

BENTONITE









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BENTONITE belongs to the group of non-metals minerals. Generally, it is an essential basic material for the entire deep well & sea well projects.

Bentonite is clay generated frequently from the alteration of volcanic ash, consisting predominantly of smectite minerals, usually montmorillonite. Other smectite group minerals include hectorite, saponite, beidelite and nontronite. Smectites are clay minerals, i.e. they consist of individual crystallites the majority of which are $<2\mu\text{m}$ in largest dimension. Smectite crystallites themselves are three-layer clay minerals. They consist of two tetrahedral layers and one octahedral layer. In montmorillonite tetrahedral layers consisting of $[\text{SiO}_4]$ - tetrahedrons enclose the $[\text{M}(\text{O}_5, \text{OH})]$ -octahedron layer (M = and mainly Al, Mg, but Fe is also often found). The silicate layers have a slight negative charge that is compensated by exchangeable ions in the intercrystallite region. The charge is so weak that the cations (in natural form, predominantly Ca^{2+} , Mg^{2+} or Na^+ ions) can be adsorbed in this region with their hydrate shell. The extent of hydration produces intercrystalline swelling. Depending on the nature of their genesis, bentonites contain a variety of accessory minerals in addition to montmorillonite. These minerals may include quartz, feldspar, calcite and gypsum. The presence of these minerals can impact the industrial value of a deposit, reducing or increasing its value depending on the application. Bentonite presents strong colloidal properties and its volume increases several times when coming into contact with water, creating a gelatinous and viscous fluid. The special properties of bentonite (hydration, swelling, water absorption, viscosity, thixotropy) make it a valuable material for a wide range of uses and applications.

USES

FOUNDRY: Bentonite is used as a bonding material in the preparation of molding sand for the production of iron, steel and non-ferrous casting. The unique properties of bentonite yield green sand moulds with good flow ability, compact ability and thermal stability for the production of high quality castings.

CAT LITTER: Because of the unique water absorption, swelling, and odor controlling characteristics of bentonite, it is ideal for use in "clumping" types of cat litters.

PELLETIZING: Bentonite is used as a binding agent in the production of iron ore pellets.

CONSTRUCTION AND CIVIL ENGINEERING: Bentonite in civil engineering applications is used traditionally as a thixotropic, support and lubricant agent in diaphragm walls and foundations, in tunneling, in horizontal directional drilling and pipe jacking. Bentonite, due to its viscosity and plasticity, also is used in Portland cement and mortars.

ENVIRONMENTAL MARKETS: Bentonite's adsorption/absorption properties are very useful for wastewater purification.

WELL DRILLING: Drilling mud, or drilling gel, is a major component in the well drilling process.

OILS/FOOD MARKETS: Bentonite is utilized in the removal of impurities in oils where its adsorptive properties are crucial in the processing of edible oils and fats (Soya/palm/canola oil).

AGRICULTURE: Bentonite is used as an animal feed supplement, as a pelletizing aid in the production of animal feed pellets, as well as a flow ability aid for unconsolidated feed ingredients such as soy meal.

PHARMACEUTICALS, COSMETICS AND MEDICAL MARKETS: Bentonite is used as filler in pharmaceuticals, and due to its absorption/adsorption functions, it allows paste formation. Such applications include industrial protective creams, calamine lotion, wet compresses, and antiirritants for eczema. In medicine, bentonite is used as an antidote in heavy metal poisoning. Personal care products such as mud packs, sunburn paint, baby and facepowders, and face creams may all contain bentonite.

DETERGENTS: Laundry detergents and liquid hand cleansers/soaps rely on the inclusion of bentonite, in order to remove the impurities in solvents and to soften the fabrics.

PAINTS, DYES AND POLISHES: Due to its thixotropic properties, bentonite and organoclays function as a thickening and/or suspension agent in varnishes, and in water and solvent paints. Its adsorption properties are appreciated for the finishing of indigo dyeing cloth, and in dyes (lacquers for paints & wallpapers).

PAPER: Bentonite is crucial to paper making, where it is used in pitch control, i.e. absorption of wood resins that tend to obstruct the machines and to improve the efficiency of conversion of pulp into paper as well as to improve the quality of the paper. Bentonite also offers useful de-inking properties for paper recycling. In addition, acid-activated bentonite is used as the active component in the manufacture of carbonless copy paper.

CATALYST: Chemically-modified clay catalysts find application in a diverse range of duties where acid catalysis is a key mechanism. Most particularly, they are employed in the alkylation processes to produce fuel additives.

TACONITE PELLETTIZING: Taconite, a low grade iron ore, has been developed as an economic source for iron. During processing, the taconite is ground into a very fine powder. The ground taconite is then mixed with small amounts of bentonite which serves as a binder to the taconite. This mixture is processed into balls or pellets. The process is finished when these pellets are sintered in rotary kilns that give the pellets a hard surface. The taconite pellets are easy to handle at this point and can be loaded into various containers for shipment to steel mills.

METAL CASTING: Bentonite serves as an economical bonding material in the molding processes associated with the metal casting industry. Bentonite, when mixed with foundry molding sands, forms a pliable bond with the sand granules. Impressions are formed into the face of the bentonite/sand mixtures. Molten metal is pored into the impressions at temperatures exceeding 2,800 F. The unique bonding characteristics of bentonite insures the durability of the mold during these high temperatures. Once the process is complete, the bentonite/sand mold can then be broken away from the casting face and reused.

ANIMAL/POUTRY FEEDS: For many years bentonite has been used as a binder in the feed pelletizing industry. Small amounts of bentonite can be added to feed products to insure tougher, more durable pellets. By absorbing excess moisture and oils, bentonite aids in the free movement of pellets, preventing lumping and caking. Research has been conducted which indicates that bentonite has additional benefits for both animals and poultry. The bentonite used in the feed slows the digestive system and enables the animal or fowl to better utilize the feed nutrients. Other studies have shown bentonite as a useful ingredient in the control of certain toxins which affect animals and fowl.

BENTONITE DRILLING FLUIDS: Commercial Bentonite ores vary widely in amount and quality of the swelling clay, sodium montmorillonite. Ores of lower quality, those with more calcium-type montmorillonite, are treated during grinding by adding one or more of the following: sodium carbonate, long-chain synthetic polymers, carboxymethylcellulose (CMC), starch or polyphosphates. These help make the final product meet quality specifications.

Unfortunately, the additives may not remain effective in "the real mud world" when in use at the rig due to hardness ions in the water, high temperature, bacterial attack, mechanical shear-degradation and other factors that can render these additives ineffective.

BENTONITE CURE: Natural clay, especially the form known as Bentonite, has not only been used medicinally for centuries by indigenous peoples around the world, but has, in recent years, been increasingly prescribed by practitioners of alternative medicine as a simple but effective internal cleanser to assist in reversing numerous health problems. Bentonite is not a mineral but a commercial name for montmorillonite, the active mineral in many medicinal clays and which comes from weathered volcanic ash. This name derives from Montmorillon, France, where the medicinal mineral was first identified. A VOLCANIC DETOXIFIER - Bentonite, a medicinal powdered clay which is also known as montmorillonite, derives from deposits of weathered volcanic ash. It is one of the most effective natural intestinal detoxifying agents available and has been recognized as such for centuries by native peoples around the world. Whatever the name, liquid clay contains minerals that, once inside the gastrointestinal tract, are able to absorb toxins and deliver mineral nutrients to an impressive degree, says Knishinsky. Liquid clay is inert which means it passes through the body undigested.

GROUTING MATERIAL: Bentonite has great water binding ability and consequently very low permeability to water. It has been found, that the permeability of the soil is reduced considerably when substituted by sodium Bentonite. Hence, this material is often employed in construction engineering to make a porous medium water-tight. It can be used alone or with some other grouting material.

DRILLING MUDS: Drilling muds consist of water to which sodium Bentonite and pulverized barites are added. Such muds are prepared mainly for deep drilling, like oil-well drilling. Bentonite imparts two properties. It gives the fluid a viscosity several times that of water and thixotrophy. It seals the wall of the holes, thus preventing water loss. The quantity of Bentonite used is variable depending upon the depth of the hole to be drilled. Generally one tonne of Bentonite is used to prepare about 100 barrels of mud.

FOUNDRY SANDS: Bentonite is utilized in foundry to bind the sand grains into desired shapes. Bentonite helps in retaining the mechanical shape of the mould by making the particles of sands adhere and also making the surface impermeable. Strength and fusion point are the two important properties desired for selecting Bentonite. Generally, the swelling type of Bentonite is used though other types of Bentonites have also been used.

COSMETIC AND PHARMACEUTICAL PREPARATIONS: Bentonite gels are used as a carrier for a number of cosmetic preparations, tooth-pastes, creams for skin and other similar products. For the preparation of cosmetic creams, Bentonite is generally used as a paste formed with water and glycerine. Bentonite when intimately mixed with water in the proportion of one to four gives a pasty mass with the consistency of a heavy grease and in this form it is used for the preparation of medicinal ointments. Bentonite in the natural state is non-poisonous and harmless; thus it finds use in tooth-paste and even in the preparation of lipstick.

OTHER APPLICATIONS: Bentonite has also proved helpful in sealing freshwater ponds, irrigation ditches, reservoirs, sewage and industrial water lagoons, and in grouting permeable ground. In addition, it has been used in detergents, fungicides, sprays, cleansers, polishes, ceramic, paper, cosmetics and applications where its unique bonding, suspending or gellant properties are required.

The swelling type of Bentonite is finding increasing use in the manufacture of insecticides and paints.