

UTILIZING ORGANOCLAY™ MEDIA AS A SORBENT ADDITIVE TO DECREASE ORGANIC MOBILITY AND HYDRAULIC CONDUCTIVITY

BACKGROUND

Organic contaminants migrating with groundwater sources continue to offer significant challenges in terrestrial remediation applications. While selective media such as granular activated carbon (GAC) have proven to be successful at adsorbing soluble organics, these media may have reduced performance due

to blinding in the presence of high molecular weight organic matter and may be prematurely saturated due to the active sites competing for inorganic matter as well as the organic contaminants of concern. An alternative technology is emerging that addresses this problem with a clay-based adsorption media, which effectively and efficiently stabilizes low-soluble organic matter. Organoclay™ Media utilizes granular sodium bentonite clay, which has been chemically modified to attract organic matter without absorbing water. The unique platelet structure of bentonite provides tremendous surface area and the capacity of the media to adsorb over 60 percent (by weight) in organic matter.

Organoclays have been utilized as additives to permeable reactive barriers (PRB), amendments to soil liners and as a soil stabilization agent to reduce the transport of organic contaminants. The primary focus has been on the ability for this specialty sorbent to effectively adsorb low soluble organic matter from aqueous solutions. Organoclay has been also been used as an additive to soil containment barriers and low permeable slurry walls. It has been shown to reduce transport of organic contaminants and improve the hydraulic conductivity characteristics when petroleum based hydrocarbons are present. (Boldt-Leppin, Haug and Headley, 1996).

APPLICABILITY AS A SOIL SEALANT

Sodium bentonite clay has been utilized as soil admix for hydraulic barriers for a variety of remedial applications. The primary benefit of utilizing this specialty mineral is the fact that it is very hydrophilic and swells many times (by volume) in the presence of fresh water. The result is a barrier of very low hydraulic conductivity ($< 10^{-9}$ m/s typical). The design of these barrier systems has focused on minimizing the flow of water. However, even with hydraulic conductivities of less than 10^{-7} cm/s, the mass flux of many organic contaminants can be significant. While bentonite clay is able to minimize the advective flow of suspended contaminants, transport due to molecular diffusion can be a critical transport mechanism (Lake and Rowe, 2000, 2004). The inability of typical clays to impede diffusive transport has led to new research on utilizing Organoclay and other specialty sorbents to amend standard bentonite-soil barriers. Recent studies have shown that hydraulic conductivity of sodium bentonite and earthen barriers amended with 3% (by weight) of certain types of Organoclay met or surpassed regulatory requirements of 1×10^{-7} cm/s. More importantly, transport simulations indicated that these modified barriers can retard benzene transport. (Hunt, Smith, Burns and Rabideau, 2005).

APPLICABILITY IN SOIL-BENTONITE SLURRY WALLS

Slurry walls are physical barriers used to contain or direct the flow of groundwater. Most slurry walls are constructed of native soils, bentonite clay and water mixture. Portland cement and other self

hardening components are also often used if the design requires lower permeability ($< 10^{-7}$ cm/s) or higher compressive strength. While these engineered barriers have long been used in construction applications to control seepage, they continue to gain popularity in remedial applications for the containment and redirection of contaminated groundwater. When constructing slurry walls, permeability is the critical parameter for designers and regulators. However, incompatibilities between traditional construction materials and site contaminants (if they are organic in nature) have led to the development of new compositions of traditional soil-bentonite slurry walls. These new designs include specialty sorbents to more effectively contain shorter chain hydrocarbons and other organic matter that may be capable of passing through barriers with permeability as low as 10^{-7} cm/s. When mixed in to a standard slurry wall mix at a 2% (by weight) addition rate, Organoclay has proven to effectively minimize the migration of medium to light hydrocarbons previously passing through the barrier. Furthermore, within 14 days the perm value of the amended slurry wall was almost an order of magnitude lower than the standard bentonite formulation.

APPLICABILITY AS A SPECIALTY GROUT

Sheet piling consists of a series of panels with interlocking connections, driven into the ground to form an impermeable barrier. These panels can be constructed from a variety of materials such as steel, vinyl and plastic depending on the site specific contaminants present. While these specialty engineered barriers have proven to be impervious to aqueous solutions and migrating organic matter, they are sometimes susceptible to these solutions passing through the interlocking joints if not installed and sealed properly. A new specialty grout incorporating Organoclay and high swelling sodium bentonite clay has proven successful in creating an impermeable seal in the open cavities within these joints. Furthermore, the addition of Organoclay to this grout ensures that organic material migrating with these solutions will not pass beyond the piling. Grouts of this type may be used to seal known areas of high infiltration or permeable formations.

SUMMARY

Terrestrial remediation projects for organic contaminants pose many challenges for traditional technologies. Organoclay amendments to PRBs, soil liners, GCLs, slurry walls and grouts may be used to improve their performance preventing migration of these organic contaminants in both permeable and impermeable engineered barriers. Because individual site characteristics vary, project specific testing should be conducted to determine applicability.