

Not all Fluids are Created Equal

Why some fluids rise above the rest when put to the test.

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Recycling. Reducing your carbon footprint. Installing fluorescent light bulbs. Everywhere we look, the world is making great strides to 'go green', and the hydraulic world is keeping up. Over the past several years there have been major efforts made by manufacturers world-wide to promote a greener image, and in doing so reduce the impact on the environment they are working in. Furthermore, regulations are being passed globally requiring those working in or near waterways – whether they are rivers, ponds or even oceans – to respect the wildlife who calls that area home.

There are two primary standards of biodegradability – inherently biodegradable and readily biodegradable. All fluids are biodegradable, meaning they break down within some undefined span of time. According to the U.S. Army Corps of Engineers, a hydraulic fluid is classified as readily biodegradable when 60% or more of the material is decomposed in 28 days. This is a very important distinction to make when selecting a fluid.

While some fluids are biodegradable, that does not necessarily indicate that they are also non-toxic. A hydraulic fluid is considered non-toxic if a specific ratio of the hydraulic fluid to water is used and less than 50% of the test organisms die within 96 hours. To meet most new regulations, both the standards for biodegradability and toxicity must be met.

BIOFLUID CLASSIFICATIONS

There are four major classifications of biofluids, each with their own distinctive characteristics, as shown in Table 1. (Seen on the right)

PUTTING YOUR FLUIDS TO THE TEST

Ultimately, there had to be some test or standard that determines which fluid can hold up to challenge. The RPVOT (ASTM D2272 or Rotating Pressure Vessel Oxidation Test), the Cincinnati Milacron Test (ASTM D2070) or TOST (ASTM D943), do exactly that. These tests are used to monitor oils for losses in oxidation resist-

Table 1

HEPG (Polyglycols): These are commonly referred to as 'water glycols'. As a water-based fluid, they offer poor lubricity and can create major performance issues at high heat because the fluid will begin to boil and form steam bubbles, causing cavitation and rust. These fluids are popular, however, in applications where fire resistance is required. It is important to speak with your hydraulic component provider when you know you will be using an HEPG fluid, as it may be necessary to take into consideration that you may need to de-rate the performance of your hydraulic equipment.

HETG (Triglycerides): These are generally plant or animal based oils such as vegetable oil, rapeseed oil, sunflower oil, etc. Unfortunately, many of these fluids do not perform well under high heat conditions, as the oil itself will begin to cook and therefore change its chemical composition. They do offer excellent biodegradability and rust prevention, but you must be cautious when using HETG fluids in high-heat applications.

HEPR (Polyalphaolefins): Only a very limited range of PAO base fluids are readily biodegradable. These formulating restrictions lead to limited shear stability of the hydraulic fluid, meaning the viscosity is progressively lost as it is run through a system.

HEES (Synthetic Esters): These fluids can be broken up into two categories – saturated esters and unsaturated esters. Unfortunately, all HEES Synthetic biofluids are often grouped together despite their significant performance and longevity differences. Saturation is determined by the chemical bonds within the fluid itself. Unsaturated esters have multiple open bonds which interact with oxygen quickly, leading to oxidation (ageing) of the fluid. This ageing is the cause of extreme thickening and gumming of the fluid, along with deposits and shellac, which lead to major catastrophic system failures. Saturated ester products, however, have significantly fewer open bonds, and therefore they do not oxidize and will last much longer in high-heat, intense applications. The iodine number identifies the number of open bonds available, so the higher the iodine number, the greater the number of bonds that can interact and oxidize. Generally speaking, a saturated ester product has an iodine number less than 15.

(Courtesy Hydraquip Distribution, Inc.)



ance and increases in acid levels. It is important to review the TAN (Total Acid Number) in your lab results, as this may provide you with some indication that your fluid is breaking down.

PROVIDING A SOLUTION

Panolin HLP Synth is a fully synthetic, high-performance, readily biodegradable, non-toxic hydraulic fluid made from saturated esters. The Panolin product leaves no sheen when it is spilled on the water, but rather appears as light foam that is visible for easy cleanup. It is able to resist oxidation at high temperatures and high pressures, and prevents gumming and deposits within your hydraulic system. Panolin does not affect conventional sealing materials, and it provides excellent corrosion resistance and wear-protection.

Due to its base composition and saturated nature, some Panolin products are able to last within a hydraulic system for extremely long periods of time without any oil-change requirement, decreasing downtime and maintenance costs. Test documentation shows use of Panolin in equipment for over 130,000 hours without fluid change.

COMMON SYNTHETIC FLUID QUESTIONS

Seal compatibility is always a concern when selecting a fluid. NBR, HNBR, PU and FKM sealing systems are all common in hydraulic systems and react differently to different fluids (even a standard mineral oil) regardless of the classification. It is recommended that you check seal compatibility with your biofluid supplier regardless of fluid type.

Hydrolytic stability is another major factor to consider when selecting a biofluid, particularly for use on or near

large bodies of water. Hydrolytic stability is the ability of a fluid to resist decomposition in the presence of water. Since biofluids typically begin the biodegradation process when exposed to bacteria in water and soil, you certainly want a fluid that will not break down or alter its composition when a small amount of water is present in your system. Edible oils, when mixed with water and heat, are cleaved (bonded) and new chemicals are formed. This is called hydrolytic fat cleavage. The formation of an ester from an alcohol and an acid is called esterification, cleavage in the presence of water hydrolysis, or hydrolytic cleavage. 2

The base oils used in Panolin products are biodegradable esters, and can hydrolyze in the presence of water. A high TAN value indicates that a large number of ester molecules have cleaved. Panolin has proved through numerous lab tests that hydrolysis of the esters used in Panolin products to do not lead to corrosive acids, but rather the acids formed may even improve its anticorrosion capabilities. Furthermore, before hydrolysis of Panolin products will cause any issues in a hydraulic system, the water content needed for that hydrolytic process will cause major cavitation, corrosion and other catastrophic issues. Simply because a fluid claims a high level of stability when water is introduced does not indicate that any hydraulic system will function well with that level of water ingress, and every effort should still be made to keep water out of the hydraulic system. 2 In that same regard, some biofluids will emulsify, or dissolve completely with water. Panolin fluids do not emulsify with water but instead repel water. This separation makes it easy to remove water from your fluids using water-removal filtration. 2

OFFSHORE REGULATIONS & APPROVALS

For those applications where special certifications must be met, Panolin Atlantis is the answer. CEFAS in the U.K. (Centre for Environment, Fisheries & Aquaculture Science) is one of the strictest policy makers in the world, particularly the North Sea. Panolin Atlantis is rated E by CEFAS, indicating that it carries the least potential environmental hazard.

Panolin Atlantis is also registered with OSPAR in Norway. OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic) is the basis for national laws governing the waters of the OSPAR states, including many oil-producing states of Western Europe. Panolin is rated OSPAR Yellow, meaning it can be discharged into the water with permission and it has acceptable environmental properties.