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Technical Advisory #14

BIOMIN'S "TIP OF THE MONTH"

OILSORB/CARBON SYSTEMS STABILIZE ABOVE GROUND BIO-REMEDIATION SYSTEMS

Biological treatment systems have long been a low cost solution for remediation of groundwaters contaminated with high nitrate, synthetic organic compounds or biodegradable, organic wastewaters.

The principles of biological treatment are a need for substrates, electron donors or acceptors, favorable pH and temperature conditions and nutrients. Proper design is also needed, in order to allow good contact between biomass and substrate, good sludge age, and efficient solids/liquid separation.

Bio-systems suffer from the following weaknesses: 1. They are living systems that need constant process control and maintenance; slow relative to physical/chemical systems, 2. Slow growth rates and complex startup, 3. Must operate at narrow and stable pH and temperature ranges, 4. May not reduce concentrations to acceptable levels (depending on the pollutant and its concentrations), 5. Some contaminants are less suitable for biological systems such as highly chlorinated solvents like PCE, PCB and TCE.

Specific water quality constituents can interfere with the performance of biological treatment. Oil and grease tend to accumulate in biological reactors and shift the microbiology away from a balanced population. Iron can be a problem if it precipitates phosphates or other trace minerals needed for growth. Soluble metals and petroleum hydrocarbons can be toxic to biological systems if present in ppm concentrations or introduced too rapidly.

Biological systems are characterized by the predominant biology (aerobic/anaerobic,

heterotrophic/autotrophic) and support medium type (attached versus suspended growth). Groundwater cleanup systems tend to be anaerobic, fixed film type systems. For these systems, the optimal pH is 6.6 to 7.6, no lower than 6.2. Dissolved oxygen must be less than 0.1 mg/L and temperature is in the mesophilic range, 20 plus or minus, by 10 degrees C or so.

Oilsorb Organoclay filtration in conjunction with activated carbon may serve as a pre-treatment barrier against synthetic organic spikes that can occur in susceptible surface and groundwater affected by spills, seasonal pesticide applications, storm water and runoff water, and dewatering operations (for example brown fields).

Oilsorb organoclay adsorption (partition) is an excellent approach prior to biological treatment for removal of readily sorbed recalcitrants, particularly those contaminants (Hg, PCB) which present toxicity conflicts with downstream biological treatment or that inhibit co-metabolic de-halogenation reactions. Oilsorb filtration can also enhance oil/water separator effluent, providing redundancy and protection for downstream biological systems. In such instances a 2-stage pH adjustment, pre-and post Oilsorb filtration, is likely needed to control inorganic scaling on the filter, enhance sorption characteristics and maintain the biological influent pH at appropriate levels.

Post biological Oilsorb filtration can effectively enhance carbon polishing. A sand filter should be installed prior to Oilsorb/carbon systems to intercept fugitive biomass. In this instance, pH adjustment to 5 prior to Oilsorb filtration would likely inactivate biological carryover, prevent biofouling (and carbonate precipitation) in the downstream filters and enhance sorption of the target compounds. A final pH adjustment can restore the pH prior to discharge.

Biological remediation, particularly with low organic content waters (e.g. groundwater or storm water) or variable high strength waste streams, will, of course, require additional adjustments of substrate, an electron donor/acceptor, and nutrients that may effect operational requirements of the pre- or post-filtration system. Lack of attention to these and other environmental controls can be problematic and may lead to biological upsets and settleability issues that can blind downstream filtration units.

Overall, the use of organoclay provides a mechanism to remove the more recalcitrant oil and grease materials which become the limiting factor in the performance of a biological system. Removal of these fractions which impede overall system performance can lead to increased flow rates and mitigation of potential process upsets.

For more information and consulting assistance on bio-remediation contact Dr. Al Venosa, venosa.albert@epa.gov; or Glenn Dombeck, P.E. at glenn@ascendinnovations.com. More information about Oilsorb is available at www.biomininc.com.