TECHNICAL BULLETIN
ESTERS IN OILS
Issue: October 2015

History

It is believed that the first synthesized hydrocarbons were created by Friedel & Crafts in 1877. It was in 1929 that the commercial development of synthesized hydrocarbons was undertaken by Standard Oil of Indiana. At that time there was not a lot of interest in these types of compounds. From 1938 to 1944, thousands of esters were evaluated in Germany with excellent results. Their first uses though were in military aviation in the 1940's. It was the space age that helped create a greater appreciation for the benefits of synthetic lubricants. Jet engines raised the bar on what was required of a lubricant. The high speed, high heat and cold temperature performance requirements of modern jets created a demand for a new kind of lubricant. Following WWII, the first use of diesters by the British in turboprop engines for high temperature performance were used and from the early 1970's various synthetic fluids were developed to meet the demands of new and more efficient high performance engines and machines in the automotive industry. The first 100% synthetic diester based engine oil to pass the API sequence tests and receive API qualification was in 1972.

What is an Ester?

In simple terms, esters can be defined as the reaction products of acids and alcohols. They are manufactured to produce predetermined molecular structures designed specifically for high performance lubrication. These synthetic base stocks are primarily branched hydrocarbons which are thermally stable, have high and low viscosity indices and are extremely pure. For automotive purposes, esters can be the base stock (base oil) for a lubricant or be used in conjunction with other base stocks such as PAOs, Group III, Group II's etc. to make full synthetic or semi synthetic lubricants.

Ester Characteristics

Volatility

Esters have a polarity that attracts them to one another as well as to positively charged surfaces. When the molecules are attracted to one another it requires more energy to vaporise them giving them a higher flash point and lower evaporation rate.

Lubricity

The polarity also allows them to be attracted to metal surfaces to create a strong film of lubricant, improving lubricity and lowering energy consumption and friction heat.

Detergency / Dispersancy

Esters can disperse oil degradation by-products that might otherwise be deposited as sludge, allowing for cleaner operation of the engine. They can also improve the additive solubility in the final lubricant.

Biodegradability

While esters are stable against oxidative and thermal breakdown, the ester linkage provides a vulnerable site for microbes to begin their work of biodegrading the ester molecule. This translates into very high biodegradability rates for ester lubricants and allows more environmentally friendly products to be formulated. This is important, especially for developing two stroke oils that provide great lubricity and have the ability to be biodegradable at the same time.

Compatibility

As with any product, there are some downsides to esters. One concern when formulating with ester base stocks is compatibility with the elastomer material used in the seals. All esters will tend to swell and soften most elastomer seals however, the degree to which they do so can be controlled through selection. Another disadvantage with esters is that they can react with water or hydrolyse under certain conditions.

What are Esters used in?

There are many different kinds of esters commercially produced for a broad range of applications. They have been used for automotive lubrication now for approximately 45 years. They are also used in synthetic refrigeration lubricants used with CFC replacement refrigerants. Within the realm of synthetic lubrication, a relatively small but substantial family of esters have been found to be very useful in severe environment applications.

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Ester Based Automotive Engine Oils

In automotive applications, esters in many cases have given way to PAOs and Group 3 synthetics due to cost and their formulating similarities to mineral oil. Nevertheless, esters are often used in combination with PAOs or Group 3 based synthetic oils in order to balance the effect on seals, solubilize additives, reduce volatility, and improve energy efficiency through higher lubricity. The more ester used will obviously affect the price of the lubricant as it is very expensive as a base stock compared with PAO or a Group 3 Synthetic.

There are very little, if any, 100% full ester based 4 stroke engine oils in the automotive aftermarket. The best way to check is by obtaining a Safety Data sheet for the product.

Penrite Engine Oils with Ester

Penrite manufacture a range of engine oils that utilise PAOs and esters in their formulations.

Penrite 10 Tenths Racing Range
Penrite 10 Tenths Premium Synthetic Range
Penrite Motorcycle PAO & Ester Synthetics Range
Penrite Biomarine Full Synthetic 2 Stroke Oil

Click Here to visit the Penrite Pre-70's product guide.

Click Here to visit the Penrite Recommendation Guide, which will ensure you receive the correct oil for your vehicle

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