TIPS FOR RESOLVING ODOR IN YOUR CUTTING OILS

ODOR CAN BE A CHALLENGE TO DIAGNOSE AND RESOLVE, BECAUSE THE SOURCE MAY BE DIFFICULT TO LOCATE.

Generally, odors can be classified as either biological (from bacteria and/or fungus growth in the metalworking fluid) or chemical. We break down the causes of both and ways you can minimize and reduce the potential of odor in your fluids.

BIOLOGICAL ODORS

Odor complaints are most often the result of rancidity or bacteria growth in the fluid. Metalworking fluids contain organic compounds and other components that bacteria utilize as a source of nutrition. While odor is the most identifiable issue with bacteria growth, there are numerous other related issues, including decreases in pH, selective depletion of key product components, reduced corrosion protection and reduced emulsion stability.

Less frequently, but no less detrimental, odor may be caused by the presence of fungus or mold. Unlike bacteria, fungus does not exist uniformly in the metalworking fluid. Instead, it tends to grow as a biomass in dark, warm, stagnant areas of the machine, and at the fluid-air interface. Some common areas to find fungal biomass are in filter systems, return trenches, rarely used coolant lines, under machine covers and in the main coolant reservoir. Like bacteria, fungi create various issues in addition to objectionable odors, including slime and residue formation, blinding and rapid indexing of filter media, blockage of coolant lines and deterioration of tool life and surface finish.

Since bacteria are found nearly everywhere in a typical machine shop (the water, air, soils, contaminants and people) the opportunity for bacteria inoculation and growth in the fluid is significant. Once bacteria inoculate a metalworking fluid, their growth rate is rapid.

IN A 24-HOUR PERIOD, BACTERIA CAN PROLIFERATE FROM 1 COLONY/ML OF FLUID TO MORE THAN 16-MILLION COLONIES/ML OF FLUID.

Spoilage due to bacteria is one of the most prevalent causes of shortened life and frequent change-outs of metalworking fluids and can have a significant impact on the shop's bottom line.

An alternative to fluid change-out is to treat the system with a tank-side biocide. While this approach may increase fluid longevity, it is often a short-term solution that may come with significant costs. The biocides utilized and approved for metalworking fluids are often extremely expensive and may subject operators and plant personnel to potentially harmful chemicals. The first step in preventing bacteria or fungus growth is to choose a metalworking fluid that has been specifically designed and tested to resist biological growth. The second step is proper fluid maintenance.

Utilizing a high-quality metalworking fluid and good maintenance practices will minimize odor issues due to bacteria and fungus. However, when an odor complaint does arise, the first step in troubleshooting is to understand the nature of the odor. Odors caused by bacteria growth can manifest as a rotten egg, sulfur or sour smell. The nature of the odor often depends on whether it is the result of aerobic bacteria (bacteria that grow in the presence of oxygen), anaerobic bacteria (bacteria that grow in the absence of oxygen) or facultative anaerobic bacteria (bacteria that can grow with or without the presence of oxygen).

For instance, a rotten egg odor is often an indication of particular anaerobic bacteria that reduce sulfates commonly found in metalworking fluids into hydrogen sulfide gas. Anaerobic bacteria flourish in oxygen-starved environments, such as an idle sump that has a layer of tramp oil floating on the surface of the fluid. This "rotten egg" odor is commonly referred to as Monday-morning odor.

To minimize Monday-morning odor, many shops resort to installing compressed air bubblers or other devices to keep the fluid circulating and oxygenated. As with tankside biocides, this can be a costly, band-aid approach. Keeping the fluid circulating only restricts anaerobic bacteria growth; the aerobic bacteria still proliferate, resulting in odors and other issues.

Fungus usually carriers a "locker room" type smell

Whether the odor is rancid or musty, or caused by bacteria or fungus, the following steps can eliminate the odor and prevent it from returning.

First, have Castrol utilize a bacteria and fungus dip slide test to confirm if there is a presence of bacteria and/or fungus in your metalworking fluid. If a positive fungus result is obtained, it is critical to inspect the system for areas of biomass, and physically remove any visible growth. As an immediate corrective action, the fluid may need to be treated with a biocide to eliminate the existing bacteria and fungus. Subsequently, the key to eliminating future bacteria and fungus outbreaks is to diagnose how and why they got there. For the purpose of this article, it is assumed the coolant itself is of high quality and relatively biologically resistant.

The first step in keeping a metalworking fluid free of bacteria and fungus is to continually maintain proper concentration levels (generally between 5% to 10%). Concentration can be easily monitored using a refractometer or titration kit. Regular concentrate additions are vital to ensuring optimum fluid performance. Most high-quality metalworking fluids incorporate a biocide or utilize the synergistic effect of various components to provide bio-resistive properties. When concentration levels are low, the components in the fluid that provide biological resistance are insufficient to protect against biological growth. For most metalworking fluids, low concentrations are those generally below 4%. If concentration is lean, simply add sufficient concentrate to bring the system within the recommended range. If concentration levels are adequately controlled, check the system for excessive contamination. Contaminants can come from the machining process (tramp oils, grinding swarf and metal fines) as well as from external sources, such as cleaners, floor soaps, tobacco, food and human waste.

Tramp oils are ideal food sources for bacteria and fungus. While under most conditions, eliminating tramp oil contamination at the source is difficult, it is important to take the necessary steps to remove tramp oil from the fluid. Depending on the type of fluid in use, equipment to remove tramp oil can range from passive oil skimmers to coelescers to centrifuges.

The buildup of metal fines and swarf in the coolant reservoir also creates a potential breeding ground for bacteria, because the fluid and its bio-resistive components cannot fully penetrate the chip accumulation. Use a dipstick to determine if your reservoir is full of chips; be sure to check various areas of the tank, especially those near the fluid return and pump intake. To prevent chips from building up in the fluid, investigate filtration options for the system, such as adding a filter to a system that currently has no filtration, or adjusting the filter media currently used to enable improved performance. As a matter of good housekeeping and fluid maintenance, external contaminants should be aggressively prevented from polluting your metalworking fluid. If the fluid is excessively contaminated, it will likely be necessary to dump, clean and recharge the system to eliminate the bacteria or fungus issue. Once new fluid is in the reservoir, take proper steps to minimize external contaminants.

If neither concentration control nor contaminants appear to be the root cause of the biological odor, inspect the system for stagnant areas. These are ideal breeding grounds for both bacteria and fungus. As the fluid sits stagnant, the bio-resistive components deplete. Since fresh fluid with its full complement of additives is not regularly introduced into these areas, the fluid becomes subject to biological attack and is unable to preserve itself. If stagnant areas are identified, take the necessary steps to ensure adequate fluid circulation. If machine tools sit idle for extended periods, consider circulating the fluid periodically.

SOME FLUIDS INCORPORATE A FORMALDEHYDE-RELEASE BIOCIDE AS A PRESERVATIVE

CHEMICAL ODORS

While odors associated with metalworking fluids are most often assumed to be biological in nature, chemical odors do occasionally occur. Like biological odors, the nature of the odor is a key component to determining the root cause. Chemical odors can normally be divided into those caused by the product, and those caused by contaminants.

Every fluid has its own distinctive odor. Some fluids have a strong smell upon initial charge-up that dissipates over time. Chemical odors caused by the product are different than the normal fluid smell. Most frequently, product-related chemical odors are the result of excessive concentration (generally greater than 15%). Use a refractometer or alkalinity titration kit to determine if the concentration is excessive. If it is well above range, dilute the system with a sufficient amount of water.

Less frequently, chemical odors are the result of a reaction within the fluid. One example is known as an "ammonia bloom." Some fluids incorporate a formaldehyde-release biocide as a preservative. Under the right conditions, a reaction can occur in which ammonia gas is released from the fluid. The odor subsequent to the ammonia release can be pungent and overpowering. Using a fluid that does not contain a formaldehyde-release biocide is one means of prevention.

Chemical odors caused by contamination can vary widely, depending on the contaminant. First, review the chemicals in the machine shop to determine which, if any, may have been inadvertently added to the metalworking fluid. Second, perform a visual inspection to determine if the fluid has been contaminated. A sudden, distinct change in fluid appearance, such as a change in color, is often a sign of contamination. Other changes, such as foaming, are also potential signs of contamination.

A pH test is often effective for detecting contamination. Under normal operating conditions, a cutting fluid has a characteristic pH range. If the pH is above its normal range, the system was likely contaminated with an industrial cleaner or other high-alkalinity chemical. If the pH is normal, the fluid supplier may be able to perform more detailed, analytical testing to determine if contaminants are present. Once the source of contamination is found, make the changes necessary to eliminate future occurrences.