

Biomim

Ion Exchange Resin Fouling by Oil

Technical Advisory Number 22

BACKGROUND

To understand the problems associated with the effects of oily waste on deionization resins, it is important to first understand the categories of oily waste materials. In general, oily wastes fall into three categories:

- Free
- Emulsified
- Dissolved

Free oils are recognized by the "rainbow" sheen on water surfaces. Since oils are lighter than water they will always float on the surface, and a "quick and dirty" test for their presence involves the use of camphor. Camphor sticks can be purchased at drug stores, and if a small flake from the stick is dropped onto the water surface, it will spin on the surface if no oil is present. If it floats without spinning, that indicates the presence of free oil.

Emulsified oils consist of tiny droplets forming an emulsion that "ties up" the oil so that it is dispersed throughout the water and behaves like a suspended solid. Emulsions can be either "chemical", formed by emulsifiers, or "mechanical", resulting from turbulence and/or rapid mixing.

Dissolved oils are the particular components of oil that are water soluble and produce a solution in the water stream. Whereas most oily wastes contain some soluble components, they usually constitute a very small percentage of the total oil contamination.

Resin Fouling

Deionization resins are particularly susceptible to fouling from free oils. This is because the oil film will readily coat each ion exchange bead, and severely inhibit the bead's ability to adsorb ionic materials from the water stream. As the film is also sticky, it will result in agglomeration of the beads, producing channeling of the bed. The agglomeration can also significantly affect backwashing.

Ion exchange resins, if not too badly fouled by free oils, can be cleaned with a non-ionic surfactant such as Triton X-100 (or even some dishwashing detergents); however, the

"defouling" activity requires soaking, air agitation, rinsing, backwashing and finally, regeneration - an extremely labor extensive process.

Since, on a microscopic level, emulsions behave similarly to suspended solids, they also plug and foul ion exchange resins, and require a similarly extensive treatment regimen for removal.

Dissolved oil, those water-soluble components of oily waste, can attack the polymeric structure of the ion exchange resin beads, causing irreversible fouling.

ORGANOCLAY TREATMENT

Organoclays are bentonite clays which have been modified with quaternary amine compounds which render them hydrophobic and organophylic, and have been used as thickeners and anti-settling agents in greases, lubricants, putties, and paints since the 1950s. Organoclays have the ability to remove 50% of their weight in oil, which represents a seven-fold increase over activated carbon.

Because they are available in granular form, they can be placed in vessels appropriate for other filter media and operated in a similar fashion.

Less expensive than activated carbon, and more effective at removing oily waste, organoclays make optimum pretreatment technologies for all oily wastewater contamination issues.

ECONOMICS

The typical cost of regeneration for mixed bed deionization resins (labor plus chemicals) is in the area of \$50/ft³. The cost to clean resins fouled with oily waste using the regimen described above ranges from \$100 to \$150/ft³.

Organoclay costs approximately \$100/ft³.

Assume that a water source containing 3 ppm of oil is processed by 2ft³ of mixed bed resin at a rate of 10 gpm (24 hr/day basis). To ensure virtually complete removal of the oil, place a filter housing containing 1ft³ of organoclay upstream of the mixed bed resin. The adsorptive capacity of the organoclay will require that it be changed no more frequently than every 694 days.

A conservative design would dictate organoclay replacement annually, at a cost of \$100/yr. Assuming that the DI resin (without the organoclay pretreatment) would require cleaning after contact with a total of 0.5 lb oil (0.25lb/ft³), the cleaning frequency would be every 2 weeks at a cost of \$200-\$300. This results in an annual cost of approx. \$6500 vs. \$100 for organoclay pretreatment. These calculations do not include more frequent resin replacement resulting from the effect of the oil fouling.

Reference: Gary Schreiber, CWS VI

The Purolite Company

Biomin Short Course

George Alther of Biomin Inc. will present a three hour workshop on October 18 on the use of organoclay in conjunction with activated carbon and other organoclay applications. This workshop will be a part of the 18th International Activated Carbon Conference & Courses program in Pittsburgh, PA.

Call BIOMIN, Inc. for further information.

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