Wilson Environmental
ENGINEERED WATER & WASTEWATER SYSTEMS

Removing Oils from Wastewater using Organoclays

Introduction:

The intent of this paper is to provide general information to assist in understanding oil water emulsions commonly found in industrial wastewater and the use of organoclays compared to traditional methods to remove oil from wastewater.

Understanding Oils in Industrial Wastewater:

Free Oil: Free oil is oil in a wastewater stream that will rise to the surface as a free oil layer. Free oil separates by gravity and can removed by a conventional gravity oil water separator. Typical oil droplet size is 150 microns.

Gravity Oil Water Separator: A chambered tank with over and under weirs to trap free oil in a chamber where it can be removed by a skimmer device, such as a wier, belt or rope type skimmer.

Emulsified Oils: Emulsified oils are small oil droplets in the wastewater ranging in size from 10 to 150 microns. Emulsified oils will not rise to the surface by gravity alone. Emulsified oils are either Mechanically emulsified or Chemically emulsified.

Mechanically Emulsified Oils: The oil droplets range in size from 20 to150 mircorns. Mechanically emulsified oils are mixed with water by high shear forces as in a centrifugal pump. The high shear forces physically shearthe oil droplets into smaller droplets. Mechanically emulsified oils will eventually separate by gravity.

Chemically Emulsified Oils: These are oils that have been emulsified by the action of soaps, detergents and degreasers. Cutting lubricants are formulated as oil water emulsions to both cool the cutting tool and to provide lubrication for the cutting tool. Cutting lubricants are more difficult to treat as the emulsifier was selected for its strength in holding the oil in an emulsified state. pH will also chemically emulsified oil. If the pH is greater than 8.5 (>8.5 pH) the oil is chemically emulsified and will not separate by gravity.

Dissolved Oils: Dissolved oils are organic chemicals such as gasoline, the BETX compounds; Benzene, Toluene, Ethyl benzene and Xylene that can be

dissolved in the wastewater.

Oily wet solids: These are particles of dirt or other solid particles that are coated with oil.

What is Organoclay?

Organoclays are chemically altered bentonite clays. The clay is treated with a quarternary amine. Quaternary amines are surfactants that bond to the clay particle by ion exchange. The quaternary amine has two ends, a water loving end (hydrophilic) and an oil loving end (lipophilic). It is the water loving end that binds to the clay particle leaving the oil loving end ready to remove oil from your wastewater.

Removing Oil from Wastewater with Organolay

Organoclays can remove 30 % to 50 % of their weight in oil, grease, diesel, other hydrocarbons and chlorinated hydrocarbons. For example: If a filter vessel contains 100 pounds of organclay, it should be able to absorb 30 + pounds of oil or about 4 gallons of oil. If your wastewater contains 200 mg/l (typical concentration after a gravity oil water separator) you should be able to treat approximately 19,000,000 gallons of water before the filter is spent.

Organoclays are generally mixed with another filter media such as anthracite coal. The typical blend is 70% anthracite coal and 30% organoclay. As the organoclay adsorbs oil and hydrocarbons from the wastewater it begins to swell. This is why it is mixed with anthracite coal, to prevent early swelling and blinding of the filter vessel. The swelling effect can also split open the filter housing if used at higher percentages.

Organoclay Compared to Granular Activated Carbon : Organoclay can absorb up to 7 times more oil than GAC. Since oil can foul a GAC filter, organoclay filters are unused in front of GAC filters to prevent oil fouling and prolong the life of the GAC filter.

Beneficial Use of Spent Orgnoclay: If you are burning the absorbed oil, the anthracite coal will add to the BTU value.

Other Methods for Separating Oil and Water

Oil Water Separators: Oil water separators work by gravity and can remove free oil, and some emulsified oils depending on the oil type and the droplet size. Generally, a gravity oil water separator, treating a non-emulsified oily wastewater stream, will lower the oil concentration to a range of 10 to 200 mg/l. Many oil water separators are equipped with a coalescing grid. The grid is made of an oliophilic plastic material, usually HDPE, High Density Poly Ethylene. The coalescing grid forces the wastewater to repeatedly change direction as it works its way through the separator. The theory is the oil droplets will collide with the oiliophilic surface of the grid and stick to and begin to accumulate. As the oil layer increases in size the oil will makes its way to the top where it is skimmed off.

Heat: Heating is sometimes used to break oil water emulsions. The wastewater stream is heated to 170 to 220 degrees Fahrenheit where the oil will separate and begin to float.

pH adjustment: pH adjustment is sometimes needed to lower the pH form an elevated level to around 6 to 6.8. pH adjustment is generally used in conjunction with a gravity oil water separator.

Coagulants: Coagulants such as ferric chloride and Aluminum Sulfate can break the oil water emulsion. These require a polymer to floc the coagulated oils and achieve separation.

Other Wastewater Issues:

Industrial Wastewater Permits: All industrial discharges to a public sewer system are subject to general and specific prohibitions identified in the Code of Federal Regulations identified in 40 (CFR) 403.6 which prohibits the discharge of any pollutant that may impair worker or public health and safety, or that might upset or pass through the wastewater treatment plant untreated.

Always check with your local sewage treatment authority for permit requirements.

References

University of Houston: Civil Engineering Dept.