THE ROLE OF ECE CLAYFLOC BASED PRODUCTS IN WASTE WATER TREATMENT

The topic of this article will center primarily on a specific type of clay and on its proven ability in wastewater treatment.

Typically, industrial wastewater may be contaminated with suspended solids, heavy metals, organic compounds and other potential pollutants. Various methods exist for removal of these contaminants, to include acidifying (to break oil emulsions) precipitating heavy metals, adding primary coagulants, coagulant aids, settling, filtration etc. In general, a series of steps is necessary, requiring the addition of various chemicals to several mixing tanks and equipment. The resulting sludge produced, depending upon the initial contaminants, may be classified as hazardous, entailing high disposal costs.

ECE Clayfloc lines of products are highly efficient waste water treatment formulations that are designed to be mixed in a dry state directly to a contaminated industrial waste stream. The products are dry powders comprising a blend of sodium montrmorillonite clay, pH adjusting items and polymers (polyelectrolytes). The various ingredients act in a sequential fashion to break oil and water emulsions, precipitate heavy metals as hydroxides, promote flocculation, agglomeration and suspended solids removal.

ECE Clayfloc formulations are directly applied to a waste stream; clay particles flocculate, removing certain cationic metal contaminants from solution. Additionally, through the precise use of polyelectrolyte, the clay agglomerates, encapsulating any suspended hydrocarbons. The resulting mass is a complex mixture of encapsulated contaminants and waste held together by Van der Waals forces as well as electrostatic forces. The clay particles then begin to stick together entrapping the other components and surrounding them completely. The contaminants, once microencapsulated, are surrounded by a barrier of clay particles and are unavailable to external leaching fluids for as long as these fluids are kept from the interior of the clay “pocket”. Since the contaminants are evenly distributed throughout the particles, no great concentration is ever “open to the environment” when disposed of properly in a landfill situation.

What is sodium montromorillonite clay and why is it preferred over others? To develop a better understand of these clays we must first review their geologic history. Sodium bentonite, can be traced back 90 to 110 million years, presumably associated with the emplacement of the Idaho batholith, when volcanic eruptions hurled micro-fine particles of volcanic ash into the atmosphere. Prevailing winds swept the fine ash eastward across the inland salt seas where the particles fell out and eventually settled to the seafloor in uniform horizontal layers. Through a process of devitrification (to change from a glass condition caused by heat to a crystalline condition) and chemical alteration, the amorphous ash (having no real or apparent crystalline form) reacted with the salt water to form the right composition of aluminum, silicon and magnesium ions. In the few thousand years that followed, the noncrystalline material organized itself into very small crystalline units that in time developed into a waxy claylike substance. Eventually a massive uplift of the seafloor occurred, forming what we know today as the Bighorn Mountains. As a result of millions of years of erosion, the bentonite deposits have outcropped on the surface and are recognized as narrow, light colored bands running parallel to the mountains. This unique product of nature’s forces called bentonite can be classified as sodium based montmorillonite clay. Nowhere else but in the confines of North West U.S. is this clay mineral found in such quantity and with such consistent properties.

Bentonite structurally is made up of billions of tiny plate-like particles, each averaging less than 1 micron in size (1 micron is about 1/25,000 inch) These particles are staked or layered one upon the other, much like sheets of paper in a tablet. If one could separate platelet from its neighbor and place them side by side, approximately one handful of bentonite (or one cubic inch) would more than completely cover a half acre of land. Bentonite’s unique molecular structure, which allows it to absorb nearly five times its weight in water and swell to a volume of 12 to 16 times its dry bulk are very significant factors to consider when we begin to assess its applications for industrial use.

As mentioned earlier, clays, and bentonite in particular, are hydrous aluminum silicates. The bentonites are composed of three layers of silicates compressed into a microscopic sized plate sandwich. Despite their small size however, the platelets have a relatively large surface area. The edges of the bentonite platelets are positively charged and the flat surface areas of the platelets are negatively charged. Because of their small size, electrostatic charges control the bentonite platelet behavior, and they are strongly attracted or repelled by each other and various other substances as well. Pure sodium bentonites are extremely hydrophilic, that is, they swell in water because of the electrically balanced water molecules, which are attracted to the plate surfaces and force them apart. It is for that reason, that pure sodium bentonite exhibits a propensity to adsorb heavy metals from solution. The electrically balanced dissolved metals insulation is attracted to the plate surface of the bentonite particles. Sodium bentonite will in effect draw any positively charged ion out of solutions and electrochemically absorbs them. It is important to note that these cations are absorbed into the interior surfaces of the bentonite and not adsorbed upon the exterior. It is for this reason that the resultant sludge from wastewater treatment reacts favorably to TCLP Testing criteria.

Let's pause for a moment and consider why it is important for heavy metals and like species to be removed from water sources. Studies have proven that significant levels of lead in drinking water are known carcinogens. Increased levels of lead can also lead to kidney and central nervous systems effects. Barium is known to effect blood pressure, cadmium is known to effect kidney functions. Elevated levels of nickel are thought to have adverse effects on liver functions, just to name a few. By eliminating these contaminants from treated waste streams, the risks associated with water re-use are proportionally decreased.

To summarize, the bentonite clay, based formulations by ECE, has the ability to separate oily contaminants from the water, precipitate metallic hydroxides, ironically react with non-precipitated heavy metal cations and encapsulate the materials forming a non-hazardous waste, thus lowering disposal costs. These conclusions can be verified by independent laboratory testing, as is suggested. The procedure is quite simple, just one step and can be accomplished by either manual or completely automatic mechanisms.

Recent cost analysis has shown that by using ECE Clayfloc clay-based products for wastewater treatment, users could expect to save 80-90% over conventional waste transport and disposal costs, making this alternative not only efficient, but also cost effective. Many variables are to be considered when weighing options for wastewater treatment such as volumes of water to be treated, waste constituents, and equipment necessities. However, clay-based products have proven to be a viable alternative to waste water treatment.