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Photos courtesy of Blaser Swisslube (top left) and ITW Rocol North America

# Environmentally FRIENDLY CUTTING FLUIDS

“We were doing some hard skiving, and tool life was a big issue,” says Kevin Lynch, business unit manager for gear manufacturer ITW Spiroid. The Glenview, IL-based company recently switched from a mineral oil-based cutting fluid to a vegetable oil-based fluid. “The cutting tools are really expensive, so we switched to it, and we actually saw about a 30% increase in tool life.”

ITW Spiroid, like many gear manufacturers and other metalworking companies, is finding that many of today’s more environmentally friendly industrial fluids are actually making their biggest impact not in environmental terms, but in performance.

“We really didn’t do it for the envi-

ronmental aspects,” Lynch says. The key for them was increasing tool life, but the environmental benefits were an added bonus.

ITW Spiroid uses the vegetable oil-based Accu-Lube Flood 40 coolant from sister company ITW Rocol.

## Tools for Reducing Environmental Impact

Today’s formulators of industrial chemicals have a wider array of tools than ever, from new types of synthetic esters to new breeds of genetically modified vegetable oil crops. This means a greater ability for manufacturers to tailor fluids to their exact metal cutting needs.

So manufacturers are able to increase

productivity, achieve a better surface finish, or—like ITW Spiroid—improve tool life, all while improving the work environment for their employees and reducing the costs associated with disposing of waste fluids.

Many coolant suppliers offer some choices that are more environmentally friendly than others. In some cases, a more environmentally friendly product is simply one that can be recycled or that lasts longer. If you have to dispose of less waste fluid, you have less impact on the environment.

“A lot of people consider that even a mineral oil-based product can be environmentally friendly, through extended sump life or by formulating with chemistries

that aren't hazardous to aquatic or plant life," says Randy Templin, vice president of Blaser Swissslube. Blaser supplies both traditional mineral oil-based products and the Vasco line of vegetable oil-based products. But, Templin adds, "We consider ourselves to be a leader in marketing products based on natural and synthetic esters that are derived from a vegetable base."

## Vegetable Oils

Metalworking fluids based on vegetable oils are available as straight oil (as in the case of the Accu-Lube Flood 40 fluid used by ITW Spiroid) or as water soluble products, where a concentrate is mixed with water to produce the coolant. But no matter which form the fluid comes in, vegetable oils have a number of performance benefits over straight mineral oils.

"In general, we can get better lubricity with a vegetable based-oil than we can with a straight oil," says Robert Myers, business unit manager for the Accu-Lube product line. The extra lubricity is what gives manufacturers better tool life, he adds.

Blaser has seen increased demand for its vegetable oil-based products, especially in Europe, where higher environmental concerns, regulations and disposal costs require manufacturers to use coolants without chlorine. "When you take the chlorinated additive out of a cutting fluid, you give up considerable performance, and with some materials, it can be dramatic," Templin says. "The vegetable oils offer much higher lubricity than mineral oils, so you're able to machine chlorine free."

In addition to greater lubricity, vegetable-based products offer many advantages over traditional mineral oils, says Templin. Among those advantages are a higher flash point, which means less chance of fire; less misting than mineral oil; and better compatibility with skin.

Another company using vegetable-based products to push the performance envelope is Environmental Lubricants Manufacturing Inc. (ELM) of Plainfield, IA. ELM produces the SoyEasy line of industrial fluids, which are based on

genetically modified soybean oil. The modified soybean produces an oil that resists oxidation and lasts longer in the sump, according to Gene Tripp, director of sales and marketing.

Tripp has been working for several years with a number of well-known agricultural, off-highway, automotive and aerospace companies, testing his company's coolants for gear manufacturing operations.

"We've tested on a broach, on a shaper cutter, and on a finish shaving cutter operation," Tripp says, "and we've done very well."

Besides being biodegradable and recyclable, vegetable oil-based products, offer longer tool life, higher feeds and speeds and improved surface finish of parts, Tripp says.

"These products are environmentally friendly, and they're extremely lubric, without the harmful additives, he says." "They offer less mist, less foam, less chance of fire. They're high performance products that will exceed petroleum and are extremely stable."

The company's major gear customers are still in the proving stages, but ELM has a number of non-gear customers who have achieved significant tooling savings by switching to the SoyEasy, Tripp says.

## Reduce, Reuse, Recycle

In addition to raising performance, one of the goals among coolant suppliers is to help manufacturers reduce the amount of fluid that's disposed.

"That's our drive—our obsession—to produce a zero waste stream," says Hank Limper, general manager of the metal cutting fluids division of Houghton International.

"What we felt was the golden fleece of this industry was metalworking fluids that would not go rancid, that would not sour, that basically would last 'forever,'" Limper says.

Typically, a company disposes of metalworking fluids because of biological activity that breaks them down, causes odors and dramatically reduces the sump life of the fluids, Limper says.

So Houghton developed the HOCUT 795 line of metalworking fluids, a water soluble product, based on what Limper describes as a "bio-stable building block," a chemical ingredient that

helps the fluids last longer and also allows them to be used for a variety of applications.

Starting with the bio-stable base material, Houghton can modify the formulation to suit a user's needs. "We can add a lot of mineral oil and make it a soluble oil, we can use less mineral oil and make it a semi-synthetic, we can add synthetic components like polymers and make it a synthetic product offering, or we can add vegetable oil and make it a truly vegetable oil-based product," Limper says.

But the key to being environmentally friendly is the ability of the water soluble products to be reused and recycled, Limper says. Houghton uses what they call a "congruent chemistry approach." That means that a wide variety of industrial fluids, including quench oils, spray wash cleaners, rust inhibitors and coolants, are all based on the same bio-stable building block. The idea is that when certain fluids become too contaminated for further use, instead of dumping fluid into the waste stream, it gets filtered, processed and put back into a central coolant system.

"The theory is that you could tie all your process chemicals into the central coolant system," Limper says.

Reducing waste can save a company a lot of money, he adds.

In fact, Houghton worked with a major U.S. manufacturer of aerospace gears to implement a rigorous fluids management program that included replacing the company's old coolants and processes with a central system using HOCUT 795. That facility reduced its hazardous waste disposal by 95%, saving the company \$66,000 per year.

## Okay, So Why Isn't Everybody Going Green?

It would be easy to switch to more environmentally friendly cutting fluids if all manufacturers had to think about were the enhanced performance, environmental benefits and reduced waste. The main disadvantage of all these products is price.

The cost differences range depending on what the customer is using, says Blaser's Templin. Some of the refined mineral-based cutting oils, particularly recycled oils, can be as little as one-fifth the cost of Blaser's vegetable-based





Courtesy of  
Houghton  
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Courtesy of  
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products. In most cases, the price disparity isn't that great, Templin says, but it's not uncommon for the vegetable based-products to cost as much as 50% more.

That price differential means that nobody is willing to pay just for the environmental benefits, Templin says. "Environmental concern might drive their interest, but they have to justify it by performance."

Blaser has conducted a number of studies on gear manufacturing operations to demonstrate the performance and cost benefits of the vegetable-based cutting fluids. In one study, which involved hobbing transmission gears, tool life was measured in actual production runs over a two-month period. A variety of gears were cut using both a mineral-oil based coolant and Blaser's Vascomill 42 vegetable oil-based coolant. In all cases, the tool life achieved with the vegetable oil-based coolant was significantly higher (averaging 45% greater tool life over two months).

In another Blaser study involving transmission parts, tool life was increased by 40%, even while feeds were increased so that cycle time per piece was reduced by 30%.

Other customers have replaced mineral oil with Vascomill for performance improvements in gear shaping, milling, shaving and broaching operations, Templin says.

Although the additional price can't always be justified, in many operations, the more expensive fluids offer a clear-cut advantage.

"Consistently, customers tell us that when you look at the whole picture, the price per gallon pales when compared to tool life savings and the reduced usage and consumption," Limper says. "Those things are part of the total cost picture that the intelligent customer is measuring."

Beyond price, there may also be some resistance in the marketplace due to early attempts to introduce vegetable-based products.

"Biological populations—bacteria—love vegetable oil," Limper says. "It's literally Thanksgiving dinner for them. People would move to this technology and find the product being waste treated right in the sump, because the bacteria

would tear it apart and have a field day with it."

But the vendors all agree that the oxidation problem of the early vegetable products has largely been overcome through a combination of technological improvements, including better basic materials, such as Houghton's biostable building block or ELM's genetically modified soybean oil. Also, the fluids are now formulated with highly specialized additive packages that help reduce the biological activity.

"Some of our original customers that are now seven years old still claim that most of their machines have never been dumped or discharged due to failure of the coolant," Limper says.

The vendors also agree that demand for more and more environmentally friendly cutting tools will continue to grow.

"I believe it's definitely a market that's growing," Templin says. "As people replace older equipment with newer technology, they're demanding more out of the fluids themselves, and they're paying more attention to the oils they're using. In addition to that, the environment, health and safety are becoming more and more important to the customers." 

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