

# SOY-BASED LUBRICANTS

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**SOYBEAN OILS HAVE A HIGHER VISCOSITY INDEX, LOWER EVAPORATION LOSS AND POTENTIAL TO ENHANCE LUBRICITY.**

## Driving Issues

The market for soybean oil in lubricants will be driven by a combination of environmental concerns, economics and performance issues. Historically, petroleum- or mineral-based oils have been the economical choice of many manufacturers to satisfy performance, logistic and cost targets in many applications. Soy oils, especially enhanced varieties, and other vegetable oils show the ability to compete in significant segments of this market.

The need for readily biodegradable and low-toxicity lubricants in environmentally sensitive areas has been recognized especially in Europe but also in the U.S. and many other regions. Both synthetic-ester and rapeseed-oil lubricants have been developed to meet these needs.

The combination of growing regulatory pressure to reduce or eliminate certain emissions of petroleum lubricants and the U.S. Department of Agriculture (USDA) BioPreferred® Program, which gives procurement preference to biobased products, should encourage increased use of renewable oils. Soybean-based lubricants have begun to capture a significant share of this emerging market segment.

## Competing Products

Soybean oil competes for a share of the growing environmentally sensitive and renewable-lubricant markets with other vegetable oils and with synthetic lubricants. Vegetable oils, including soy, cost less than synthetics and will be the product of choice when they meet customer performance requirements.

When compared with mineral-oil-lubricant base stocks, vegetable oils have the following advantages: higher viscosity index, lower evaporation loss and a potential to enhance lubricity, which could lead to improved energy efficiency.

Soy is readily available and lower in cost than many other vegetable oils. It has low-temperature properties that are superior to most animal fats.

## High Oleic Soybean Oil

While conventional soybean oil is acceptable as a base stock in many applications, oils lower in saturated fats and polyunsaturates are preferred for their lower pour points and greater oxidative stability. In the fall of 2012, the first major harvest of improved soybean varieties that have high levels of monounsaturated oleic acid took place in the U.S. As high oleic soybean oil becomes readily available, its use in lubricants is anticipated.

Testing of high oleic soybean oil has shown that the oil has improved oxidative stability even before the use of additives. While additives are still needed in some applications, the level required is reduced, and the cost of making a lubricant formulation should decline.

## Soybean Oil vs. Synthetics

Biodegradable synthetic oils have been developed for environmentally sensitive segments of the lubricants market. They offer improved performance over mineral oil-based lubricants and vegetable oils but at a significantly higher price. Most of the synthetics in this market segment are polyalphaolefins or synthetic esters and offer superior thermal and oxidative stability. Increasingly, lubricant formulators are finding that soybean oil can be formulated with synthetics without



sacrificing performance or biodegradability, while also lowering the finished product's cost.

### Hydraulic Fluids

Industrial hydraulic fluids represent a 222-million-gallon market in the United States (according to 2012 data). In Europe, environmental regulations and consumer pressure have already forced the conversion to more environmentally acceptable hydraulic fluids in sensitive areas such as waterways, farms and forests. These are either rapeseed-based lubricants or synthetic fluids that have been used successfully for over a decade.

In the U.S., a number of soy-based hydraulic fluids have been launched as well. These include several that are designed for use with heavy equipment and other light- to moderate-pressure applications. Spills are common in this market segment, and, in most cases, spills of soy oil hydraulic fluid don't require disposal as a hazardous waste. One of the most successful markets is elevator hydraulic fluid. Soy oil works well in this market and has a real advantage in its low flammability/high ignition point. Soy hydraulic fluids are typically low in volatility and odor as well, which are real advantages where large quantities are stored inside buildings.

### Transformer Oils

The use of soybean oil as a dielectric fluid is one of the fastest-growing markets for soybean oil. Properly formulated soybean oil improves the capacity of the transformer, allowing more current to be handled and extending the useful life of the fluid inside. Again, the high flashpoint of soybean oil provides added safety against fire, a real hazard at substations with massive transformers in crowded locations such as near stadiums or in below-ground use where a fire could present a real danger.

### Total-Loss Oils

Lubricants are lost directly into the environment in a number of applications, including two-cycle engines, bar/chain oils, penetrating oils, rail and flange oils, wire-rope lubricants and dust-suppressant oils. There is a strong need for viable, low-toxicity, readily biodegradable oils in these uses, and successful soy formulations have been produced to meet the performance needs of all uses, such as combustion properties, shelf stability and other issues.

Increasing commercial acceptance of properly formulated soy-based products in total-loss lubricants has resulted in a number of new products being launched each year. While individual market segments are small, they collectively represent significant potential.

### Metalworking Fluids

A host of soy-based metalworking fluids have been introduced based on both unmodified soybean oil and methyl soyate. Soybean oil and methyl soyate have many advantages, including being regarded as safe by the Food and Drug Administration as an incidental food-contact product when used in rolling metal foils. USB-sponsored research has focused on formulating soybean oil or methyl soyate for more technically challenging areas like extreme-pressure metalworking. Research has also led to water-miscible metalworking formulas that are both effective and stable.

### Used Oil Disposal

Testing by Safety Kleen has shown that soy-based lubricants can be disposed of and re-refined along with conventional mineral oil-based lubricants.

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**ABOUT USB** United Soybean Board's 73 farmer-directors work on behalf of all U.S. soybean farmers to achieve maximum value for their soy checkoff investments. These volunteers invest and leverage checkoff funds in programs and partnerships to drive soybean innovation beyond the bushel and increase preference for U.S. soy. That preference is based on U.S. soybean meal and oil quality and the sustainability of U.S. soybean farmers. As stipulated in the federal Soybean Promotion, Research and Consumer Information Act, the USDA Agricultural Marketing Service has oversight responsibilities for USB and the soy checkoff.

