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Ask Tom! Column

“Wyoming” Bentonite Pond Liners and Sealants

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The little known, but widely used industrial mineral called “Wyoming” bentonite can create a natural “hydraulic barrier” in a wide range of industrial, commercial and consumer applications. From industrial effluent lagoons to stormwater retention basins to animal feedlot settling ponds to decorative water features around your home, bentonite-based, hydraulic barriers offer the opportunity for one to easily construct a pond or lagoon.

What is Bentonite?

Bentonite is an industrial mineral, rich in a clay mineral called montmorillonite. Bentonites used for hydraulic barriers in North America are produced from the naturally occurring sodium bentonites mined in the state of Wyoming. These bentonites have a unique cation chemistry. The cations that balance electrostatic charge in the clay structure are “exchangeable” cations and consist of sodium (Na+), calcium (Ca++), and Mg (++) cations. The largest deposits of commercial sodium bentonite are found in Wyoming, Montana and South Dakota. Over the years, these special bentonites have become famous and commonly referred to as “Wyoming” bentonite.

The combination of the relative purity, its unusual geochemistry and structure is why “Wyoming” bentonite is used as a sealant. Purity is defined by the amount of sodium montmorillonite as compared to the other minerals present in the bentonite. A typical “Wyoming” bentonite contains ~90% montmorillonite while other bentonites produced around the world have only 70-80% montmorillonite.

The montmorillonite structure contributes to the usefulness of bentonite. Montmorillonite is a layered aluminum and silicate mineral, which is thought to occur as very small, two dimensional mineral form called a “platelet”. The thickness of this basic building block is approximately 1.0 - 1.5 nanometers, or about 50,000 times thinner than a human hair. These montmorillonite platelets have aspect ratios of 500:1 to over 1000:1 (width x height) which in turn creates a very high surface area per unit volume. These platelets physically occur in nanometer-scale stacks or “decks-of-cards”.

“Wyoming” Bentonite as a Pond or Lagoon Liner

The principal function of bentonite for earthen ponds and lagoons is as a hydraulic barrier. It is the hydration properties of “Wyoming” bentonite that provide its unique sealing or barrier qualities. Due to its sodium content, it is different from calcium and sodium-activated bentonites because of its ability to swell 1000% of its natural volume when introduced to water. It is this swelling property that allows bentonite when hydrated to fill “sandy” soils and “self-heal” if breached. This self-healing property is a unique and distinguishing feature “Wyoming”bentonites when compared to conventional synthetic or polymer membrane liners.

Bentonite hydration is an area of ongoing research and the “swelling” phenomenon not completely understood. Visually, hydrated bentonite appears as pasty or tacky gel with the consistency of butter. Upon hydration, bentonite in a geosynthetic clay liner (GCL) or amended soil, swells to form a layer or liner of low-permeability.

GCL and Amended Soil Liners

There two general types of bentonite products are used for liner markets. Bentonite is utilized in industrial markets in the form of geosynthetic clay liner (GCL) or as a compacted, amended bentonite/soil mixture.

Geosynthetic clay liners are used in a range of applications from livestock pond liners to landfill liners. Liners are composites of geotextile fabric and bentonite. The GC liners sandwich low-permeability bentonite between two layers of high-quality geotextile fabric(s). These liners have become a favored option in the industry due to their long-term containment capability, chemical resistance, environmental compatibility and ease of installation.

Typical Bentonite GCL Pond Liner Application

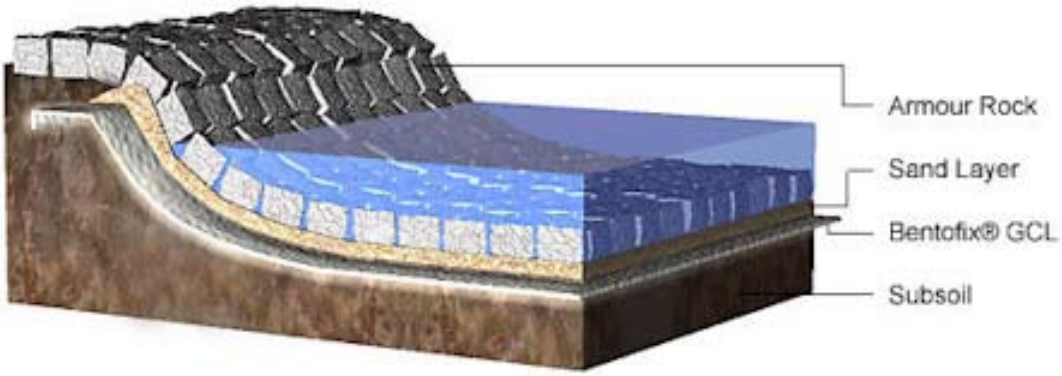

Photo Courtesy Naue Fasertechnik Gmbh

A compacted clay liner can either be in the form of an bentonite/soil mixture with the disturbed soil or as a discreet layer of bentonite. For the bentonite/soil amended liners, the granular or powdered bentonite is mixed with the disturbed soils or earthen materials at ratios of 3:1 to 5:1 (soil/clay) depending on the texture of the soil. After a uniform mixture is achieved, the mixture is compacted. For the discreet compacted clay liner, 4-8 inches of the product is compacted over the area of the pond prior to filling.

Other Applications

Bentonite for Decorative Water Features

A new market for bentonite-based products is emerging in North America, the “decorative water features” market. A “decorative water feature” is any manmade stream, fountain, waterfall, or other manmade water feature that contains water for landscape purposes. These consumer-oriented markets also require convenience, performance and safety.

Customers ask the same questions, “how do I prevent seepage?” and “how is bentonite used as a decorative pond liner?”. Bentonite Performance Minerals produces a special bentonite product called Enviro-Seal™ HG is that can be used to control seepage. With a minimum application rate of 5 to 6 lbs per square foot spread over the pond area for sealing, the bentonite is tilled into the soil to a depth of 4 to 6 inches prior to compaction. Once it is compacted, the pond may be further decorated with sands, gravels or stones.

Bentonite for Water Clarification and Phosphorus Removal

Bentonite Performance Minerals also offers a new generation bentonite products called BaraClear™, a time-released, water clarification product for the water treatment market. It is available in form of a tablet or briquette. The primary use of BaraClear™ is for organic and inorganic contaminate removal, including phosphorus. It is an efficient way to clarify natural and industrial waters and remove phosphorus, a key contaminant in many natural water systems.

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Welcome to Ask Tom!, a monthly column by our resident water treatment guru, Tom Keenan of National Environmental Services Agency (NESA). Tom addresses the issues that bug you the most. And Tom knows!! With 35 years experience in providing environmental support services to public and private sector clients on a wide range of environmental issues.

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Guest articles for the **Ask Tom!** Column are always welcome, for more information please contact Tom Keenan directly at his email address: info@nesa.ie

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