THE MAGAZINE OF THE INDEPENDENT LUBRICANT MANUFACTURERS ASSOCIATION

COMPOUNDINGS

HAZARDS AHEAD

Leaders offer counsel on navigating OSHA's 2024 Hazard Communication Standard

ADVANCING ALTERNATIVES

Sustainability and performance are starting to coexist as bio-based lubricants evolve... ***page 22***

ON THIN ICE

As manufacturers brace for immigration enforcement visits, it's crucial to understand what is — and isn't — allowed... ***page 26***

ILMA

JUL-AUG 2025 | V75 | NO 6

ADVANCING ALTERNATIVES

Sustainability and performance are starting to coexist as bio-based lubricants evolve

BY MINDY LONG

Performance capabilities, regulatory compliance and improved sustainability are increasing demand for alternative base oils, and manufacturers are developing new products for companies looking for non-petroleum-derived options.

"Traditionally, performance and sustainability were almost opposites, meaning, if you wanted really good sustainability, you sacrificed performance," said Matt Kriech, CEO of Biosynthetic Technologies and chairman of ILMA's Sustainability Committee. "Most of the technology gains over the last 10 years by companies like ours and others have overcome these challenges, so they can be both sustainable and maintain high performance."

The term "alternative" can be broad. When the base oil groups were established by the American Petroleum Institute (API) in the 1990s, the categories cited both conventional and nonconventional base stocks. Feed source was not defined, while processing was included but was not all-inclusive and was left to be flexible, said Ernie Henderson, Ph.D., president of K&E Petroleum Consulting LLC. "Alternative base oil is one that was not considered with the original definitions," he said.

Most lubricants still rely on Group I, II and III base oils, but Henderson said that demand is growing for other sources, especially in areas where the environmental attributes can be leveraged. "This is more with industrial oil products, where there are many types and grades and differing and, in

some instances, unique performance features," he explained.

THE ROLE OF REGULATIONS

Some of the growing interest is driven by changing regulatory requirements. One example is with chlorinated paraffins — used most frequently as lubricant additives in metalworking — which are becoming restricted. "We have a bio-based solution that can offer a replacement to the chlorinated products. There is demand for those applications where you can make replacements with a bio-based, sustainable, nontoxic solution," Kriech said.

Troy Paquette, vice president of technology for Environmental Lubricants Manufacturing (ELM), which produces BioBlend bio-based products, said a big push for biodegradable products happened when the U.S. Environmental Protection Agency (EPA) pushed out the initial requirements for the Vessel General Permit (VGP). The VGP governs incidental discharges (such as ballast water or bilgewater) for commercial vessels over 79 feet in length within federally managed U.S. waters.

"Environmentally acceptable lubricants had never been really clearly defined until EPA came out with the VGP," Paquette said, adding that for vessels to comply with VGP, they need to use lubricants that are biodegradable, nontoxic or minimally toxic.

In Canadian mines, lubricants also have biodegradability requirements. "Whether it's a rock drill oil that is used on the drills that are digging the tunnels or the hydraulic oil, it's all got to be biodegradable in Canada," Paquette said.

In the U.S., there are higher levels of variability. "Federally, there is not a hard mandate away from the water that says you have to be biodegradable for these things. Some states have different regulations that can be a little more stringent, especially in California," Paquette said.

While regulatory requirements can spur adoption of changes, they can also hinder growth. "We have to be very careful about what we are allowed to do due to the regulatory landscape," Kriech said. "If we change too much and trigger the new regulatory review or scope, we have to re-register a new molecule, which is expensive and time-consuming."

Manufacturers building a new base oil technology have to sell it globally to be competitive, and global registration of a new molecule, even if it is perfect, can take five to seven years for non-polymer exempt molecules. "Payback can be challenging," Kriech said. "It's so expensive, time-consuming and such a risk that most people aren't innovating around new base oil technologies."

PERFORMANCE-DRIVEN DEMANDS

Some end users need or see benefits in higher performance capabilities. As equipment complexity grows, Stephen Eck, chief operating officer of VBase Oil Co., said one-size-fits-all fluids no longer cut it.

"For hydrocarbon oils to meet modern requirements, they need increasingly complex additive packages," Eck said, adding that as OEMs push for smaller, more powerful systems, formulators are turning to inherently high-performance base fluids.

Eck explained that high-performance synthetic esters, such as VBase secondary polyol ester base oils, close performance gaps that hydrocarbon oils can't. They provide thermo-oxidative stability for high-temperature service, friction control and deposit mitigation to boost efficiency and equipment reliability, and fire resistance, which makes them ideal for safety-critical hydraulic and gear fluids in hot or hazardous environments.

When Novvi, which makes a hydrocarbon synthetic base oil derived from plants, first released its product line, the emphasis was on it being a renewable and sustainable offering, said William Downey Jr., senior advisor to the company's president.

"At the same time, we were building knowledge and realized our products are better," Downey explained. "We've got a customer that's been working with some heavy-duty trucking fleets, and they found by using our products in place of other synthetic products, they're able to extend the drain intervals."

Novvi says its synthetic base oil can be used as a substitute for fossil-derived base oils and can drop in to some applications where high-performance base oils are used today. In addition to extending the drain intervals, the customer's fleet has reduced fuel consumption and experienced longer stretches between diesel particulate filter regenerations. "Here's a case where there were three opportunities for the fleet to save money or have more uptime by purchasing a higher-performance engine oil," Downey said.

ELM's BioBlend was able to increase the life of elevator equipment by 30%. "We do a much better job penetrating into those, so we dramatically increase the life expectancy on that equipment," Paquette said. "When you look at how the biodegradables perform and how much better their function is,

"We have to be very careful about what we are allowed to do due to the regulatory landscape."

Matt Kriech, CEO, Biosynthetic Technologies, and ILMA Sustainability Committee Chairman

while their price is higher, their cost is actually lower."

ELM has also created hydraulic fluids with pour points that can perform well below 60 degrees Fahrenheit and fluids that can handle temperatures ranging from 300 to 500 degrees Fahrenheit. "It's not just about the fact that it's biodegradable. It's a high-performance synthetic product that is also biodegradable," Paquette said.

VBase offers a secondary polyol esters (SPE) platform, and Eck said that, by design, SPE base oils incorporate high levels of oxygen into their backbone. As a result, they deliver high volumetric heat capacity, so equipment runs cooler. This slows lubricant aging, extends drain intervals and lengthens key equipment life.

"Due to inherently high [viscosity index], wear capability and built-in detergency, a formulator can fine-tune viscosity and additive treat rates to hit end-use targets without over-engineering," Eck explained, adding that SPE base oils are readily biodegradable and have greater than 50% bio-based carbon.

Niche applications are driving increased alternative base oil demand. "Sometimes, I just need a molecule that's going to do X, and your molecule is the only one that fits that keyhole, if you will, to unlock that potential," Kriech said.

Kriech said Biosynthetic Technologies has focused on performance-driven sustainability. "Almost all of our products are derived from oleochemicals, which means they're plant based versus petroleum derived," he explained. "We make everything from thickening agents for greases to base oils for gear oils, hydraulic fluids, compressor oils, passenger car motor oil to additives and metalworking fluids."

Downey said customers tend to come to Novvi looking to reduce their carbon footprint. "We're finding that OEMs, blending and additive companies all want to lower their carbon footprint," he said.

"We're finding that OEMs, blending and additive companies all want to lower their carbon footprint."

William Downey Jr., Senior Advisor to the President, Novvi

While improving sustainability is a noble goal, Richard Camper, executive vice president of Hasco Oil Co. and ILMA president, has found that end users don't care about sustainability 95% of the time. "Selling a product that is X times more expensive with no real value proposition besides the fact that it's carbon neutral doesn't resonate, especially in the United States because it isn't mandated," he said. "There needs to be a more compelling reason than it's just carbon neutral."

Even for end-users that are focused on sustainability, the decisions can be nuanced. In Camper's experience, a large trucking fleet, for example, that wants to reduce carbon dioxide emissions is more likely to turn to a non-carbon-neutral solution that can improve fuel economy rather than a carbon-neutral option. "If you want to be sustainable, the fuel reduction is more compelling than using a zero-emission suite of lubricants," he said. "What it comes down to when you talk about alternative fluids is performance."

Camper does see some advantages for companies that are focused on having a benign workplace or being good stewards in the community. "You could say to your employees, your customers and the community around you that you are using safe, carbon-neutral products," he said.

CHALLENGES TO INNOVATION

Innovation in base oils can be lengthy and cost-prohibitive, especially when working in multiple regions. "If you're going to build a new base oil technology, you can't limit it to just North America," Kriech said. "You have to sell it globally to be competitive." The need to get API certifications can also restrict new Group IV and Group V base oil technologies in the motor oil space because API requires manufacturers to run the full gamut of tests. "API certification is highly disadvantaged for new base oil technology and highly advantaged for the current Group I, II and III mineral oils," Kriech said.

Novvi spent about two years as part of a working group that was looking to establish a uniform approach to sustainability in the lubricant space under the banner of API. "It was hard for anybody who had a unique technology," Downey said.

Henderson said the cost of testing is much smaller with industrial oils than with automotive oils, which is why much of the innovation is occurring in the industrial space.

Improving quality and sustainability comes at a cost, and alternative base oils are more expensive, but prices are coming down as processes have gotten more efficient. Today, a biodegradable product is about three times the cost of a traditional base oil, Paquette said.

"There is definitely a cost associated with it, but we've also worked really hard to give you performance increases that go right along with that increased cost," Paquette said. "They last as long as your petroleum and, in some cases, longer. They have better lubricity, so they provide better protection on your equipment's metal surfaces, and we're gaining longevity."

"Focusing on smaller and niche markets will allow one to upsell their base oils and create a value return for the investment, both in terms of R&D and commercialization."

Ernie Henderson, Ph.D., President, K&E Petroleum Consulting

Henderson said manufacturers need to understand the markets in which they wish to participate and compete. "Focusing on smaller and niche markets will allow one to upsell their base oils and create a value return for the investment, both in terms of R&D and commercialization," he said. "This would suggest industrial oils, metalworking fluids, food-grade lubricants or in applications where oil contact with the environment may occur."

RE-REFINED OILS OFFER A LOW-CARBON OPTION

An increased focus on sustainability and the demonstrated performance of re-refined oil is driving increased adoption of re-refined products.

Ernie Henderson, president of K&E Petroleum Consulting LLC, explained that re-refining was included in the API categories established in the 1990s, which means re-refined oil is not typically considered an alternative base oil. "Re-refining was included with the original definitions as it was recognized as an important base oil option to include," he said.

However, re-refined oils do offer end users a more sustainable option. "Re-refined is still technically a mineral-based base oil. What people are usually looking for with re-refined is to have a more sustainable, lower-carbon footprint," said Matt Kriech, CEO of Biosynthetic Technologies and chairman of ILMA's Sustainability Committee.

An in-depth life-cycle assessment of Crystal Clean's HCC 150 re-refined base oil conducted by environmental consulting firm ClimeCo and reviewed by an independent third party found a 77% reduction in greenhouse gas emissions compared to traditional virgin base oils, the company wrote in a news release.

"The life cycle analysis of HCC 150 showcases our ability to provide solutions that not only meet the industry's highest standards but also help our customers achieve their environmental goals," said Brian Recatto, president and CEO of Crystal Clean. "This product is proof that sustainability and performance can go hand in hand."

The re-refining process produces high-quality Group II base oils from used motor oils and lubricants that meet the same API and ILSAC performance standards as their virgin counterparts, Recatto said.

Richard Camper, executive vice president of Hasco Oil Co. and ILMA president, said the feedstock for re-refined oils is getting better, which could have some performance advantages. "Their feedstock is getting better and they're producing, theoretically, a better base stock than traditional Group II product. There could be a true value proposition there," he said, adding that end users remain concerned about cost. "It's going to come down to demonstrating a cost savings."

With new, non-petroleum products, manufacturers may need to increase education and explain their unique position in the marketplace. "Sometimes that unique position comes from being local or having stock in a particular situation, but it also could be because it is a problem solver or has better performance and you're creating value for the customer," Downey said. "On top of everything else, it could be renewable, sustainable and green."

He added that the lubricant industry tends to be conservative. "For something non-petroleum, it takes a fair bit of time to gain the trust of the people in the customer organizations," he said.

There are some lingering misconceptions about the products. Paquette said one of the challenges is that most people think biodegradable base oils can't handle heat. "That's been a big part of educating and marketing since biodegradable really kicked off in the late '90s, early 2000s," he said.

THE ROAD AHEAD

Kriech is optimistic about the alternative base oil space and expects high-performing, more sustainable molecules to continue gaining market share, but he also says they won't replace traditional base oils entirely.

"There isn't enough plant-derived sustainable acreage in the world to supplant or replace all of the mineral oil that's produced from petroleum," Kriech said, adding that the industry has to decide where to use the technology available to make the most impact. "We don't view petroleum as competition. We view it as a thing that we need to work with and co-blend with to enhance what is available."

***Long** is a freelance writer and journalist. She can be reached at 480-306-7177 or mindy@mindylong.com.*