber

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ABSTRACT

In this work, polyaniline-coated carbon nanofiber with acid treatment (named CNFA@PANI) composite was synthesized and used to eliminate diclofenac from the water environment. Thanks to the abundant amino functional groups and benzene-ring structures, the as-prepared CNFA@PANI composite presented the excellent adsorption capacity (q_e) of 202.9 mg/g and high distribution constant (K_d) value of 1.02×10^4 for diclofenac. The physical and chemical properties of the manufactured composites were characterized by scanning electron microscopy (SEM), X-ray diffraction (XRD), and Fourier-transformed infrared spectroscopy (FT-IR). The novel adsorbent possessed rapid and excellent adsorption performance for diclofenac. Moreover, in the wide pH range, the CNFA@PANI possessed well adsorption capacities. Meanwhile, after five adsorption-desorption cycles, the composite still showed excellent reusability performance. Furthermore, quantum chemical theory calculations indicated the possible adsorption sites of the composite for diclofenac. In total, this work provides an easy method to design novel composites for the efficient removal of diclofenac from the water environment.

KEYWORDS: pharmaceuticals, diclofenac, polyaniline, carbon nanofiber, adsorption

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Occurrence and fate of OMPs and ARGs in innovative full-scale WWTPs

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ABSTRACT

The presence of antibiotic resistance determinants in wastewater treatment plants (WWTPs) presents a potential risk for human health and for the environment (Manaia et al., 2018). The scientific knowledge related to this topic is still limited, while new technologies are being implemented to reduce the environmental impact associated to conventional WWTPs. Besides removing conventional pollutants; innovative technologies should deal with contaminants of emerging concern (CECs). CECs are typically divided into chemicals (for example pharmaceuticals and other organic micropollutants, OMPs) and biological pollutants, such as pathogens or antibiotic resistant microbes (ARMs). The aim of this study is to evaluate the occurrence and fate of some CECs in two full-scale urban WWTPs based on advanced technologies. The selected CECs were 8 OMPs (antibiotics) and 35 antibiotic resistance genes (ARGs). Two sampling campaigns were performed to determine the presence and the removal efficiencies of the selected CECs in each treatment step. The results of the first sampling campaign showed moderate removal efficiencies for OMPs, between 20 and 80 %; and a higher distribution of ARGs in the sludge line, compared to the water line, where a removal of 2-3 $\log_{10}$ units was achieved. A second campaign was already completed and the results will be available in coming weeks.

KEYWORDS: Real sewage, innovative technologies, organic micropollutants, antibiotic resistances.

ACKNOWLEDGMENTS

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Unveiling The Occurrence Of Organic Micropollutants In Different Species Of Terrestrial Mesocarnivores Utilizing HRMS Techniques

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ABSTRACT

The introduction of organic micropollutants in terrestrial and aquatic ecosystems, which mainly originate from anthropogenic activities, is supported by overwhelming evidence from global studies conducted as early as the turn of the 20th century. A fraction of these xenobiotics, the regulated “Persistent Organic Pollutants (POPs)”, are constantly monitored due to their thoroughly studied persistent, bioaccumulative, and toxic (PBT) properties. Although the occurrence of POPs in the various environmental compartments is well-studied, there are chemicals, which are not systematically subjected to examination, the so-called “Emerging Contaminants (ECs)”. These contaminants are not subjected to marketing restrictions or regulatory investigations but are candidates for future regulation, due to their frequent detection in environmental matrices and their potential toxic properties (Gkotsis et al; 2023, Thomaidis et al; 2012, Badry et al; 2022). The partitioning of organic micropollutants through the ecosystems and their subsequent bioaccumulation and biomagnification in the upper trophic levels necessitate the systematic investigation of their presence in this group of organisms. (Badea et al., 2020; Riget et al., 2016). Subsequently, biomonitoring and risk assessment studies that target apex predators benefit from certain characteristics of their trophic position in the ecosystem, such as their relatively long lifespan over which bioaccumulation occurs, the incorporation of spatial and temporal exposure, and the relative ease of quantifying their populations (Movalli et al; 2022, Malarvannan et al; 2020). Even though there are many biomonitoring data concerning the presence of xenobiotics in marine organisms, the respective data on terrestrial predators are scarce.

The aim of the current biomonitoring study is to reveal the chemical fingerprint of terrestrial mesocarnivores gathered from Germany by utilizing complementary chromatographic techniques coupled with High-Resolution Mass Spectrometry (HRMS). In this framework, 23 mesocarnivore liver samples collected in Baden-Württemberg state, Germany between 1993 and 2021, were analyzed following wide-scope target screening methodologies, in order to investigate the presence of organic micropollutants. Different species were analyzed, including European polecats, beech martens, and European pine martens.Briefly, the analytes were extracted from lyophilized liver samples through generic sample preparation protocols using Accelerated Solvent Extraction (ASE), followed by a purification step using Solid Phase Extraction (SPE). The cartridges used for the SPE step were in-house mixed-mode and Florisil, for LC and GC analysis, respectively. The final extracts were analyzed by Liquid Chromatography (LC) with Electrospray Ionization (ESI) and Gas Chromatography (GC) with Atmospheric Pressure Chemical Ionization (APCI) as ion sources, coupled with HRMS, to broaden the chemical domain accessible to wide-scope target analysis. The acquired HR-MS data were screened for the presence of more than 2,400 organic micropollutants, included in the target lists of the National and Kapodistrian University of Athens (NKUA). Compounds of different classes (such as pharmaceuticals, personal care products, illicit drugs, plant protection products, stimulants, industrial chemicals, sweeteners, plasticizers, surfactants, flame retardants, and phthalates), as well as their Transformation products (TPs) and metabolites, are included in the NKUA datasets, which are updated regularly. The LC and GC target lists are available as data sets in Zenodo((DOI: 10.5281/zenodo.3723478, and GC database DOI:10.5281/zenodo.3753372, respectively). The data treatment protocols applied during the target screening utilized the strict identification thresholds of mass accuracy (<2mDa), retention time shift (<0.20min), isotopic pattern fitting (mSigma<100), and fragmentation pattern match. The standard addition method was used for the quantification of the analytes (Gago-Ferrero et al;2020).The results yielded by the LC & GC HRMS analysis reveal the presence of numerous organic pollutants in the tested samples, classified under several different chemical categories, such as pharmaceuticals (including venlafaxine, gabapentin, oxfendazole), plant protection products (like jasmolin, propoxur, and tralkoxydim), personal care products (for instance the parabens butylparaben, ethylparaben, methylparaben). Furthermore, several industrial chemicals were detected comprising of 4 Polychlorinated Biphenyls (PCBs), 6 Polycyclic Aromatic Hydrocarbons

(PAHs) and 14 Per- and Polyfluoroalkyl Substances (PFAS). In addition to the parent compounds, multiple TPs of pharmaceuticals, plant protection products, as well as coffee and tobacco-related compounds were detected in the terrestrial mesocarnivore liver samples. Moreover, the most abundant and frequently detected xenobiotic compound was PFOS, affirming its persistent and bioaccumulative properties already reported in the literature (Rupp et al; 2023). The persistence of these analytes may cause potentially harmful effects on the environment and eventually on human health and therefore should be thoroughly investigated in environmental studies. Overall, the previously indicated findings highlight the importance of HRMS wide-scope target screening methodologies in biomonitoring studies.

KEYWORDS: Organic Micropollutants; High Resolution Mass Spectrometry; Biomonitoring; Terrestrial Ecosystem; Mesocarnivores.

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Targeted And Untargeted Trend Analysis In Historic Samples Of Top Predators And Their Preys

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ABSTRACT

Chemical dispersion and bioaccumulation in ecosystems can be assessed by biomonitoring studies using wildlife, which has been proven as an valuable tool. Samples from top predators such as marine mammals, raptors, and otters allow for investigation of bioaccumulative legacy pollutants and contaminants of emerging concern (CECs). The integration of historical samples from ESBs, research collections, and natural history museums provides a better understanding of chemical trends in wildlife. The temporal data support the European Green Deal by reviewing the effectiveness of current and past chemical management and providing early warning signals for new potential problem chemicals. The presented research provides key findings from the LIFE APEX project (LIFE 17 ENV/SK/000355), which aimed to enhance the systematic use of contaminant data from apex predators and their prey in chemicals management. . The purpose of the research presented here was to identify contaminant time trends over the the period 1995-2017 in otter, bream, harbour seal and buzzard in Europe,. We used a comprehensive approach which included target and non-target screening for the identification and assessment of 2,545 chemicals. LIFE APEX project trend analysis findings highlighted the apex predators' crucial importance of chemical monitoring. The project's findings can contribute to a better

chemical dispersion understanding, provide valuable information to evaluate the associated CEC risk, and support the design, development and implementation of more effective regulatory strategies in order to protect the environment, wildlife and human health, in an One Health approach.

Keywords: top predators, non-target screening, trend analysis, specimen banks, LIFE APEX project

ACKNOWLEDGEMENTS

This research has received funding from the European Union through the program LIFE17 ENV/SK/000355 “Systematic use of contaminant data from apex predators and their prey in chemicals management”. The LIFE APEX project (LIFE17 ENV/SK/000355) has received additional co-financing from the Green Fund, in order to support the implementation of the project’s actions.

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Predominant Chemical Mixtures In Top Predators And Their Prey In Europe

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ABSTRACT

Apex predators and prey samples from marine, freshwater and terrestrial compartments were retrieved from environmental specimen banks (ESBs), natural history museum (NHMs) and other scientific collections. Samples were collected from 20 European countries between 1996 and 2022. The samples were extracted and analysed by the LIFE APEX partners for a wide range of legacy and emerging contaminants. The chemical occurrence data was modeled using graph analytics. Chemical mixtures were identified for the samples from the freshwater and marine environments. Legacy perfluoroalkyl and polyfluoroalkyl Substances (PFAS), brominated diphenyl ethers (BDEs), and Polychlorinated biphenyls (PCBs) were found to be the predominant chemicals for both environments. Among contaminants of emerging concern, 4-formylaminoantipyrine and gabapentin-lactam (were predominant in both environments, and may pose a threat for human and environmental health. In the marine environment, other important substances in the chemical mixtures were the surfactant N,N-Bis(2-hydroxyethyl)dodecanamide, the synthetic musk galaxolide, the pesticide isoprocarb and the metabolite of nicotine (nornicotine). These chemicals are known to be produced/used in high quantities in Europe and should be systematically monitored in environmental compartments and further addressed by future legislation. It has to be noted that sample collection aimed to achieve an investigative spatial overview and not to assess food chain accumulation. Therefore, the presented results need to be taken with caution and must be verified given that the samples were not taken exactly in the same spatio-temporal context.

KEYWORDS:

predominant chemical mixtures, top predators, LIFE APEX, contaminants of emerging concern

ACKNOWLEDGEMENTS

This research has received funding from the European Union through the program LIFE17 ENV/SK/000355 "Systematic use of contaminant data from apex predators and their prey in chemicals management". The LIFE APEX project (LIFE17 ENV/SK/000355) has received additional co-financing from the Green Fund, in order to support the implementation of the project's actions.

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SESSION 47- ENERGY RECOVERY FROM WASTE

Saturday 2 September -Afternoon

Life Cycle Assessment of Tyre Pyrolysis Oil, a case for Cyprus

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ABSTRACT

The disposal of used vehicle tyres at the end of their life time, is a significant environmental concern for several countries. Although, there is specific legislative framework, regulating their collection and disposal, after these are replaced, there are several options for further processing. In the framework of circular economy, recovery methods and new applications for the material are available. Waste to energy methods are also proposed and used. However, for every choice, there are connected environmental impacts that have to be investigated and assessed. This work presents a Life Cycle Assessment (LCA) for the generation of electricity by using oil that have been produced by pyrolysis of vehicle tyres material at the end of their life. The four phases of a LCA study, according to ISO 14040 are implemented. The system under study starts from the receipt of shredded used tyres, and includes the pyrolysis process, the electricity generation and the management of by-products, pollutants and waste for a case study about a unit designed to operate in Cyprus. The functional unit is 1 MWh of produced electricity. A detailed Life Cycle Inventory (LCI) is presented and moreover, by applying the CML 2001 impact characterization method, the acidification potential, the eutrophication potential, the global warming potential, the ozone depletion potential, the photochemical ozone creation potential, the marine aquatic ecotoxicity potential, the human toxicity potential, the freshwater aquatic and the terrestrial ecotoxicity potential, the depletion of abiotic resources – fossil fuels potential and the depletion of abiotic resources – elements, ultimate reserves potential are calculated for the electricity generated at the unit by using produced on site tyre pyrolysis oil. A contribution analysis is also presented and the results are interpreted and discussed, therefore specific conclusions and recommendations for environmental optimization of the processes are formulated.

KEYWORDS: Tyre Pyrolysis Oil, Life Cycle Assessment, Environmental Impacts, waste to energy, ISO 14040

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Utilization Of Agricultural And Urban Plastic Waste Review: Introduction To Pyrolisis And Hydrocarbon Reformation

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ABSTRACT

Agricultural and urban waste consist of large quantities of biomass and petroleum originated waste. These two categories are rich in hydrocarbons which can be utilized again after their first life cycle. Pyrolysis is a thermochemical process in which solid hydrocarbons decompose in conditions of high temperatures and lack of oxygen (O_2).Normally the chemical elements of carbon (C) and hydrogen (H_2) react by releasing heat called combustion in an environment with oxygen. This paper examines the maintenance of high temperature conditions with oxygen deficiency that keep these chemical elements (C and H_2) distinct until their formation of new chemical compounds of hydrocarbons. These new synthesis have a different number of C and H_2 atoms from the initials, which form fuels in solid, liquid and gas state . It turns out that pyrolysis is the first stage in all the other thermochemicals, as well as combustion and gasification. Without pyrolysis, combustion and gasification cannot take place. This research presents analyzed parameters that affect the decomposition of hydrocarbons and the composition of new with characteristic suffixes. These new fuels can be utilized into conventional equipment that can produce heat, lighting, mechanical work and electricity.

KEYWORDS: pyrolysis; hydrocarbons; plastic waste; alternative fuels; biomass

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Comparative Analysis Of Wte Technologies Based On Multiple Criteria Analysis And Life Cycle Considerations

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ABSTRACT

Nowadays, a range of alternative options and technologies for Waste to Energy are currently available and analytically discussed in the effort to promote energy production and rational waste management. In this paper, a generic methodological scheme is proposed for the comparative analysis of WtE (Waste-to-Energy) technologies based on multiple criteria analysis and life cycle considerations. The approach is based on Multi-Criteria Decision Analysis (MCDA). The methodological scheme simultaneously considers environmental, economic, and social criteria to support robust decision-making. Towards validating the methodology, the latter was demonstrated in a real-world case study taking for Greece, considering four main technological options i.e., incineration, gasification, pyrolysis, and anaerobic digestion. Questionnaires, both for a pool of fifteen experts and the public were disseminated and interesting results are analyzed and discussed. Based on the proposed methodological scheme, the results for the basic scenario (when social, environmental, and economic considerations have equal weighting factor) promote anaerobic digestion as a more preferred option for Greece, followed by incineration, gasification, and pyrolysis. However, the optimal solution puts forward a mixture of technologies (i.e., combination of anaerobic digestion and incineration or gasification), depending on the differentiations of the scenarios weighting factors. Life cycle thinking should also be considered to provide a more reliable analysis related to the estimation of environmental performance of alternative technological solutions.

KEYWORDS: sustainable management; thermal treatment; decision support system; multi-criteria analysis; waste management

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Investigating the Performance of Anaerobic Co-Digestion of Primary Sludge and Acid Whey Using a Twin Pilot Scale System

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ABSTRACT

Anaerobic Digestion (AD) has proven to be an effective method for transforming organic waste into biogas, a renewable energy source that can play a crucial role in reducing our dependence on finite fossil fuels. Despite its widespread use, mono-digestion, where a single substrate is utilized, is prone to several drawbacks, including process instability, limited feedstock options, and low biogas/methane efficiency. To overcome these limitations, anaerobic co-digestion (AcoD) has emerged as a promising alternative. In AcoD, multiple substrates are digested simultaneously, leading to a more stable process, a greater variety of feedstock options, and an increased biogas/methane yield. The co-digestion of wastewater treatment plant (WWTP) sludge and food processing wastes has proven to be a popular area of research in AcoD, offering a balanced mix of carbon, nutrients, and minerals for optimal digestion. This study investigates the performance of AcoD between primary sludge (PS) and acid whey (AW) compared to PS mono-digestion, using a twin 15 L pilot scale continuous flow complete stirring tank reactor (CSTR) system. The experiment was carried out at a mesophilic temperature (35 °C) with an increasing organic loading rate (OLR). The results suggest that AcoD of PS and AW is a promising approach as optimal process conditions were maintained while the biogas yield increased.

KEYWORDS: Anaerobic co-digestion, AcoD, Anaerobic digestion, AD, Primary sludge, Acid whey, Biogas, Methane, waste to energy, continuous flow, BMP

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Agro-Industry Waste Fed Microbial Electrolysis Cell for Biohydrogen Production

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ABSTRACT

The microbial electrolysis cell is gaining advantage over the other biological hydrogen production techniques as it requires less energy for hydrogen generation as compared to the water electrolysis process. The present study aims to assess the aptness of Agro-Industry Waste (AIW) fed membrane-less single chambered Microbial Electrolysis Cell (SC-MEC) for the biohydrogen production in batch mode under applied voltage of 1 V at 30 ± 2 °C (Fig.1). The performance of the reactor was assessed through volume of hydrogen per gram of COD removed, columbic efficiency, cathodic hydrogen recovery and COD removal efficiency. The highest COD removal of 71% was reported with columbic efficiency of around 45%. These results demonstrated an energy-efficient approach for biohydrogen production from AIW coupled with waste mitigation

KEYWORDS: electro-hydrogenesis, microbial electrolysis cell, electrode modification, over-potential reduction, hydrogen evolution reaction

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Plastic waste utilization: Challenges and opportunities for waste-to-energy in Baguio City, Philippines

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ABSTRACT

Amounts of residual wastes, such as plastics, paper, and textiles, in urban areas have drastically increased over the years, which hence requires sustainable waste management schemes. Refuse derived fuel (RDF) provides a solution in addressing minimizing waste disposal in landfills and providing energy, particularly in developing nations. In this study, waste-to-energy (WtE) potential from residual wastes in Baguio City was assessed. With an experimental value of 13.738 MJ/kg, it revealed a percentage error of 20.748% when compared with predicted values from an energy regression model. However, ANOVA results revealed that the energy, moisture, and ash content were all statistically comparable to reports across RDF-related studies.

KEYWORDS: ***plastic pollution; residual waste; rdf; sustainability; waste-to-energy***

PAPER ID: cest2023_00533

Impact of Fatty Waste on Anaerobic Digestion of Sewage Sludge at a Municipal Wastewater Treatment Plant - A Case Study

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ABSTRACT

Anaerobic digestion is a common method for utilization of sewage sludge at large-scale wastewater treatment plants. This process generates biogas, which is a source of renewable energy. Intensification of biogas production can be achieved, for example, through co-digestion, with fatty waste characterized by a high methane potential (0.85 Nm^3/kg VS versus 0.136 Nm^3/kg VS for excess sludge). However, due to high lipid content, fatty waste can cause incomplete degradation of organic compounds and accumulation of volatile fatty acids (VFA) in the digester.

The purpose of this study is to show the changes in the efficiency of the digestion process at a municipal wastewater treatment plant after feeding digester with fatty waste. Co-fermentation shortened HRT from 27.0 d to 23.7 d. The use of co-digestion had a positive effect on biogas production. Volume of biogas increased from 2750 Nm^3/d to 4004 Nm^3/d (average). It was noted that the percentage share of organic dry matter in the digested sludge decreased on average from 71.32% to 69.15%.

KEYWORDS: anaerobic digestion, biogas, municipal wastewater treatment plant, co-digestion

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PART B – POSTER PRESENTATIONS

CLIMATE CHANGE

Bidirectional effects between the dental industry and climate change

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ABSTRACT

While the last decade has seen rapid advances of dental sciences, the literature indicates that the profession has yet to embrace the emerging field of environmental sciences and the interactions with population oral health. This work involves a systematic thematic analysis of the circular relationship between the dental industry and climate change. Among the effects of the dental industry to the environment include water contamination, mercury release, use of microplastics, and a slow adoption of recyclables. Effects of climate change to dentistry include the expansion of "dental deserts", exacerbations of social determinants of oral health, disruptions and dislocation of dental practices due to natural disasters, a gradual worsening of the maldistribution of the dental work force, effects on oral hygiene due to water scarcity and more.

KEYWORDS: climate change, oral health, dental industry, social determinants of health

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The Geopolitical Risk İndex Effect On The Energy Market, Emissions And Climate Change

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ABSTRACT

Over time, global crises have affected the energy market much more than major geopolitical events. In recent years, humanity has been faced with the Covid 19 crisis, which has caused great disruption in the energy market and unprecedented phenomena in oil prices.

Also, during the same period, due to the decrease in global production and the low demand for energy, there were unusually large reductions in emissions across the planet. In the post-covid era, the world is faced with the crisis of the Russian - Ukrainian war and the corresponding surge in gas and oil prices. As these critical geopolitical events have the dynamic to affect the entire world, this investigation utilizing the Geopolitical Risk index of Caldara and Iacoviello (2021) aims to identify if events related to energy, green investments, or measures of pollutant emission assessments can be predicted.

I) Can the Geopolitical Risk Factor (GPR) be a tool for predicting events related to the energy crisis?

II) GPR can be a reference point for green investments

III) Does the GPR have the possibility to be a measure of pollutant emission assessment?

KEYWORDS: GPR, energy market, emissions, RAS

ACKNOWLEDGEMENT

This work has been fully supported by the University of Piraeus Research Center

PAPER ID: cest2023_00504

AGROFORESTRY, FOREST AND AGRICULTURAL SUSTAINABILITY

Wild Rabbits Impact On The Agricultural Ecosystems Of Lemnos Island By Analyzing ELGA's Compensations

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ABSTRACT:

The European Wild Rabbit (WR) (Oryctolagus Cuniculus) had been introduced to Lemnos island, Greece many centuries ago. However, in the last few decades, there has been a systematic decline of human presence in the rural areas following agriculture abandonment and decreased WR hunting. These changes led to the WR overpopulation because humans are its main predators, which negatively affected farming production and the local rural economy. In this study, we estimated the distribution of the wild rabbits' impact on the agroecosystems of Lemnos, using the quantitative data from the Hellenic Agricultural Insurance Organization (ELGA). Based on an 11-year (period 2011-2021) spatiotemporal analysis of the damaged crop types, areas and compensation payments, annual maps of the wild rabbits' impact were produced. Results showed that the northeast part of the island has been more affected by the WR overpopulation. There is a continuing increase in crop losses with local variances per year, except for a significant decline of WR impact for the period 2018-2019. The spatial analysis of the ELGA's compensation time series could be a significant tool to understand the WR distribution and impact on rural areas, and furthermore to support environmental management solutions for the WR overpopulation problem of Lemnos island. The present research and the APC were funded by EPAnEk-NRSF 2014-2020; Operational Program "Competitiveness, Entrepreneurship and Innovation, Call 111 "Support of Regional Excellence" in the context of the implementation of the program: AGRICA II: AGrifood Research and Innovation Network of ExCellence of the Aegean, which is co-financed by the European Regional Development Fund (ERDF), MIS code: 5046750.

KEYWORDS: Oryctolagus cuniculus, ecosystem disturbances, food chain, agricultural crops, Lemnos

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CEST 2023

Improve the post-harvest quality of fruits based on edible natural resources

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ABSTRACT.

Edible coatings and films from natural resources from which benefit both the consumer and the environment. The primary objective of this study is to enhance the post-harvest quality of fruits using recycled edible natural resources and edible natural plasticizers, while maintaining their nutritional value, taste, and sensory properties. Edible coatings and films are a viable, eco-friendly solution for prolonging the shelf life of fresh fruit throughout the supply chain, while being cost-effective. Edible films and coatings offer a cost-effective and environmentally friendly way to extend the shelf life of fresh fruit throughout the supply chain. These are made from commonly consumed food products, including natural extracts, which interact when combined to create an effective gas barrier, making it more difficult for oxygen to enter the fruit and water vapor to escape. The rise in fascination and exploration of edible packaging is driven by two key factors: firstly, the growing desire among consumers for food that is safe, easy to handle, and remains fresh for longer; and secondly, the recognition of the harmful effects of non-biodegradable packaging on the environment

KEYWORDS: edible coatings, edible films, fruits, natural resources, plant extracts

ACKNOWLEDGEMENTS

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ANTIBIOTIC RESISTANCE

Smoothie Drinks as a Possible Source of Resistant and Biofilm-forming Bacteria

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ABSTRACT

Smoothie drinks are currently very popular drinks sold especially in fast food establishments. However, smoothies are significant source of microorganisms with high level of antibiotic resistance. The aim of the study was to evaluate the microbiological quality of smoothies purchased in Eastern Bohemia. A higher prevalence of mesophilic aerobic bacteria (5.4–7.2 log CFU/mL), yeast (4.4–5.9 log CFU/mL), and coliform bacteria (3.1–6.0 log CFU/mL) was observed in vegetable smoothies, in which even the occurrence of enterococci (1.6-3.3 log CFU/mL) was observed. However, the occurrence of *S. aureus*, *Salmonella* spp. and *Listeria* spp. was not observed in any sample. Nevertheless, a significant occurrence of resistant microbial strains was observed in all samples. The highest level of resistance was found in isolates from smoothie drinks with a dominant vegetable content (green-smoothie drinks). Considerable resistance was observed in Gram-negative rods, especially to amoxicillin (82.2%) and amoxicillin with clavulanic acid (55.6%). Among enterococci, only one vancomycin-resistant strain was detected. The vast majority of isolated strains were able to form biofilms at a significant level, which increases the clinical importance of these microorganisms and their resistance. The highest biofilm production was found in *Pseudomonas aeruginosa*, *Kocuria kristinae* and *Klebsiella pneumoniae*. Overall, significant biofilm production was also noted among isolates of *Candida* spp.

KEYWORDS: Antibiotic resistance, resistant bacteria, biofilm, smoothie drink.

PAPER ID: cest2023_00015

BEACH EROSION OF ISLAND BEACHES IN EASTERN MEDITERRANEAN (GREECE AND CYPRUS): ASSESMENT, MONITORING AND MANAGEMENT

An Example of a Detailed Beach Inventory at an Island Scale: The Case of Chios, Greece

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ABSTRACT

This contribution presents an example of a detailed beach inventory that can provide a comprehensive understanding of beach characteristics, using as a case study the island of Chios. The inventory was assembled using various sources, such as satellite imagery, optical information/tools provided by the Google Earth Pro application, online resources, and local information sources, including interviews with locals. The 'dry' beaches were digitized as polygons on the satellite imagery. Metadata production from the digitized polygons was carried out in GIS. Geospatial information (e.g., width, area, orientation), environmental characteristics (e.g. sediment texture, coastal dunes, cliffs, rivers), socio-economic parameters (e.g. beach development, touristic activity) and human intervention features (e.g. coastal defenses, port facilities) were included in the database. The spatial characteristics and other attributes of the island beaches stored in the database were statistically analyzed, to identify underlying relationships. The geographical distribution of the beach characteristics along the coastline of Chios was also analyzed. This database serves as a vital management tool, facilitating the fulfilment of relevant legal obligations of Greece regarding coastal management. Its comprehensive and detailed information supports effective decision-making and aids in the sustainable management of the island's beaches.

KEYWORDS: Beach inventory, Chios, Geo-spatial characteristics, Statistical analyses

ACKNOWLEDGEMENTS

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PAPER ID: cset2023_00299

Uncovering the Hidden Treasures: A Meta-Analysis and Map of the Monetary Value of Mediterranean Seagrass Ecosystem Services

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ABSTRACT

Seagrass meadows provide valuable services for human well-being and the economy. However, the importance of these services is often underestimated by decision-makers due to limited accessibility. To assess the value of Mediterranean seagrasses, we reviewed 386 publications, but only 13 met the criteria for statistical meta-analysis. These publications provided 74 unique observations on 8 ecosystem services. The majority of these observations focused on specific types of ecosystem services in the northwestern Mediterranean, utilizing similar methodologies. Our analysis concentrated on the economic value of seagrass ecosystem services, using standardized International dollars (Int$) per hectare in 2020 as the dependent variable in our meta-regression. The results revealed that the Gross Domestic Product per capita and the type of ecosystem service significantly influenced the variation in seagrass values. Moreover, we utilized the meta-analysis model to extrapolate the findings spatially and estimate the ecosystem services provided by seagrass meadows in the Mediterranean region. Our findings demonstrated that Italy, with a seagrass meadow surface area of 461,028 ha, possessed the highest total value of seagrass meadows in the study region, amounting to 3.4 billion Int$/2020. Conversely, Libya, with a seagrass meadow surface area of 852 hectares, had the lowest value at 2.5 million Int$/2020. When considering the cumulative value of the eight ecosystem services per unit area, Monaco had the highest value per hectare with 241,631 Int$/ha/2020, while Tunisia had the lowest with 3,298 Int$/ha/2020.Meta-analysis and benefit transfer techniques serve as valuable tools in decision-making, particularly when no existing valuation studies are available for a specific region of interest. In conclusion, our study highlights the urgent need for more rigorous research on seagrass valuation in the Mediterranean region, with a focus on the southeast areas and ecosystem services where data availability is limited

KEYWORDS: Seagrass, Mediterranean, Meta-Analysis, Ecosystem Services, Monetary

PAPER ID: cest2023_00454

Carbon market

Exploring the Potential and Challenges of a Developing Carbon Market in the Philippines

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ABSTRACT

The worldwide shift towards the use of renewable energy sources is very necessary if we are going to reduce our impact on the environment and become more sustainable over the long run. However, owing to the intermittent nature of renewable energy sources, concerns with grid management, and restrictions in the market, the incorporation of these sources into the energy systems that are already in place creates a number of challenges. The Internet of Things (IoT), big data analytics, artificial intelligence (AI), and blockchain are examples of technologies that were developed as part of the Industry 4.0 initiative and provide substantial promise for overcoming these difficulties. This article provides a detailed analysis of the role that Industry 4.0 technologies play in the integration of renewable energy sources. It does so by presenting successful case studies and investigating the constraints and problems involved with their implementation. In order to assist the wider adoption of Industry 4.0 technologies in the renewable energy industry, recommendations and potential future research paths are also offered in this article.

KEYWORDS: carbon market, Philippines, emerging
PAPER ID: cest2023_00175

Improving farming practices to reduce carbon footprint towards climate change mitigation

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ABSTRACT

The demand for kiwi is gaining traction among consumers worldwide, strengthened by consumers' growing concern for health and wellness. Although kiwi has a relatively low water and carbon footprint compared to other foods, its production could be improved to reduce climatic consequences. It is unknown whether adopting alternative farming practices will increase production while reducing carbon emissions. The goal of the kiwifruit carbon footprint project is to work towards the development of sector-specific methodologies and guidance for the measurement, management, and mitigation of GHG emissions associated with the kiwifruit product. Here we quantify the carbon footprint of alternative water management practices. A decision support system (DSS) was developed to support the management of the water resource system for kiwi production. The criteria were the quantity, the location, and the time of irrigation. We find that integrating improved farming practices lowers kiwi's carbon footprint based on irrigation practice (kgCO2eq/kg fruit) by 23.5%.

KEYWORDS Climate Change; Carbon Footprint; Carbon Market; Mitigation

ACKNOWLEDGMENTS

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CIRCULAR ECONOMY AND INDUSTRIAL SYMBIOSIS

Competencies of the Young Generation Regarding the Circular Economy

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ABSTRACT

The main objective of the research was to establish the competences possessed by the younger generation (according to self-assessment) regarding the circular economy. The diagnosis of competences required a survey, based on a proprietary questionnaire. Individuals for the study were selected at random. The sampling frame was a list from the database of the Military Complementary Headquarters, prepared for the purpose of classification for military service. In the end, 2234 people responded to the survey questions. The surveyed representatives of the younger generation have little competence in the circular economy and are aware of it. It turned out that the higher the representatives of the young generation rate their competence in the circular economy, the higher they have (according to the self-assessment) a willingness to travel abroad for work, have a greater willingness to work on a temporary basis, have greater digital competence, work and career are of higher value to them, care more about the environment, expect more mentor support at work and have higher leadership skills.

KEYWORDS: competence, circular economy, young generation.

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Toward A Circular Agriculture Approach, Though Industrial Symbiosis.

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ABSTRACT:

As the world population raise, the demand for energy, water and food is increasing as the cities becomes more developed and complex. Conversely, the Earth's resources are scarce and have a limited capacity to meet these rising needs. The implementation of modern agriculture practices rapidly improves productivity, however with a high cost in terms of resources overconsumption and unsustainable energy use. As a result, there is an urgent need to reshape the existing economic model of "take-make-use-dispose" towards a new one that focuses on "prevention-reuse-remake-recycle" in order to reduce natural resource overconsumption and restore environmental impacts. In this sense, the circular economy model is a promising approach that provide sustainable agriculture in the face of resource scarcity, climate change and environmental pollution. The circular economy strategy could be effectively applied in agriculture through: (i) the conversion of waste, including agricultural stalks and leaves, as well as livestock manure, into fertilizers rich in nitrogen, phosphorus, and potassium; (ii) the reuse of wastewater from animal production and irrigation runoff, (iii) the use biomass to produce biofuels; and (iv) waste reduction through the promotion of 3R strategies. Under the European program ClimaMed LIFE17 CCM-GR-000087, the objective of the study is to promote industrial symbiosis through the recycle and reuse of agriculture waste. What is consider waste by one organization may be consider raw material by other enterprises. Components that circulate inside a farm or a cooperative could create economic value reducing also the use resources extracted from environment.

KEYWORDS: circular economy, agriculture, industrial symbiosis

Paper ID: cest2023_00050

CLİMATE CHANGE ADAPTATİON

Evaluation Of The Impact Of Climate Change On The Supply Of Drinking Water From The Spring Of Mompiano, Brescia, Italy

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ABSTRACT

Water treatment plants are entrusted with the task of providing safe drinking water to consumers. They involve several processes that work together to create physical and chemical barriers against chemicals and pathogens present in raw water, ensuring the supply of drinking water to the public. However, these systems face various inherent challenges. Severe weather events like critical drought and flooding can impact and create significant physical, chemical, and biological, which can have important implications for the design, operation, and cost of future drinking water treatment processes. Which parameters in the processes will primarily affect the plant's operation? which decisions are informed, by different global resource management and consumption policies, will be crucial to ensure an adequate and sufficient water supply that is safe, easily accessible, and economically viable. and application of rainfall and temperature based on the context of groundwater and mixed river water sources, as well as values related to Turbidity, UV and, TOC, Nitrate (NO3), and will help managers enhance measures such as monitoring and updating water source safety management.

KEYWORDS: Drinking water treatment, climate change, turbidity, Nitrate, and Ultraviolet 254nm (UV254fAbs/m)

PAPER ID: cest2023_00437

Integrating Urban Heat Island Mitigation into Green Building Rating Systems

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ABSTRACT

Amidst the climate crisis, cities remain the foremost cause and victims of the Urban Heat Island (UHI) effect. UHI is the higher temperature observed in a city compared to nearby rural environments. The built environment, in particular buildings, are known to be highly responsible for heating up or increasing the temperature of spaces in which they are built. Due to environmental and public interest concerns, how buildings are approved and constructed should be of concern in the fight against the UHI effect and climate change. Currently, municipalities use the Green Building Rating Systems (GBRS) to analyze the environmental performance of buildings. Reviews of the GBRS show that they primarily focus on energy consumption and carbon emissions in buildings. There is no evidence that GBRS assess how municipalities monitor or regulate the heat emitted by buildings. This research is designed to empirically ascertain from architecture, engineering, and construction (AEC) professionals how municipalities can directly, through their regulatory processes or indirectly though the GBRS, gauge the heat emitted by buildings, and prescribe pragmatic mitigation measures. The study was conducted through a questionnaire survey that will be administered online via snowball sampling. The outcomes of this research should provide practical insights into how UHI mitigation can be integrated into GBRS used by governments. Such integration will add value to the broader efforts of governments to combat climate change.

KEYWORDS: Built environment; Urban Heat Island (UHI); Green Building Rating Systems (GBRSs)

PAPER ID: cest2023_00010

Desalination

Recent Developments In Solar-Powered Membrane Distillation

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ABSTRACT

Freshwater scarcity remains one of the most crucial issues facing our world. Although the traditional membrane distillation (MD) technique can efficiently produce clean water irrespective of climate conditions, the process wastes a lot of energy. Thanks to the development of photo-thermal materials, the solar-powered membrane distillation (SPMD) process has received intensive attention in the last decade. SPMD is a highly promising substitute for traditional MD, which is based on fossil fuels, as it can stop the harmful emissions impact on the environment. Combining solar energy with MD has the potential to lower the expenses associated with water purification and ensure the generation of clean water remotely. Reviewing the most current advancements of the SPMD system is essential at this point, in addition to highlighting the challenges and prospective of this technology. Based on that, the background, recent progress, and principles of SPMD, their configurations and mechanisms, fabrication methods, and various applications, along with their advantages and current limitations, are reviewed.

KEYWORDS: Freshwater, solar-powered membrane distillation, desalination, energy consumption, photothermal membranes.

ACKNOWLEDGMENTS

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PAPER ID: cest2023_00104

Water desalination using polyelectrolyte hydrogel. Gibbs ensemble modeling

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ABSTRACT

Polyelectrolyte hydrogels possess the remarkable ability to efficiently absorb large volumes of water through an osmotic membrane by exerting swelling pressure. Conversely, the insoluble cross-linked structure of the gel allows for dewatering when triggered by external stimuli such as temperature or mechanical forces. Moreover, from a thermodynamic perspective, polyelectrolyte hydrogels act as osmotic membranes, effectively preventing the passage of ions between external and internal solutions. These unique properties make these gels highly promising for desalination applications, offering an alternative to expensive membranes. In this study, we present our recent investigation into the utilization of polyelectrolyte hydrogels for water desalination. We developed a model to analyze the thermodynamic equilibrium between the gel and the supernatant aqueous salt solution. Our findings demonstrate that as the gel undergoes compression, the salinity of the supernatant phase decreases due to the release of absorbed solution with lower salinity from within the gel matrix. Furthermore, we conducted a series of simulations to replicate the continuous reduction of solution salinity until freshwater concentrations were achieved.

KEYWORDS: polyelectrolye hydrogel; simulation; desalination

PAPER ID: cest2023_00488

ECOLOGICAL EFFECTS OF ENVIRONMENTAL CHANGE

Changes İn The Value Of Ecosystem Services Due To Land Use Dynamics İn Lithuania

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ABSTRACT

Changes in land cover affect ecosystem services that are essential for human well-being. Land cover data were used to assess land cover changes in Lithuania between 1990 and 2018. In total, the area under cultivation decreased during the period under study, while the area under grassland and forest increased. The results showed that the highest value of ecosystem services is provided by cultivated land, forests, and grasslands, while the total value of ecosystem services in Lithuania decreased during the period under study due to the decrease in the area of cultivated land. The results of this study provide valuable insights into the potential for sustainable ecosystem management and restoration.

KEYWORDS land cover change, ecosystem services, assessment, Lithuania

PAPER ID: cest2023_00343

Estimating the population of wild rabbits by analyzing their impact on agricultural crops of Lemnos island

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ABSTRACT

In general, the European Wild Rabbit (WR) (Oryctolagus cuniculus) plays a key role in the ecological stability of natural areas, as it could perform various ecosystem processes and become a major prey for many predators. Nevertheless, in many areas, specific local ecological conditions may favor the growth of WR population, turning it into a "parasite", causing considerable damage to crops and natural ecosystems. In this study, we estimated the distribution of the WR population of Lemnos island, Greece using time series data of the Hellenic Agricultural Insurance Organization (ELGA), based on an 11-year (period 2011-2021) spatiotemporal analysis of the damaged crop types and areas. This crop loss provided a better comprehension of the WR food choices as they have been specialized to local conditions, combined with its population's spatial response to environmental changes and human activities, especially agricultural ones. Results showed a high density of WR population on the northeast part of the island, mainly in cultivated areas, near natural habitats and preferably within a distance from villages and small settlements. These findings have highlighted the WR ability to adapt its food choices based on local crop production and could be used towards a better decomposition of the WR overpopulation problem on Lemnos island..

KEYWORDS:

Population dynamics, Oryctolagus cuniculus, environmental disturbances, food chain, Lemnos

ACKNOWLEDGMENTS

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Emerging pollutants

Identification and quantification of organochlorine pesticides by GC-ECD in environmental matrices

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ABSTRACT

An analytical method for the determination of organochlorine pesticides (OCPs) (α-HCH, β-HCH, γ-HCH (Lindane), δ-HCH, Aldrin, Dieldrin, Endrin, DDT, DDD, DDE, Heptachlor, Chlordane, Endosulfan I and Endosulfan II) in environmental samples (wastewater, soil) uses liquid phase extraction and gas chromatography with electron capture detector (GC-µECD) quantification was developed. The analytes detection was performed on an Agilent 8890B GC system using a DB5 capillary column (60 m X 0.25 mm, 0.25 µm) for the separation of the compounds. The structural and retention time confirmation for the studied compounds was done using a ThermoTSQ 8000 Evo GC-MS/MS system with the same type of column and similar operating parameters. The extraction from wastewater samples was done using hexane as non-polar solvent in a separatory funnel. For soil samples the extraction was carried out in 50 mL centrifuge tubes using acetone as polar solvent and hexane as non-polar solvent. The repeatability and the intermediate precision of the GC-µECD method were determined. The obtained values demonstrate that the method is accurate with RSD less than15% and can be successfully applied for studied matrices.

KEYWORDS: pesticides, GC-µECD, GC-MS/MS, wastewater, extraction

ACKNOWLEDGEMENTS

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Environmental biotechnology and bioenergy

Anaerobic Co-Digestion of olive oil wastewater with municipal solid and liquid waste: An Urban-Industrial symbiosis concept

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ABSTRACT

The aim of this research was to explore the possibility for joint waste management from industry and municipality (Industrial-Urban Symbiosis (I-US)) through material and energy exchanges between municipality and industry and to improve the efficiency and environmental performance of biofuel production via such a combined waste valorization.
In particular, the production of methane from three waste streams (Olive Industry Wastewater (OIWW), Liquid Fraction of Food Waste (LFFW) and Municipal Wastewater (MWW)), through anaerobic digestion under mesophilic conditions was carried out using a 40L CSTR. The CSTR was started up with synthetic wastewater and in the sequel the feed was replaced by a real wastewater mixture. A feed composition of 91.7% MWW, 3.3% LFFW, 5% OIWW was found to be appropriate as higher percentages of OIWW proved to be detrimental to the operation of the reactor. The mixture fed to the reactor had a COD concentration of approximately 10,000 g/L and NaHCO3 was added in order to maintain the reactor pH at approximately 7.5. The HRT was initially 40d and was progressively reduced to 30d and 20d (feed flow rate of 1, 1.34 and 2 L/d respectively). The VSS of the reactor stabilized at an average of 3.4 g/L. The biogas production rate stabilized at approximately 6.3 L/d, very close to the theoretically predicted based on COD removal and the methane content was 79%. A soluble COD removal of approximately 98% was attained.

KEYWORDS: gaseous biofuels, Industrial-Urban Symbiosis (I-US), food waste, olive oil waste water, wastewater

ACKNOWLEDGMENT

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Development of an innovative scheme for the simultaneous treatment of wastewater and the condensate from drying food waste

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ABSTRACT

The objective of this work is the development of a new treatment scheme for Municipal Wastewater (MWW) along with the condensate from drying and shredding food waste. These two streams are currently collected and treated separately from each other. The new environmentally efficient treatment scheme proposed here is based on the chemical similarity of these two waste streams due to their mainly organic nature. Food waste was collected separately from households and led to a drier/shredder, where the liquid phase (condensate) is separated from the solid phase. The condensate is mixed with MWW and led to a high-rate anaerobic reactor, where both streams are treated. In this work a 77L high-rate digester, a Periodic Anaerobic Baffled Reactor (PABR) was utilized. The PABR effluent is fed in a Sequencing Batch Reactor (SBR) for further treatment until the final effluent meets the environmental criteria for safe disposal. The biogas generated from the PABR was 36.6 L/d with a methane content of 65%. The SBR operated utilizing the Anaerobic – Aerobic -Anoxic (AOA) process for simultaneous organic carbon and nutrient removal. The process generated an effluent suitable for disposal in terms of organic matter, nitrogen and phosphorus content.

KEYWORDS: Anaerobic Digestion; Food Waste; Municipal Wastewater; PABR; SBR

ACKNOWLEDGMENT

The research work was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the "First Call for H.F.R.I. Research Projects to support Faculty members and Researchers and the procurement of high-cost research equipment grant" (Project Number: 2797).

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HAZARDOUS WASTE MANAGEMENT

Evaluation Of Industrial Wastes As Active Materials In Permeable Reactive Barrier For Acid Mine Drainage Remediation

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ABSTRACT

The aim of this work was to evaluate the use of agricultural and industrial waste materials as reactive agents into Permeable Reactive Barriers (PRB) for Acid Mine Drainage (AMD) remediation. Laboratory-scale columns containing Volcanic Scoria (VS) as porous fill material and approximately 18% w/w of industrial wastes used as reactive materials were used as PRB under up-flow continuous mode treating 1.9 L AMD d^{-1}. Drinking water sludge (DWS) clearly enhanced AMD remediation because of chemical neutralization and biological sulphate reduction, which produced metals precipitation. The removal yields obtained when using DWS as reactive material ranged from 60 to 90%. Because of these results, the use of the DWS in PRBs would allow to simultaneously carry out the management of an industrial waste and the remediation of AMD through a low-cost and environmentally sustainable procedure.

KEYWORDS: permeable reactive barrier; industrial waste; acid mine drainage

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Marine environment and coastal management

Can Disinfection By Products Occur In Fish?

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ABSTRACT

Disinfection byproducts (DBPs) are a group of chemicals that can form when disinfectants such as chlorine, chloramine, chlorine dioxide or their combinations are used to treat drinking water. DBPs are formed due to the reaction of disinfectants with organic compounds present in water that act as precursors. The main categories of DBPs are trihalomethanes (THMs), haloacetic acids (HAAs), haloacetonitriles and haloketones (HANs/HKs) and nitrosamines, while several hundreds individual compounds have been identified. The occurrence and formation of DBPs in disinfected waters and especially drinking water as well as wastewater has been well documented during the last decades with a vast number of publications. Toxicological studies have also revealed adverse effects for many DBPs, leading to regulatory limits of the concentration of some categories in drinking water. However, recent research has shown that DBPs can also be present in the marine environment, due to disinfected water and wastewater release as well as due to disinfectant reactions with marine organic matter and via disinfected seawater. DBPs occurrence in fish has recently drawn particular scientific interest, and health concerns are being raised for human consumption of DBPs also through fish, as relevant research results are suggesting.

KEYWORDS: disinfection by products, thms, haas fish, analysis

PAPER ID: cest2023_00545

An Assessment of Metal Scraps Recycling and its Environmental Impact In Kano- Nigeria.

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ABSTRACT

Metal scrap recycling is the reusing of metallic items from previously manufactured product. Metal is termed as scrap when its useful service period expires or as a result of accident or other misfortunate. Metal is the only material that successfully can be recycled without losing its mechanical and physical properties. Likewise steel industries use about 30% of scrap in steel production. Kano state is the second leading industries both formal and informal are on increase. Collection and disposal of metal scrap is a lucrative business averagely on daily basis major dealers earn between N20,000 to N50,000 ($30- 75) as profit from a truck of metal scrap worth N500,000($780). However, the safety and health issues are of great concern to the people involved as no government regulations on how scavengers collect from dumps and move to major collection centres. The paper discusses the recycling of metal scrap and its environmental impact in Kano –Nigeria with a view to regulate the practice in terms of safety and health of those involved by imposing laws and regulations on handling metals scrap from dump sites to industries. Government should look into the business of metal scrap and recycling by registering all major collection centers and promulgate safety and health regulations for the centers and regular inspection by the ministry of environment at state level.

KEYWORD: metal scrap, recycling, heath issues.

PAPER ID: cest2023_00526

Calcium Peroxide (Cao_2) Granules Enclosed In Textile Materials As H_2o_2 Delivery Systems To Mitigate *Microcystis* Sp. Blooms

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ABSTRACT

While seeking environmentally friendly, efficient, and alternatives to copper algaecides *in-lake* treatments for toxic cyanobacteria, hydrogen peroxide (H_2O_2) has been introduced as the best available option because of its selective oxidation and zero waste production. However, application of liquid H_2O_2 is heavily depended on the bloom type and density and overall water quality. Overdosing with H_2O_2 has affected biodiversity in many European lakes. Calcium peroxide (CaO_2) granules are an alternative to liquid H_2O_2 due to their slow H_2O_2 releasing properties. Herein, concentrations of 0.5, 1.0, and 2.0 g/L CaO_2 granules were (i) added into a surface water matrix to investigate their H_2O_2 releasing properties, (ii) enclosed in four types (A-D) of textile materials as delivery systems to evaluate their overall oxidant releasing capacity and (iii) the optimum ones were applied on a dense *Microcystis* sp. bloom to investigate their potential to combat cyanobacteria. No difference was observed between the maximum H_2O_2 concentrations of the direct application of granules and the fabric delivery systems of types A – C, (released up to 12 mg/L H_2O_2 for 2.0 g/L CaO_2). Fabric system type D had the lowest H_2O_2 release (2.0 mg/L). Treatment experiments showed that delivery system B with 2 g/L granules and type C of 1 g/L and 2g/L were sufficient to significantly reduce the photosynthetic activity of *Microcystis*, proving that these delivery systems have the potential to become a more environmentally friendly alternative to H_2O_2. The idea of encapsulating the granules in wasted textiles of the fashion industry supports the principles of circular economy by reusing its waste.

KEYWORDS: Microcystis spp., calcium peroxide, reused textiles, circular economy

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RIVER SYSTEMS IN DIVERSE CLIMATES AND ENVIRONMENTS

Year-round assessment of water pollutants in five Greek rivers

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ABSTRACT

Globally, an estimated 80% of industrial and municipal wastewater is discharged into the environment without any prior treatment, with adverse effects on human health and the ecosystem. The current study was conducted for a year-round assessment of water pollutants in five Greek rivers (Glafkos, Assopos, Kifissos, Messapios and Rematia-Halandri). The rivers were selected based on their vicinity to municipal or industrial areas. All values of parameters determined were below permissible limits for the rivers selected. Only Kifisos River showed relatively elevated concentrations for arsenic and manganese. In Assopos River, manganese was slightly higher in spring while in Glafkos was increased in winter. Chromium in Messapios River in Evia was found to be much higher than in other surface waters. Nitrates in Rematia – Halandri were higher than the other surface waters.

KEYWORDS: pollution, river, hexavalent chromium

PAPER ID: cest2023_00581

SPATIAL ENVIRONMENTAL PLANNING

Carrying Capacity Assessment Of The South Aegean Region, Greece

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ABSTRACT

Since the early 1950's Greece has been a top travel destination providing high-quality tourism services. This was amplified by the diverse landscape, extended sandy beaches, numerous archaeological sites, people's mentality, safety, and adequate infrastructure. In particular, the south Aegean Archipelago attracts more than six million (6,000,000) visitors annually, approximately 27% of tourist arrivals in Greece. The Carrying Capacity Assessment of the South Aegean Region aims to improve the already high standards of the offered tourist services. The relevant socio, economic and physical data were analyzed to highlight the adverse effects of traditional and current activities and increase tourism attractiveness by offering alternative products, such as hiking, biking, diving, fishing tourism, archaeological tourism, medical tourism and excursions in the remarkable landscapes. Furthermore, the outcomes of the application of the carrying capacity indicators provide specialized solutions to control the over-tourism impact, mitigate the natural environmental degradation, and, finally, establish a roadmap for sustainable development of the Region. The required data (socio, economic and physical) was analyzed according to the PAP/RAC as more suitable.

KEYWORDS: Carrying Capacity Assessment, sustainable development, tourist industry assessment, South Aegean region

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SUSTAINABLE SUPPLY OF RAW MATERIALS

The Innovative Method Of Testing Solid Fuels As An Answer To Safe And Sustainable Supply Of Raw Materials –The Example Of Coking Coal Parameters

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ABSTRACT

The metallurgical coal (coking coal) has been defined as the critical raw material (CRM) in the European Union. Using that type of coal in the coking plants allows it to produce high quality steel and steel products in steel mill around the world. Coking the metallurgical coal is a really complex and demanding process. The formation of coke with high strength and appropriate reactivity depends on the composition and coking properties of the mixture. Coke reactivity testing is recognized as the primary measure of coke quality. The most important and reliable indicators are CRI (coke reactivity index) and CSR (coke strength after reactivity). The most expected values are low CRI and high CSR results. To choose a correct and safe mixture of metallurgical coals to coking procedure, an adequate tests need to be done. The CLP-B Laboratory invented and implemented a new tool that allows to calculate the possibility of adverse reaction occurrence in coking chamber based on CRI/CSR and other coals parameters.

Keywords: critical raw materials, metallurgical coal, coke, CRI/CSR, risk calculation

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Optimizing Raw Water Sustainability Through Innovative Supply Chain Management

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ABSTRACT

The global water crisis threatens not only the availability of potable water, but also the supply of fresh water for industrial and agricultural use. In order to satisfy the rising demand for water, it is essential that the basic water supply chain be managed sustainably. This study seeks to investigate current practises in the administration of the raw water supply chain and to identify areas where innovation can be implemented to enhance sustainability. The research will consist of a comprehensive literature evaluation followed by qualitative interviews with subject-matter experts. The literature review will investigate the current state of raw water supply chain management, as well as the obstacles and constraints confronted by stakeholders. The interviews will provide valuable insight into the implementation of sustainable raw water supply chain management, including the application of technology and best practises. The findings of this study will be useful for water resource administrators, policymakers, and industries dependent on a constant supply of natural water. The results will also inform the development of innovative solutions to enhance the sustainability of the administration of the natural water supply chain. This study's ultimate objective is to contribute to the global effort to assure a sustainable fresh water supply for future generations.

KEYWORDS: sustainability, raw water, supply chain management

PAPER ID: cest2023_00191

WASTEWATER TREATMENT

Removal Of Copper (II) From Aqueous Solution Using Biopolymer-Based Materials

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ABSTRACT

Pollution from heavy metals is increasingly recognized as a major threat to Earth's ecosystem. Due to the potential economic and ecological consequences, there is an urgent need to develop waste management systems and strategies for disposing of copper ions (Cu^{2+}) from the industrial sector. This research looked at the efficacy of adsorbents from the waste olive residue, namely raw olive waste powder (OWP) and sodium alginate biocomposite beads (OWPSA). Several factors, such as the medium's pH and the length of time in contact, were studied for their impact. Both pseudo-first-order (PFO) and pseudo-second-order (PSO) models have been used in kinetics research. Research into thermodynamics has revealed that Cu^{2+} adsorption was spontaneous, endothermic, and resulted from physical molecule interactions

Keywords: Heavy metal; Copper (II);Raw olive powder;Sodium alginate biocomposite beads; Adsorption process
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WATER AND WASTEWATER

SHORT-TIME NUMERICAL SIMULATION OF ULTRASONICALLY ASSISTED ELECTROCHEMICAL REMOVAL OF STRONTIUM FROM WATER

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ABSTRACT

3D numerical simulations and measurements on an electrochemical reactor were used to analyze the efficiency of strontium removal from water, with and without simultaneous ultrasound treatment. Ultrasound was generated using 4 ultrasonic transducers with an operating frequency of 25 kHz. The reactor used 8 aluminum electrodes arranged in two blocks. Strontium ions in water are modeled as particles characterized by a charge of $3.2 \cdot 10^{-19}$ C and a diameter of $1.2 \cdot 10^{-8}$ m. The numerical model was created in Flow-3D software using the basic hydrodynamic module, electrostatic module, and general moving objects module. The performance of the studied reactor variants by numerical simulations is defined by the ratio of the number of model strontium particles permanently retained on the electrodes at the end of the simulation period to the initial number of particles in the water. For the laboratory reactor, the effect of strontium removal is defined by the ratio of the homogeneous strontium concentration in the water at the end and at the beginning of the experiments.
The results show that the use of ultrasound increases the effect of strontium removal from 10.3% to 11.2% after 180 seconds of water treatment. The results of numerical simulations agree with the results of measurements on a reactor with the same geometrical characteristics.

KEYWORDS: numerical model, electrochemical reactor, strontium

PAPER ID: cest2023_00436

WATER TREATMENT

Effect Of Plant Species On The Performance Of Vegetated Buffer Strips To Treat Agricultural Runoffs

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ABSTRACT

Vegetated buffer strips (VBS), have been recognized as the most common management practice for mitigating pollution caused by agricultural runoff. They serve a transitional zone between agricultural fields and receiving waters. In this study, two VBS planted with aromatic plants and one unvegetated BS, were examined for the treatment performance of simulated agricultural runoff, under real weather conditions. Specifically, *Lavandula dentata* and *Myrtus communis* were the plant species that were established in the two systems. The effluents of examined VBS were analyzed for COD, pH, turbidity, ammonium, nitrate and phosphate concentrations. The results show that VBS can reduce nutrient concentrations compared to the influent agricultural runoff, although not all parameters showed the same level of reduction compared to the unvegetated buffer strip. The *L. dentata* system showed higher nitrate concentrations than the unvegetated system. Finally, both of the plant systems effectively reduced phosphate concentrations with lower values than the unvegetated system.

KEYWORDS: Vegetated buffer strips, agricultural runoff, diffuse pollution, nutrient removal

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AIR POLLUTION AND HEALTH

Indoor Air Pollutants In Various Workplaces

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ABSTRACT

Indoor air pollution has been listed as one of the five most significant threats to public health, according to a US Environmental Protection Agency (EPA) assessment (Brightman et al., 2008). People spend much of their time (80 to 90%) indoors (homes, office buildings, and schools), where they are exposed to a complex mixture of air pollutants. High concentrations of volatile organic compounds (VOCs) and particular matter (PM) negatively affect indoor air quality (IAQ), human health (Lahtinen et al., 2004), and well-being (Frontczak and Wargocki, 2011; Lukcso et al., 2016). Over the years, the anthropogenic sources of emissions have increased dramatically due to industrial development, and their overall emission balance has increased, as almost every human daily activity, such as cooking, cleaning, painting (making paints), smoking, driving motor vehicles, *etc.*, contributes to the emissions of VOCs (Zhang et al., 2017). Also, there are emissions from various materials, including building materials and their additives, such as floor coverings (Uhde and Salthammer, 2007; Vuetilovoni, 2015), as well as from consumer products such as cleaning products, air fresheners, perfumes, cosmetics, and personal care products (*e.g.*, hair dyes) (Kansal, 2009; Lerner et al., 2014), pharmaceuticals, varnishes, and insecticides (Reinikainen and Jaakkola, 2003), but also from incoming polluted ambient air (Kotzias, 2021; Uhde and Salthammer, 2007; Vuetilovoni, 2015). Technical factors like insufficient outside air supply for heating, ventilation, and air conditioning systems, high building humidity (Wolkoff, 2018), high temperature, high levels of dust, inadequate lighting, and the presence of mold or fungi are among the main factors that worsen the effects of poor IAQ and increase actual pollutant concentrations (Bergström et al., 2013; Herbig et al., 2016). An additional and crucial factor for the overall quality of the enclosed environment is energy conservation in houses and public buildings. The requirement to develop airtight structures resulted in an increase in IAQ due to the accumulation of atmospheric contaminants in the inside environment. The requirement for producing consumer goods and building materials with low emissions, along with the adoption of adequate ventilation, is considered imperative.The risk to human health of many chemical compounds present in indoor air is largely unknown and difficult to predict due to the lack of toxicological data and information on dose-response characteristics in humans or animal models. Besides, with the recent Covid-19 pandemic, the importance of IAQ in crowded environments has become apparent. Undoubtedly, VOCs and PM are part of people's daily lives since they arise from different activities of human everyday life (Lafond, 2015). The latter gaseous pollutants have long- and short-term effects on human health and the environment since some of them are dangerous and harmful and cause issues with both (Zhang et al., 2017). Also, the respective emissions contribute to atmospheric pollution by triggering the production of secondary organic aerosols (SOA).

KEYWORDS: air quality, pollutants, closed environments, sorbent tubes, TD-GC-MS

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BIOPLASTICS

Effect Of Cycle Duration And Sludge Retention Time (SRT) In The Enrichment And Accumulation Of Phas In Synthetic Medium

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ABSTRACT

Progress in the implementation of polyhydroxyalkanoates (PHAs) as a viable option, for single-use packaging has been attained recently. Mixed Microbial Cultures (MMCs) have been tested extensively to produce PHAs due to their potential in reducing costs both by utilizing organic wastes as feedstock and by minimizing aseptic conditions. Replacing single-use petrochemical plastics with materials manufactured using organic wastes could be a significant step in the advancement of circular economy. Optimization of MMC enrichment in PHA producing microorganisms is crucial for the maximization of PHA production. Feast and Famine conditions are usually selected for PHA producing organisms. Draw-fill reactors were used using 3.5 days cycles and Sludge Retention Time (SRT) of 7 days to simplify the enrichment procedure. The biomass was enriched with PHA producing microorganisms with Organic Loading Rates of 50 and 83 Cmmol/day. Growth conditions with and without aeration were tested.

Accumulation of PHA bioplastics was also carried out using Draw and fill reactors with the enriched biomass to obtain product above 40% by weight of cell mass. The production was validated gravimetrically and qualitatively with Nile Red microscopy. Extraction with chloroform was performed to obtain films. COD, VFA and ammonia measurements were performed to elucidate the process. Biomass growth of 0.43 g/(LxD) was achieved using 83 Cmmol/day, while growth using 50 Cmmol/day was insignificant. Aeration was found to be imperative for growth. Strategies for process optimization are discussed.

KEYWORDS: polyhydroxyalkanoates; circular economy; bioplastics; mixed microbial cultures
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Acclimation of microbial consortia on acidogenic effluents for enhanced production of polyhyrtoxyalkanoates.

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ABSTRACT

The aim of the present study was to develop efficient MMCs via their acclimation to a mixture of volatile fatty acids, sugars, and lactate i.e. the acidogenic effluents of a hydrogen-generating bioreactor processing food wastes. Acclimation was conducted under sequential carbon (C) and nitrogen (N) limitation in draw fill reactors with organic loading 3 g/L (in terms of the chemical oxygen demand (COD)) in the C phase and ammonium chloride as N source in the N phase. Two DFRs were operated simultaneously with different carbon-to-nitrogen ratios (C/N) i.e. 10 g COD/g N-NH4+ and 50 g COD/g N-NH_4^+ and differences in the operational efficiency and microbial structure were assessed. Subsequently, batch experiments were conducted with both of the acclimated MMCs and with different initial substrate concentrations (6 -24 g COD/L) and different C/N ratios (50-200 g COD/g N-NH_4^+). It was shown that the feeding strategy during acclimation resulted in the domination of different microbial genera of Betaproteobacteria and affected greatly the yields and production rates of PHAs at batch mode, with the highest obtained yield exceeding 0.7 g PHAs/ g microbial biomass.

KEYWORDS: polyhydroxyalkanoates, acidified food wastes, mixed cultures, microbial dynamics

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Review of Common Bioplastics' Degradation Potentials in Biogas Plants

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ABSTRACT

Plastics are widely used in our daily lives and they result in various negative effects on the environment. Management of plastic waste is also problematic due to insufficient collection, low yields with recycled materials or externalities caused by other waste management systems such as landfilling and incineration. Hence the need for new type of a material arose and bioplastics were proposed as alternatives to 'conventional' plastics. Although the name suggest that these materials are biodegradable, some of these bioplastics are composed of materials that are of biological origin, but they are not degradable. In some cases they are composed of non-biological materials but still can degrade better in the environment. These bioplastics are generally utilized in food packaging, waste collection bags, single use items and their use in various other products and packaging materials are increasing over time. These materials were reported to have degraded in composting facilities however, their degradability in biogas plants is also under question by researchers around the world. Since organic fraction of municipal waste could possibly contain these materials and they can end up in both types of plants. The most common ones of these bioplastics are polylactic acid (PLA) and starch based bioplastics. These bioplastics are commonly found in products that are used in daily routines and especially some starch based materials are officially used in waste collection systems for organic wastes in municipal solid waste stream in some countries. This review summarizes the degradability of PLA and starch based polymers in biogas plant conditions and in anaerobic conditions, in order to hypothesize their degradability in commercial biogas plants. PLA materials were not degradaded under plant operational conditions whereas stach materials were degraded in thermophilic conditions to an extent. The material compositions have affected the degradability as well as the operational conditions of the plants and innoculum. Potential for enhancement of the biodegradability of these bioplastics via certain methods are also listed. Overall, the degradability of certain polymers points out to the fact that not all bioplastics are degraded in biogas plants. This is likely since they do not always degrade in other waste management systems as well and require certain conditions for degradation, depending on the type of the polymer and the blend of polymers and additives.

KEYWORDS: Bioplastics, Biodegradability, Biogas, Anaerobic Digestion, Waste Management

PAPER ID: cest2023_00156

CIRCULAR ECONOMY AND BIOECONOMY

Research On The Possibilities Of Evaluation And Recovery Of Sludge From Sewage Treatment Plants From The Perspective Of Circular Economy

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ABSTRACT

The characterization and recovery of sludge from sewage treatment plants involves understanding its composition and implementing strategies to extract valuable resources from this byproduct. Sludge characterization helps identify its properties, including organic and inorganic content, contaminants, and potential for resource recovery. Recovery processes focus on extracting energy, nutrients, and other valuable materials from sludge, contributing to sustainable waste management practices. Characterization of sludge involves assessing its physical, chemical, and biological properties. This includes determining the moisture content, organic matter content, nutrient levels, heavy metal concentrations, and presence of pathogens or other contaminants. Through detailed characterization, treatment plants can optimize their processes and implement suitable recovery techniques. Recovery of sludge offers several benefits. Energy recovery can be achieved through anaerobic digestion, where organic matter is decomposed by microorganisms to produce biogas, a renewable energy source. Alternatively, sludge incineration can produce heat or power. Nutrient recovery is another important aspect, as sludge can be a valuable source of phosphorus and other essential nutrients for agricultural use. Additionally, innovative techniques like pyrolysis and hydrothermal carbonization are being explored to recover resources such as biochar and carbon-based materials from sludge. The characterization and recovery of sludge from sewage treatment plants are essential for sustainable waste management. By understanding its composition and implementing recovery processes, valuable resources can be extracted, including energy, nutrients, and other valuable materials. These efforts contribute to minimizing waste, promoting resource efficiency, and mitigating environmental impacts associated with sludge disposal. This study provides an overview of the characteristics, management, and potential uses of sewage sludge.

KEYWORDS: *SLUDGE, MANAGEMENT, VALORIZATION*

ACKNOWLEDGEMENT

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ETV İn Support Of The Specific Objectives Defined By The Italian National Strategy On The Circular Economy

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ABSTRACT

The LIFEproETV project promotes ETV verification as a valuable tool that can support the market uptake of innovative environmental technologies in different sectors.

The strategies to be implemented to enhance ETV and strengthen its value in terms of market attractiveness are outlined in a Roadmap, a document that defines the paths for achieving the objectives mentioned above in relation to the main challenges of specific national and sectoral contexts on key environmental issues. The Roadmap was based on country oriented promotional areas, different for Poland, Hungary, Spain, Italy and Slovenia. The Italian challenge, presented in this paper, was the definition of ETV as a policy support tool oriented at the supporting the specific objectives defined by the Italian National Strategy on the Circular Economy. According to the challenge, the main goals to be achieved are strictly linked to some specific Objectives of the Italian National Strategy on the Circular Economy. After the definition of the problems/barriers, the key stakeholders and the actions were identified.

KEYWORDS: Environmental technologies, Innovation, Circular economy, Technology verification, Roadmap

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The Art Of Possible In The Nexus Of Planetary Engineering

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ABSTRACT

Planetary Engineering disciplines is considering the future for engineer all kinds, as well as process engineers' sciences. A new discipline that must directly connected with the extra-terrestrial environments should be involved in the advanced green chemistry, environmental engineering, chemical engineering, soil engineering and process engineering curriculum. It also refers to the deliberate and large-scale manipulation of a planet's environment to address numerus challenges or improve its habitability. In general and without limitation, the concept primarily focuses on our planet (Earth), but it could potentially be applied to other planets or celestial bodies in the future. The paper will to motivate and guide the next generation of engineers in Planetary extraterrestrial environments considering the circular economy principles

Keywords: Planetary Engineering, extra-terrestrial environments

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CLIMATE CHANGE IMPACTS, VULNERABILITY AND RISKS

Assessing the Effects and Dangers of Climate Change on the Environment and Society of the Philippines

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ABSTRACT

The Philippines is one of the most susceptible nations to climate change's effects. It is anticipated that the frequency and severity of extreme weather events such as typhoons, floods, and droughts will increase over the next few decades. This thesis seeks to evaluate the environmental and social hazards posed by climate change in the Philippines. Examining the current and projected effects of global warming on critical sectors such as agriculture, coastal zones, and human health. The research methodology will include a literature review, data analysis, and case studies. This study's findings will provide crucial insights into the resiliency and vulnerability of the Philippine community to the effects of climate change. This research will contribute to the development of adaptation and mitigation strategies that will assist the nation in building resilience and reducing the risks associated with global warming. This paper will be of interest to policymakers, academics, and practitioners working in the field of climate change and sustainable development.

KEYWORDS: climate change, Philippines, emerging

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DRINKING WATER AND HEALTH

Study Of Iodo-Haloacetic Acids Using SPME-GC-MS/MS In Chlorinated Water

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ABSTRACT

The aim of the study was to develop, optimize and validate an analytical method for the simultaneous identification of iodine haloacetic acids (I-HAAs) drinking water using the technique of Gas-Chromatographic separation coupled with mass spectrometry (GC-MS/MS). The sample screening an analytes detection was performed on an Agilent 7890B gas chromatograph coupled with an Agilent 7010B triple quadrupole mass spectrometer (MS/MS). The separation of the compounds was achieved using a VF-1710 column (30m x 250mm x 0.25mm). Elution was performed with helium, 1 mL/min, with oven operating at folowing program: 35°C (6 min), 10 °C/min up to 220°C (6 min). For the extraction of I-HAAs from water samples, Solid Phase Microfiber Extraction (SPME) with arow 1.1 mm 120 µm Divinylbenzene/Carbon Wide Range/Polydimethylsiloxane (DVB/C-WR/PDMS) fiber was used.

KEYWORDS: I-HAA, SPME-GC-MS/MS analysis, drinking water.

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HEAVY METALS IN THE ENVIRONMENT

Speciation of inorganic and organic arsenic forms using HPLC-ICP-MS technique in aqueous matrices

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ABSTRACT

The aim of the study was to develop, optimize and validate an analytical method for the simultaneous detection and quantification of As species (As (III), dimethylarsinate (DMA), monomethylarsonate (MMA) and As (V)) from various water matrices (drinking water, surface water and groundwater) using the technique of high performance liquid chromatography coupled with inductively coupled plasma mass spectrometry (HPLC-ICP-MS). The separation of the species was achieved using an Agilent G3154-65002 precolumn, 4.6 mm x 10 mm, and an Agilent G3154-65001 column, 4.6 mm x 150 mm, at ambient temperature. The mobile phase used was 1M NaH_2PO_4 and 0.1 mM EDTA-2Na solution at a flow rate of 1 mL/min. Linear regression lines were drawn in the range 10-50 µg/L, the coefficients of determination (R^2) obtained for each species were higher than 0.99. The quantification limits (LOQ) varied in the range 1.8 µg/L As(V) to 2.0 µg/L As(III), and in the range 3.9 µg/L DMA to 4.1 µg /L MMA for all studied matrices. These limits allow the quantification of As species in drinking water samples, surface water and groundwater at the trace level.

KEYWORDS: As species, HPLC-ICP-MS, detection, organic and inorganic forms

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Trace Metals in the water column of the coastal zone in the Red Sea and the Gulf of Aqaba

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ABSTRACT

In this study trace metals concentrations in the water column are presented along the coastal zone of the Gulf of Aqaba and the Red Sea (Saudi Arabia). This is a baseline assessment of the metal pollution status of the water using trace metals (Cd, Co, Cr, Cu, Ni, Pb and Zn) measurements obtained at 69 sampling stations along the coastal zone of the Saudi Arabia in June–July, 2021. Spatial variability was observed with higher concentrations to be recorded in Al-Shuqaiq, and Jeddah lagoon waters. The metal concentrations were linked to the different anthropogenic pressures in the coastal zone of the Kingdom of Saudi Arabia. This is the first research extended throughout the Saudi coastline, giving the baseline information of the metal pollution in the water column. The study was carried out under the framework of Task 6 (Field Surveillance) of the MCEC project (https://mcep.kaust.edu.sa/).

KEYWORDS: Coastal marine environment of Saudi Arabia; trace metals; Red Sea; Gulf of Aqaba.

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LIFE CYCLE ANALYSIS (LCA)

Boosting Climate Resilience And Reducing Agricultural Carbon Footprint Using LCA Methodology

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ABSTRACT

Agricultural Life Cycle Assessment (LCA) is an excellent tool for evaluating and analyzing the production- and operating cycle of agricultural products at different stages of the agricultural system. Based on the life cycle approach, it provides a summary of agriculture's impact on the environment, which is an effective tool contributing to the sustainability and green growth of the agri-food sector. In recent years, LCA has been widely used in the agroecosystem for resource- and environmental impact analysis. However, there are still some challenges in agricultural LCA, one of them being data quality, an issue of utmost importance in LCA studies. In this study, we collected and created a database on a peach crop in order to evaluate the impact farm practices have on carbon footprint. In more detail, we applied crop protection practices, based on precision farming principles, in two different fields of peach trees in the Imathia region. The results have shown that this practice lowers the peach carbon footprint, based on protection practices (kg CO2eq/1000m2) for 38,5% and 45,2% for the two fields respectively.

KEYWORDS: LCA; Carbon footprint; Environmental sustainability; Mitigation

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MICROPLASTICS IN WATER TREATMENT: FATE, TOXICITY ASSESSMENT AND REMOVAL TECHNOLOGIES

AKANoah Student Team experience: microplastics analysis technics on the Po River environment

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ABSTRACT

AKANoah PoliTo is a student team from Politecnico di Torino which aims to design an environmental monitoring strategy for the urban river ecosystem and a plastic waste collection system. Data gathering and analysis are key for monitoring, mitigating, and preventing pollution of such a pivotal resource as the river environment, as pointed out by the 2030 Agenda. The urban context is a critical hotspot of pollution because its high-density population leads to multiple types of contamination, such as stormwater discharges, accidental releases, littering and irresponsible use of the river infrastructure by locals. Furthermore, surface watercourses collect different pollutants along their path, becoming a very important matrix to be monitored.The project focuses on developing and testing both the procedure and the proper instrumentation to carry out water quality assessment, microplastic sampling and macroplastic cleaning tasks, following the principles of efficiency, low environmental impact, and replicability. The monitoring and collection strategy proposed by AKANoah is a fast, efficient, and easily repeatable boat-based solution which combines macroplastic river cleaning and data acquisition on micro and macro pollutants. This strategy is intended to bring a positive impact on both the local community and the ecosystem. It also has the potential to open new opportunities for city businesses and to bring educational values not only to students directly involved in the project but also to the citizens who benefit from a healthy, thriving urban river environment and its related ecosystem services (leisure activities, urban parks, storm flows regulation).

KEYWORDS: Microplastics, River environment

PAPER ID: cest2023_00075

RENEWABLE ENERGY SOURCES

Renewable energies and energy efficiency in the Indonesian textile sector – opportunities and challenges

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ABSTRACT

The Indonesian textile industry faces fundamental challenges regarding legal international and national requirements on sustainable production, as it has to deliver significant decarbonisation of their production. Energy consumption is one part, which is tackled exemplary by the EnaTex project (2021 – 2024), funded by German Ministry of Research and Development. This paper gives an overview of possible approaches for energy savings and implementation of renewable energies to replace fossil energies in power and heat by research activities in cooperation with fully integrated textile factories in Indonesia. The factories use mainly hard coal as fuel to generate steam and thermo-oil as process heat and are 100% supplied by electricity grid which is powered by 85% with fossil fuels. The novel approach, adapted for the textile industry, focus on recycling of waste heat with the method of process integration, using the Pinch analysis method to determine possibilities to save fuel. This approach is the base to substitute coal by implementation Renewable Heat and Power in a subsequently step. Within this analysis co-firing of local solid biomasses and production of biomethane from organic residues and sewage are being investigated as solutions. Further aspects are provision of green energy by means of PV and green hydrogen.

KEYWORDS: textile industry; waste heat utilisation, renewable energies; energy efficiency.

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GREEN ENERGY TRANSITION OF SERIFOS – PRESENTATION OF THE KEY ANALYSIS SCENARIOS

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ABSTRACT

The issue of reducing the carbon footprint of energy use has become an absolute priority due to climate change. Green energy transition is considered even more necessary for islands that are not interconnected islands due to the high operating costs and high pollution of the NPPs of these islands. AT the same time, the problem of high fluctuations in demand due to tourism is another parameter that supports this direction and recent years several actions have been implemented to support the green transition of islands in Greece. A case in point is GrEco Islands, a national initiative to boost the green economy, energy independence, digital innovation and low-carbon transport. These actions include the increased use of renewable energy sources, the creation of digital infrastructure, the promotion of energy efficiency, the implementation of sustainable waste and water management practices, as well as the encouragement of electric mobility. transformation of the agriculture and tourism sectors.The University of the Aegean together with collaborating researchers studies "Sustainable Development of Serifos" and examines the issue of the green transition in a universal and holistic way. The purpose of this specific research is to study the green energy transition of Serifos at two different levels of analysis: 1) The general scenario - The analysis of the total energy consumption of the island and the modeling of green transition scenarios through the installation of RES parks. 2) The analytical scenario - The analysis of specific solutions to reduce the energy footprint in uses of different energy intensity. This scenario aims to categorize the different uses (transport, residential buildings, industries) and present individual solutions that can be adapted to each specific category.The general scenario aims to calculate the overall footprint of the island and intends to analyze different scenarios of penetration of RES into the island's electrical network, proposing different alternative scenarios of RES installation with different dimensions. The general scenario will use energy use data from the DEDDIE reports and the available RES production permits that exist for the island. The analytical scenario will take into account the building infrastructure of the island and the research will be assisted by primary energy consumption data from selected buildings with different levels of energy intensity. The selected applications - case studies will act as a guide for the green transition of the criteria of the same category and intensity. This study recorded the building potential of the island and categorized the buildings according to uses and energy intensity. In addition, the energy demand of the island has been calculated and RES installations are modelled to assess the reduction of carbon emissions and the utilization of fossil fuels for energy production. The critical point is the installation of RES systems that will allow the undisrupted electrification of the island, while utilizing solely one 1 MW diesel ICE.

KEYWORDS: green islands, renewable energy, energy modelling, energy analysis, green transition
PAPER ID: cest2023_00571

Preliminary Evaluation Of The Shallow Geothermal Potential For Heating And Cooling And Study Of Its Economic Impact: A Case Study In The Sant'Eufemia Plain, Calabria (South Italy)

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ABSTRACT

The use of renewables is of paramount importance for sustainable development and economic growth, helping to reduce greenhouse gases emission worldwide (Moya et al. 2018). Among the renewable technologies available nowadays, geothermal systems represent one of the most effective and clean solutions (Rybach and Mongillo, 2006; Zhu et al., 2015). Among the numerous geothermal utilisation (e.g., energy production, district and greenhouse heating, aquaculture, climatization, bathing, etc.), geothermal heat pumps, fed by ground-source heat exchangers (GSHEs), have the most extensive geothermal use worldwide (Lund & Toth, 2021). GSHE systems can be developed as a vertical closed-loop system (i.e., borehole heat exchanger, BHE), or as an open-loop system (i.e., groundwater heat exchanger, GWHE), using the ground- or surface-water as vector fluid. Although BHE can be developed virtually anywhere (Chow et al., 2011; Florides et al., 2007; Omer, 2008), a detailed understanding of the geological, stratigraphic, hydrogeological, and thermophysical properties of the underground, coupled with the climatic conditions and the building-climatization requirements, are needed to avoid inadequate system design (i.e., over- or under-estimation of the geothermal plant) which can lead to high economic costs and poor efficiency (Casasso and Sethi, 2016). Calabria Region represents one of the most interesting areas, from the geothermal point of view, of the entire Mediterranean sector due to its peculiar geological, hydrogeological, and structural settings. The Calabria Region generates about three times the electricity it consumes (5.7% of national electricity) through natural gas and hydraulic energy. However, this element has not led to savings on electricity costs, contributing significantly to the causes that induce the lowest value of ITALY's GDP.In response to this, in the frame of the PNRR 2023-2026 projects *(**Tech4You**, **ECS**: 00000009; **CUP:** H23C22000370006),* a detailed reconstruction of the geothermal potential of the Calabria Region represents a needed milestone. The project aims to characterise from the hydrogeological, thermophysical, and geochemical points of view the main urbanized areas to provide a decision-aid tool for the direct use of low-temperature geothermal energy for heating and cooling purposes. In this context, this work aims to provide a reliable evaluation of the shallow geothermal potential for exploiting GSHEs coupled with heat pumps in one of the pilot areas, the Sant'Eufemia Plain (where about 100,000 people live). The investigation revealed that the crystalline bedrock and the saturated conditions of the sedimentary infill mainly control the heat-exchange potential. A general increase in thermal conductivity, specific heat extraction, and geothermal potential have been mapped moving to the north side of the plain, where the crystalline basement outcrops or approaches the surface. The geothermal potential of the investigated Sant'Eufemia Plain is between ~3.0 and ~15 MWh y-1. The average depth to be drilled to supply a standard domestic power demand of 4.0 kW is ~70 m (ranging from 45 to 127 m all over the valley). The final acquired data will be processed with GIS and geostatistical software to define geothermal thematic maps. The project's data will support the decision-making and management phases of the future exploitation of geothermal potential.

KEYWORDS*: borehole heat exchangers; geothermal potential; shallow geothermal energy; thermal conductivity; specific heat extraction; Sant'Eufemia Plain; Calabria.*

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Exploring the Potential of Renewable Energy Sources in the Philippines: Challenges and Opportunities

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ABSTRACT.

The Philippines, an archipelago with significant renewable energy resources, might switch to a sustainable energy system. This report examines the Philippine energy environment, identifies renewable energy sources, analyses renewable energy development problems, and offers solutions and policy suggestions. The paper emphasizes the importance of addressing technical, financial, regulatory, and social challenges to accelerate renewable energy development and deployment to improve energy security, environmental sustainability, and socio-economic development.

KEYWORDS: Philippines, renewable energy, potential, policy proposals

PAPER ID: cest2023_00173

Plastic To Microplastic In The United Arab Emirates – Plastic Bottle Caps In A Hot, Arid Environment

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ABSTRACT

The degradation of plastic bottle tops as a common contributor to plastic waste in the environment was assessed under the hot, arid conditions of the hinterland of the United Arab Emirates. 500 bottles tops were collected from 5 different locations in the Al Ain area and their surface oxidation index was determined through FT-IR measurements. The hardness of pristine bottle tops and bottle tops aged in the environment was compared.

KEYWORDS: secondary microplastics, plastic bottle tops, surface oxidation index, degradation, plastic hardness

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SUSTAINABILITY & THE SDGS

Experiential learning as a strategy for reducing household food waste among young Greeks

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ABSTRACT

Food waste is a contemporary challenge with impacts on the environment, economy, and society. Every year 1/3 of the food produced is wasted, where the households are responsible for 53% of the total food waste. In Greece, 87 kg of household food waste are produced per inhabitant/year. Youth are among the high food waste producers. This pilot study aimed to investigate whether experiential learning can stimulate pro-environmental behaviour for household food waste prevention among young people (aged 18-21 years) in Greece. The qualitative research method was used which was divided into four-phases; a minor questionnaire, two focus groups and an intervention. The focus groups approach was based on the consumption characteristics of Greek consumers. Experiential learning was used as the intervention method to develop food waste prevention skills. It was found that the participants were interested in gaining practical knowledge and cooking skills for food waste prevention as they found it is an important issue. They had theoretical knowledge and understanding on food waste prevention, which was gained through family practices, awareness campaigns, and on the Internet. However, they lacked practical knowledge. The participants, through focus group discussions, reshaped their thought process on food waste prevention. The experiential learning intervention provided useful skills and practical knowledge, that will help them reach the target of food waste prevention.

KEYWORDS: Food waste prevention, SDG's, experiential learning

Paper ID: cest2023_00405

Mathematics for Optimal Design of Sustainable Infrastructures

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ABSTRACT

The main objective of this work is to show how mathematics, particularly the combination of modelling, numerical simulation and optimization, is a useful tool in the design of sustainable infrastructures. To do it, we clarify what we understand by systems optimization and present three interesting environmental problems (related to sustainable infrastructures) we have studied in the last decade and that fit well in this framework: the design of a river fishway to help migratory fish to climb a dam, the design of an irrigation channel to minimize sedimentation and erosion, and the management of an urban road network with an environmental perspective. Finally, we briefly discuss on some conclusions which can be drawn of this work.

KEYWORDS: Sustainable Development Goals, Systems Optimization, Modelling, Numerical Simulation, Optimal Control
PAPER ID: CEST2023_00380

SUSTAINABLE SUPPLY OF RAW MATERIALS

Cheese Whey Valorization For The Production Of *Arthrospira* (Spirulina) *Platensis* Growth In The Context Of Circular Economy

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ABSTRACT

Cultivation of microalgae with the addition of wastewater and carbon dioxide (CO2) could be a cost-effective treatment method which at the same time provides essential nutrients for biomass production and reduces CO2 emissions. The potential use of cheese whey for Arthrospira (spirulina) platensis cultivation could provide a sustainable solution aligned with circular economy principles for the treatment of dairy industry wastewater, in regions such as North Aegean (Greece). The main objectives of this research are to investigate the parameters affecting the growth of Arthrospira platensis biomass in whey-rich solutions with the addition of CO2 using an airlift vertical plate photobioreactor. During the first two experimental sets (14 days each), the effect of different whey dilution ratios and irradiation conditions on biomass productivity were studied and the results show that the 10% (v/v) whey cheese concentration performed best in both experimental lighting sets, continuous light/dark cycles. The highest biomass production (1.06 g l −1) was achieved in 14-day experiments at pH 10.5 and with a 12-h dark/light photoperiod. In the light/dark cycle culture, about 85% COD removal and 70% NO−3 − N consumption was measured.

Regarding the third experimental set using CO2, the results show that the addition of 1mL CO2/min lead to better performance in terms of optical density. It seems that CO2 accelerates the production of Arthrospira platensis in a short period of time and provides long-term environmental benefit.

KEYWORDS: Cyanobacteria, Dairy waste, Light/dark cycles, Continuous illumination, circular economy

PAPER ID: cest2023_00596

Physicochemical And Spectroscopic Characteristics Of Compost From Vineyard Waste And Wine Lees Valorization

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ABSTRACT

The present study deals with the analysis of chemical and spectroscopic characteristics of compost as a valorization product of vineyard and winery wastes within circular economy.The C/N ratio showed a stabilized compost. HA was increased at the final stage and low E4/E6 values denoted a mature compost.

KEYWORDS: compost, wine lees, humification

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Evaluation of a new technology for increasing the quality of a compost

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ABSTRACT

Composting is a treatment process that transforms biodegradable organic waste into compost, a product rich in essential nutrients used as a fertilizer, an advantageous procedure with a good impact on the environment.

In collaboration with the companies G.A.I.A. S.p.A (compost producer) and TOSO S.r.l. (conveyor producer), the following actions were decided to improve the compost treatment process in its final refining step. where, three fraction are produced: > 50 mm (containing plastic films and paper), <12 mm (stocked for market), and < 50 mm > 12 mm This last fraction is used as inoculum because rich in bacteria for organic biodegradation but it still contains a significant amount of plastic film, which thanks to the recirculation as inoculum continues to remain in the process.

To propose a plant solution, this compost fraction was characterized and the efficiency of a deplasticizer machine equipped by a conveyor belt, beater rollers and aspirator was analysed. The fine clean material falls through the mesh, and it is separated from the coarse impure material. The results thus obtained were satisfactory with the recovery of more than 10% of the of fine clean compost and very low percentages of unwanted substances.

KEYWORDS: organic, compost, impurities, conveyor belt, aspiration
PAPER ID: cest2023_00379

URBAN ENVIRONMENT AND HEALTH

Vulnerability of Informal Settlements to Flood Disasters: A Review of Public Health Implication

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ABSTRACT

Floods are the most frequent disasters in the world with devastating effects on millions of people and the natural environment. The health status of any community is directly affected by the quality of their housing and the environmental risks they are exposed to. Rapid urbanization and the inability of the government to meet with the high demand for housing has led to the formation of informal settlements resulting in the unsustainability of cities due to overcrowded housing, poor sanitation, poor collection of solid waste, blocked drainage system as well as poor healthcare and compromised healthcare delivery system. The impact of floods on informal settlement dwellers is becoming increasingly severe and frequent. Using multiple data sources, this study critically evaluates eThekwini metropolitan area. The review shows that eThekwini has the largest number of informal settlements in south Africa characterized by poor housing conditions, inadequate infrastructure, unhealthy natural environments and poor health services predisposing them to increased risk of diseases and poor wellbeing, which is exacerbated during flood disasters. The findings of this study advocate for improved governmental involvement in service delivery, risk informed decision-making concerning floods, public health and affordable housing for residents of informal settlements in eThekwini metropolitan area.

KEYWORDS: Floods; Healthcare; eThekwini Metropolitan area; Informal settlements; Environment.

PAPER ID: cest2023_00059

WASTE MANAGEMENT AND TECHNOLOGIES

EVALUATION OF BIOMETHANE POTENTIAL OF PETROCHEMICAL SLUDGE AFTER PRETREATMENT

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ABSTRACT

Increasing energy needs are expanding the demand for new and clean energy sources, particularly in the energy intensive industries. Biogas production is both an energy source from waste and a method used for waste disposal in order to improve existing processes and spread green energy applications. Biogas can be used to produce heat and electricity. Furthermore, it can be used as a substitute of natural gas or as a fuel in vehicles for transportation after up-grading. This study examines the laboratory-scale production of biogas from a pretreated sludge of a petrochemical industry. Petrochemical industry sludge is a difficult substrate to digest without application of a well-defined pretreatment method(s). In this study, batch scale experiments are conducted to investigate the biogas and methane production potential from a pretreated petrochemical industry wastewater sludge. Co-digestion of pretreated sludge is also investigated to obtain higher methane yields. Ozone and ultrasound pretreatment techniques are applied to petrochemical sludge prior to anaerobic digestion.

KEYWORDS: Anaerobic digestion; Biogas; Petrochemical sludge; Pretreatment;

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WASTEWATER TREATMENT

Wastewater surveillance of pharmaceuticals and drugs of abuse in Attica, Greece over the post COVID-19 period with LC-MS/MS

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ABSTRACT

The COVID-19 pandemic had a significant impact on many aspects of people's lives globally . Habits, lifestyle, behavior, health, and economy were strongly affected. Moreover, this impact has also appeared in the use of pharmaceuticals and drugs of abuse by the examined society. Consequently, it is crucial to provide information about the consumption changes that appeared in the community. Thus, wastewater analysis can help gain the aforementioned information. Wastewater-based epidemiology (WBE) is a well-known technique that gains popularity in the public health and environmental science communities, providing valuable insights into the lifestyle and behavior of the society with high spatial and temporal resolution. WBE works as a mirror of society and can detect changes that appear in it. Since every consumed compound is excreted via urine and feces, can be driven through the sewage system to a Wastewater Treatment Plant. That means, that every change in chemical consumption can alter wastewater. This alteration is of great importance and can be identified by wastewater analysis.

Many studies conducted in the pre-COVID-19, COVID-19 ,and post-COVID-19 periods have shown an increase in the use of pharmaceuticals and drugs of abuse which can be justified due to the strict measures of lockdown that many countries enforced. Ongoing research for these substances is really important to identify trends in usage patterns. Furthermore, pharmaceuticals that appear in the sewage system can pose a risk to the environment meaning that the science community should be alert to detect them and take measures to change the situation if things go out of control.

This study aims to monitor pharmaceuticals and drugs of abuse in Attica, Greece over the post-COVID-19 period to provide a clear insight into the consumption of these substances and correlate them with the COVID-19 pandemic, employing Wastewater-based Epidemiology. To achieve those aims, a method was developed and validated for the simultaneous detection of pharmaceuticals and drugs of abuse. Thereafter, influent wastewater samples were collected from the wastewater treatment plant which is in Attica, Greece, and analyzed with LC-MS/MS using SCIEX Triple Quad 5500 system.

KEYWORDS: pharmaceuticals, drugs of abuse, wastewater-based epidimiology, LC-MS/MS

Paper ID: cest2023_00556

Wastewater surveillance of the most common circulating respiratory viruses in the city of Attica

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ABSTRACT

Due to governments' actions to contain the spread of SARS-CoV-2, the activity of common circulating respiratory viruses was significantly disrupted after the Covid-19 pandemic and thorough surveillance of respiratory pathogens was considered essential worldwide. Wastewater-based epidemiology has proven to be a valuable tool, that provides complementary information on disease outbreaks and is increasingly used to study the infection dynamics of other viruses, apart from SARS-CoV-2. The aims of the present study were the detection of four commonly circulating respiratory viruses: SARS-CoV-2, influenza A, B and RSV, the evaluation of the Covid-19 pandemic impact on their seasonality and the determination of the possible common trends in the viral load of these viruses in the wastewater of the Attica region. A standardized and validated concentration and extraction protocol was used, generic for all four viruses, followed by RT-qPCR assays. The study proved that there was a prolonged period when all four viruses circulated in the population and an early outbreak of seasonal influenza and RSV in 2022-2023, compared to data from the pre-Covid-19 period. SARS-CoV-2, influenza A and RSV concentrations showed peak levels during December, followed by a slight decline in influenza A concentrations, followed by steady increase of influenza B concentrations in January 2023. SARS-CoV-2 was the dominant virus throughout the whole study period. This is the first study in Greece that investigated the most common circulating viruses simultaneously and in one of the largest timelines, providing crucial information about their infection dynamics during a period when an outbreak of respiratory diseases was declared by the National Public Health Organization. Presented results highlight the establishment of environmental surveillance as a non-invasive and complementary virus outbreak monitoring tool and the importance of influenza A, B and RSV integration into a wastewater-based surveillance system to help in disease management.

KEYWORDS: Influenza Virus, Respiratory Syncytial Virus, SARS-CoV-2, Wastewater-based epidemiology

PAPER ID: cest2023_00517

WATER POLICY, MANAGEMENT AND SOCIETY

Sustainable Water Resources Governance Developments:Societal Practice And Cross-Sectorial Policies

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ABSTRACT.

The governance process of surface water resources in Latvia, particularly, in small river catchment areas and lake lands, also being Natura 2000 territories, was the main foci for two studies described. Previous traditional research done in related fields in Latvia has been focusing on water studies/protection and nature protection, diverse agriculture sector developments, but often mono-disciplinary and very limited on governance studies, particularly, cross-sectorial governance of the local-regional water/lake/nature territorial socio-ecological system, and also on general and environmental-water-nature governance communications, especially to have all complementary communication instrument groups (information, education/training, participation and pro-environmental behavior).

For this extended abstract/paper, we are to recognize still not sufficiently developed cross-sectorial understanding and its top-down management applications, but also a kind of partially compensatory instrument - existing bottom-up management applications with more cross-sectorial practice and also innovative participatory management qualities. Communities and local municipalities, having limited national support and capacities limitations, developed different specific management approaches for water resources and also Natura 2000 territories governance – they could be called as non-governmental management approach and also tourism communication management approach, where lakes etc. are managed by NGOs established by the municipalities or combined with inhabitants and anglers, being the issue studied during these research projects.

KEYWORDS: water and nature management, societal participation, bottom-up instruments, communication

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Hydrogeological Research On Water Supply Conditions In A Mountainous Region Of NE Greece

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ABSTRACT

This paper deals with the investigation of the aquifer system of Myki Municipality in the mountainous area of Xanthi Prefecture, NE Greece, within the context of the development and management of groundwater of the study area for meeting drinking water supply needs. The work included, during spring, summer and autumn of 2021-2022, measurements of discharge from a selected network of fifty-two (52) points (springs and groundwater wells), sampling of groundwater from all springs and wells, chemical analyses, as well as relevant analysis, elaboration, presentation of the produced results and composition of related proposals regarding the improvement of water supply conditions at Myki Municipality. The research resulted in calculating the water supply values for each settlement (L/capita/day) and the surplus or deficit supply values with respect to the private special consumption value for domestic use of 250 L/capita/day. It was found that the available water resources to meet water needs of the Myki Municipality are partially insufficient. The observed water shortage can be attributed to the limited capacity of aquifers in some places, some bad groundwater recovery facilities, as well as water losses in the water supply system.

KEYWORDS: hydrogeology, mountain aquifers, water supply, Myki Municipality, NE Greece

PAPER ID: cest2023_00132

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