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Tramp Oil

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Overview

Tramp oil is probably one of the most common contaminants in metalworking fluids. The term is a catch all for all sources of non-soluble contaminants (usually oil-based) that can come in contact with the metalworking fluid as a function of the process or the equipment. The sources can be one of the following:

- Hydraulic fluid
- Way lubricant
- Slide lubricant
- Gear lubricant
- Spindle lubricant
- Corrosion preventive (from a previous process or carried in on the parts)
- Stamping lubricant (from a previous process or carried in on the parts)

Whatever the source, tramp oil is a foreign contaminant that can create the problems detailed below.

Corrosion and/or Stain

Tramp oils can induce or enhance corrosion or staining problems. Most of the time, this is caused by the components of the tramp oils. However, the tramp oils can also interfere with the natural detergency (see Detergency and Residue Section) of the fluid. If the coolant loses its detergency, it cannot effectively wash away the debris that can initiate corrosion sites (like chips, fines and other debris).

Dermatitis

Some tramp oils may contain some ingredients that can promote dermatitis. Many times they may contain ingredients that can cause skin irritation. Other times oil floating on top of the coolant can trap and hold chips, fines and other metallic debris. This debris can wind up on someone's skin. Microscopic lacerations can be produced when the debris is removed. These skin openings can be subject to irritation.

Detergency and Residues

Emulsifiable products, like semi-synthetics and soluble oils, rely on emulsifiers to hold the product together when added to water. These emulsifiers also provide a certain level of detergency which helps keep the parts, tooling and the machine tool clean. High levels of tramp will interfere with the detergency of the coolant by trying to become part of the emulsion. This interference can lead to emulsion instability. Emulsion instability can lead to more residues on parts, machine surfaces and tool. Partially emulsified tramp oil will create a creamy layer that can be more difficult to separate using conventional methods (centrifuging or skimming).

Foam

There are pros and cons to the use of tramp oil when foam is involved. Some customers rely upon a certain amount of tramp oil, although minor, to suppress foam in their coolant systems. As the oil floats on the surface, it helps to break the bubbles as they form. However, there have been documented situations where the presence of the tramp oil actually produced foam. Many times, floating oil will also suspend chips and fines, which can create filtration problems. A thick layer of oily foam can also blind certain types of filter paper. This blinding can cause the filter paper to index more rapidly than normal.

Lubrication

The emulsion is critical to the stability of a fluid. The emulsion is held together by emulsifiers. Emulsifiers have a lipophilic (oil-loving) end and a hydrophilic (water-loving) end. These emulsifiers stabilize the oil-loving components (which often include the lubricants) and the water-loving ingredients to create the "oil in water" emulsion. Over time, the presence of tramp oil can disrupt the balance of the emulsion. The emulsion may become looser and actually split into distinct phases as more tramp oil enters the system. When the lubricant package is not properly emulsified, the overall performance of the product can be negatively impacted.

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Microbiological

Microorganisms, but mostly bacteria, can grow and proliferate as the tramp oil level increases. First of all, the tramp oil can act as a food source for the growth. Secondly, an emulsion weakened or destabilized by an influx of tramp oil is more prone to bacterial attack. Growth of bacteria leads to odor, corrosion, and further destabilization of the emulsion.

Smoke and Mist

Health issues are most times related to vapors from the fluid as created by the application. The presence of tramp oil exacerbates this problem. Tramp oil can coat hot metals (tools, parts and machine surfaces) and produce smoke as it burns off. This can be avoided by making sure the machine sump has a device for removing tramp oil.

Misting typically is attributed to "something" being thrown into the air. Most of the times, it is tramp oil that is the cause. There have been applications where a solution synthetic coolant (which provides the best tramp oil rejection) did its job rejecting the tramp oil but there was no mechanism in place to remove it. Hence, there continued to be mist in the customer's plant until the tramp oil was removed.

Tramp Oil Removal Methods

There are many conventional methods for tramp oil removal. The most common are skimmers, centrifuges and coalescers. Seach the Internet for equipment suppliers in your area.

There are a number of manufacturers that make and sell different types of skimming devices. The purpose of the skimmer is to reside in a "quiet" area of the machine tool where the tramp oil will have time and a place to collect. The skimmer then moves through the surface, "skimming" the oil away from the coolant and into some other container to collect the tramp oil. These skimmers can be "hairy" ropes, discs, wheels or some other type of lipophilic surface that attracts the oil.

Centrifuges have been used for years and rely upon the density of the oil versus the density of water-soluble coolants. Except for high product concentrations, the majority of water-soluble coolants will have a density close to that of water, 8.34 pounds/gallon. Most oils have a density that is much lower, typically 6.80-7.40 pounds/gallon. Because of this difference, oil floats on water. The centrifuge simply accelerates this process for the sake of saving time. Laboratory centrifuges are used to determine the level of tramp oil in a coolant and work for the same reasons as industrial centrifuges. Sometimes, other oil-loving ingredients present in the formulation can be removed along with the tramp oil in centrifuging process.

As long as the ring dams have been set properly, a centrifuge can remove tramp oil and very little coolant. However, if the coolant is already in a meta-stable position because of too much tramp oil breaking down the emulsion, there is a possibility that the centrifuge might begin to pull apart the already weakened emulsion. Alfa-Laval and US Centrifuge are just a few manufacturers of industrial centrifuges.

The act of "coalescing" is to bring together smaller droplets of oil into a larger droplet. The coalescer, like the centrifuge, is a device designed to enhance this principle. Most coalescers rely upon lipophilic surfaces to attract the tramp oil. As more oil is attracted to this surface, the smaller droplets begin to coalesce and become larger. As they grow in size, they float to the surface where they can be extracted by a skimmer or some type of a weir that is just below the oil surface. Most coalescers have few moving parts, which helps to keep maintenance costs low. There are many manufacturers of coalescers like AFL Industries, CECO, Hyde Products and Keller Products.

If the devices listed above are put into practice, monitored for efficiency, and maintained properly they will pay their own price in the minimization of problems related to tramp oil. Used on a proactive basis, this equipment can be highly beneficial to the overall process. Collected tramp oil can be sold to oil reclaimers or burned for its BTU value. This provides an additional incentive to remove tramp oil from fluids and processes.

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Summary

Quaker's recommendation is to maintain tramp oil at or below 2.0%. However, some operations or applications may be more sensitive to tramp. Always strive to minimize the impact of tramp oil on the coolant and make sure there are systems in place to remove the tramp oil before it can do damage.

Contact Quaker at
info@quakerchem.com