



Quaker Knowledge Network

Oils

Skill Builder

Overview

Mention “lubrication” and the world thinks of oil. Yet, for something so important to the world’s economy, there are many misconceptions about oil. To be an effective seller of cutting and grinding fluids, one should know the basics of petroleum.

Definition

As everyone is aware, crude oil, taken from the ground, is the beginning for most petroleum products. As the crude is processed, assorted fractions are removed, based on specific physical and chemical properties. Gasoline accounts for almost 45-55% of the production. Less than 2% of the production results in the type of components that Quaker purchases. These materials would be naphthenic and paraffinic oils. These oils can be classified as natural hydrocarbons.

A hydrocarbon is any compound containing exclusively hydrogen and carbon atoms. Hydrocarbons are further classified depending upon their level of saturation. Saturation is a simple way of describing the number of double bonds, triple bonds, and ring structures contained in the compound. The level of saturation is key in selecting specific properties.

Crude Oil

The two major classifications of oil are naphthenic and paraffinic. The difference between naphthenic and paraffinic oils stems from the nature of the crude oil. There are crude oils that are high in content of either naphthenic or paraffinic materials. Most suppliers have separate facilities for handling the different crude oils.

Generally speaking, paraffinic oils have higher flash points than naphthenic oils of similar viscosity. They tend not to accept additives as easily as naphthenics. Paraffinic stocks tend to have more wax-like materials, which require additional processing, thus adding more cost to the process.

Naphthenic oils show the opposite properties; lower flash points but higher additive acceptance.

Parameter	Naphthenic Oil	Paraffinic Oil
Additive Solubility	Very Good (Higher)	Acceptable
Viscosity Index	Acceptable	Very Good (Higher)
Flash Point	Acceptable	Very Good (Higher)
Pour Point	Very Good (Lower)	Acceptable
Response to Cold	Very Good	Acceptable

Viscosity

One way to describe oil is by its viscosity. Viscosity is a fluid’s resistance to flow, or in other words, how thick it is. The units for measurement are centistoke (cSt) or Saybolt Universal Second (SUS). Viscosity is typically measured at 100°F or 210°F. Water has a low viscosity (1.8 cSt or 30 SUS) while something like honey would have a high viscosity.

Quaker tends to use naphthenic oils for their higher solvency of oil-soluble additives. These oils range from a low of 40 SUS to as high as 1200 SUS. The 40 SUS oil is used for honing fluids and is close to mineral seal oil. Most of Quaker’s cutting fluids use blends of oils to achieve a desired end viscosity. Blending different viscosity oils allows Quaker to inventory just a few oils while still providing a wide range of viscosities. As the viscosity increases, solubility of additives tends to decrease. Some Quaker products utilize paraffinic oil for specific properties. Paraffinic oils, when used in straight cutting oils, provides higher flash points.



Quaker Knowledge Network

Oils

Skill Builder

Formulating Use

An oil's primary use is to provide hydrodynamic lubrication. While viscosity of the oil does impact the level of hydrodynamic lubrication, an oil does not lend any boundary lubrication. The second reason for using oil is to act as a carrier for the various ingredients. Oil-soluble materials range from fatty acids and antioxidants to biocides and corrosion inhibitors.

"Synthetic" hydrocarbons are man-made materials. Sometimes they are derived from processes designed to produce an end result; and sometimes they are extracted from some other process as a by-product. Alpha olefins are just one type of synthetic hydrocarbon. Technically speaking, these alpha olefins provide better lubrication and oxidation resistance over oils. Also, the issue of oil mist may be overcome using a synthetic hydrocarbon. The downside is that the cost of synthetic hydrocarbons is significantly higher than oil.

Regulatory

In the mid-1980's, the oil companies were required by law to change the processing of their oils to insure removal of polynuclear aromatics (PNAs), polycyclic aromatic hydrocarbons (PAHs), or polycyclic aromatic compounds (PACs). These acronyms are often used interchangeably but do have differences. However, the bottom line is that oils were found to contain compounds that were carcinogenic. While not all the compounds were carcinogenic, it was decided that it was easiest to remove them all so there would be no questions regarding carcinogenicity. Two processes were identified as being acceptable to remove the hazardous compounds. They were severe hydrotreatment and solvent refinement.

Severe hydrotreatment involves very specific minimum requirements for temperature and pressure to assure that all PNAs/PAHs/PACs are broken down. Solvent refinement involves the use of specific organic compounds to "strip" out the undesirable components. On a Quaker MSDS oil is identified as "severely hydrotreated distillates" in reference to the process.

Oil mist is an issue with some customers. While oil itself has no threshold limit value (TLV), OSHA has set a TLV for oil mist at 5 milligrams per cubic meter (mg/m^3). It appears that recent legislation may decrease this value to 0.5 mg/m^3 . This may be further defined to differentiate between "liquid mist" and "particulate" in the mist. As of the writing of this document, those details are not available. Either way, oil mist will continue to come under scrutiny.

Quaker has found that typical machining & grinding operations actually produce more mist from tramp oil than from the actual fluid. However, this is dependent upon the severity of the application. This is further evidence that tramp oil is a cause for concern as its removal from the fluid is important.

Non-Virgin Oil Sources

Many competitors use non-virgin mineral oils sources. The common names are reclaimed or re-refined. Unless the MSDS specifically states that the oil has been solvent refined or severely hydrotreated, there is no guarantee that the oil is NOT carcinogenic. Most re-refined oils are not solvent refined or severely hydrotreated. Reclaimed oil generally involves filtering and de-watering activities. Re-refining is the same as reclaiming but also adds a distillation process for improvements.

The main reason for using non-virgin oils is the lower cost. However, the issue of carcinogenicity certainly plays a role in what will be allowed as more focus is paid to "oil mist."

Contact Quaker at
info@quakerchem.com