Is Oil a Problem for your Wastewater Treatment?

As local governments and municipalities are working to resolve the issue of fats, oils and grease (FOG) that are clogging sewers systems, the issue has an immediate impact not just on households and restaurants, but also for the industrial sector such as remanufacturing and metal finishing.

Any manufacturer that discharges wastewater into municipal sewers systems is facing stricter FOG regulations now and in the future. Facilities whose discharge include drawing, stamping and machining oils — as well as buffing and polishing compounds, corrosion prevention compounds and dye penetrate testing solutions — need to have preventive measures in place to break down the FOGs and treat their discharge in a way that is environmentally safe and protects their discharge lines from clogging.

Traditionally, breaking oil emulsions out via pH adjustment has been the most utilized way to remove oil from wastewater. This is still a viable treatment method for heavily laden wastewater, and we will discuss the pros and cons of utilizing this method. We will then discuss new methods of emulsion breaking, how to utilize them in industrial wastewater applications, and if they are right for the needs of the facility. New methods to be covered will include physical/chemical means of emulsion breaking, new equipment on the market and bacteria who consume oil.

Why are FOGs a Problem in Wastewater

The U.S. Environmental Protection Agency says that fats, oils and grease (FOG) includes "materials of vegetable, animal and mineral origin. Mineral oils include petroleum, hydrocarbon, and/or non-polar fats, oils and grease." (*EPA local Limits Development Guidance, 5-23*) EPA's Report to Congress on combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) identified that "grease from restaurants, homes, and industrial sources are the most common cause (47%) of reported blockages. Grease is problematic because it solidifies, reduces conveyance capacity, and blocks flow." (*See Impacts and Controls of CSOs and SSOs, EPA-833-R-04 001, August 2004*)

From an industrial user standpoint, FOG coats probes, blinds filter presses and can clog discharge pipes. FOG can also create downstream issues by contributing to the clogs formed when larger particles such as personal care wipes snag in sewage pipes. FOG will coat these pieces and allow grit to attach to them, forming larger clogs that are referred to as a "fatburg" that can weigh in over 150 tons in some cases. They require intensive work to remove; when they have totally clogged a sewage main, overflows can occur that disrupt everything in a city from traffic flow to drinking water supplies.

Manufacturing Contributions to FOG

Manufacturing processes that contribute to FOG include drawing oils, stamping oils, machining oils, buffing compounds, polishing compounds, corrosion prevention compounds, dye penetrate testing solutions and transportation equipment such as forklifts. Each manufacturing process that utilizes one of the above poses a unique challenge in wastewater streams. The EPA has set the standards for industrial users to discharge FOG under 40 CFR 403.5(b)(6). It prohibits the discharge of "petroleum oil, non-biodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through.". The limits set by publicly owned treatment works (POTW) are based on their need to protect the treatment plant, and the receiving stream of water from these harmful pollutants. With that in mind, the pretreat limit set by most POTWs is 100 mg/L for FOG. This can and does differ depending on the POTW. The limit is based on an article written in 1975 titled *Treatability of Oil and Grease Discharged to Publicly Owned Treatment Works*. It has been determined that best management practices along with current treatment methods can achieve the 100 mg/L limit easily.

There are several current methods of oil recovery/removal for industrial wastewater systems to combat these FOG issues. Manufacturing facilities can bring in consultants to help them understand how their current wastewater treatment system is functioning, and make recommendations on how to address their situation. The current methods include:

- **pH Adjustment with Oil Skimming**: the most common form of oil recovery/removal is pH adjustment with oil skimming. By lowering the pH with sulfuric acid, emulsified oils become destabilized while slightly acidic oils become protonated. This allows for easier separation of the oils from wastewater in a process known as "acid cracking." Once the oils are free from the wastewater, they will float on top of the water, and an oil skimmer can then be used to remove this oil layer from the tank for recycling or disposal as needed. Oil skimmers removal rates can be determined by manufacturers; most use SAE 30 weight motor oil at 65°F to rate their skimmers. Designs are based on the oil removal needs of the system over a 24-hour day. The downside to this process is that strong acids are used to lower pH for the cracking of the oils. Proper personal protection equipment (PPE) and training are needed for operators to ensure their safety. With a lower pH, the wastewater will require the addition of hydroxides to raise the pH back to acceptable discharge ranges. If the skimmer is not sized properly, oil will remain in the wastewater. If the tank does not have adequate still space for the skimmer to work, it may not capture all of the oil. Water can be captured with the oil which may require additional treatment before the oil can be sent for recycling.
- **Coalescing Oil Water Separators**: the design of coalescing oil water separators is based off of Stokes' Law, a mathematical equation that expresses the settling velocities of small particles in a fluid medium. Oily water is pushed through the media pack, where oil droplets are forced together to make bigger droplets. Once they are big enough, the droplets separate from the water and drain out of the units. Some common issues with oil water separators include odors, cracks and loose fittings. Emulsified oils of less than 0.5 microns will exhibit Brownian Movement and may never separate using coalescing technology.

- **Chemical Treatment**: chemicals have been created over the years that can break emulsified water/oil blends. These demulsifiers neutralize the stabilizing effect of the emulsifying agents. They work best at a pH range between 7-9. Motion is required, but it must be controlled; rapid movement in the water/oil solution will re-emulsify the two components. Over-doing of the products will also cause the wastewater to re-emulsify. To understand which demulsifier product will work best with the wastewater being treated, first an understanding of the emulsion is needed. Sufficient amounts of the demulsifier must be added to achieve neutralization of the emulsifier. Tanks must have adequate detention times to allow for the products to work. In some cases, heat, electric grids and coalescers may be needed to support the demulsifiers.
- **Biological treatment**: bacteria has been used for over a decade to remove oil from oil spills. Studies have shown that bacteria that produce lipase enzymes can be very successful in degrading high levels of oil in wastewater. These bacteria use oxygen for respiration and the hydrocarbons in oil as a food source. This process can take large amounts of time to occur, often over 44 hours. If enough time is given to the bacteria, around 90% of the oil can be removed. Equipment need for the bacteria to live on can be varied. Rotating biological contactos (RBC) units, trickling filters, moving bed biofilm reactor (MBBR) units and aeration basins are all types of systems that can work for the process. Each system requires oxygen to be readily available to the bacteria to keep them alive, which is known as aerobic digestion. While anaerobic bacteria can work for oil degradation, it is an even longer process that is not as efficient as aerobic bacteria.

The issue with FOGs is one that can be treated successfully with the help of trained professionals.

5-Step Plan for Reducing FOG issues in Manufacturing Operations

To stay within a discharge limits, manufacturers have to know what's in their wastewater and how it got there. Hubbard-Hall technicians determine this because they sell chemistry into upstream processes for over 170 years, so they understand how to optimize the downstream effluent. Here is a typical review and implementation process:

- **Step 1: On-Site Process review** — Hubbard-Hall's tech staff starts upstream to understand a manufacturing processes, chemical usage and sludge generation.
- **Step 2: Equipment check** — is the equipment matched to the wastewater needs? Not always. It's a common issue that causes endless challenges, and one that Hubbard-Hall can determine if a facility has the proper equipment in place.
- **Step 3**: **Jar testing** — Hubbard-Hall will sample, benchmark, sample again and conduct thorough treatability studies to identify the optional chemistry dosage.
- **Step 4: Best Process Recommendation** — Hubbard-Hall's technical staff will provide a customized report, including process recommendations, anticipated costs, and chemical and sludge reduction efficiencies.
- **Step 5: Implementation and Best -in-Class Support** — Hubbard-Hall will be at the manufacturer's side during implementation and provide staff training, comprehensive documentation and performance tracking.

Hubbard-Hall has worked extensively with remanufactures, metal finishers and metal fabricating companies who are having a difficult time dealing with FOGs. Luckily, many of Hubbard-Hall's products are being used to reduce these contaminants:

- **Aquapure OB Plus:** highly concentrated cationic coagulant used for clarification as well as dewatering of wastewater. Aquapure OB Plus can also be used as a demulsifer for oily waste water as well as liquid/solid separation during secondary treatment with DAF equipment.
- **Aquapure Quick Drop:** one step treatment. Powdered blend of clays, polymers and conditioning agents used for massing solids together for easy removal.
- **Aquapure Oil Split:** a liquid catitonic polymer used as an oil-in-water emulsion breaker in waste streams containing cutting oils, lubricating oils, coolants, grinding fluids, and tramp oils from industrial machining plants
- **Aquapure AP 99:** versatile concentrated coagulant formulated for enhanced liquid/solid separation on chelated & non-chelated wastewater.

Will a manufacturer need to change their waste treatment? Possibly not, but Hubbard-Hall can help manufacturers identify process changes that can be made upstream, so they minimize the downstream issues. And it often means helping a manufacturer you use less chemistry.

Our people. Your problem solvers.

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For questions or comments on this information please call us at
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