Research Group

InfoMine

Association of independent advisers and experts
in the field of mineral resources, metallurgy and chemical industry

Bentonite Clays and Bentonite Powders Market Research in the CIS

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Annotation

The report is devoted to review of market of bentonite clays and mud powder in CIS countries. The report is prepared on the basis of studying and analysis of data of Federal Service of State Statistics of Russia (Rosstat), Federal Customs Service of Russia, State Customs Service of Ukraine, Customs Service of Kazakhstan, EU Statistic Committee (Eurostat), Russian domestic railage statistics, State Balances of Reserves of Mineral Resources, reports of companies, data of regional mass-media and web-sites of producers and consumers of bentonite products in CIS countries, as well as InfoMine database. The report contains 125 Pages, including 62 Tables, 25 Figures and Appendix.

The first Section of the report is devoted to characteristics of current standing of world market of bentonite, including data on world reserves of bentonite clays, volumes of mining in various countries in 1998-2006 and prices on some kinds of the products in 2005-2007.

The second Section presents data on reserves and deposits of bentonite clays in CIS countries.

The third Section of the report is devoted to analysis of data on mining of bentonite and production of bentonite products. It describes technology of production of drill mud, presents data on volumes of mining of bentonite in Russia and CIS countries in 2000-2007, as well as production of drill mud in 2003-2007. Description of current standing of company-producers of bentonite products in CIS countries, including data on resources base, characteristics of the products, volumes and directions of supplies is given.

The fourth Section of the report presents analysis of foreign trade of CIS countries in bentonite products. It presents data on volumes of supplies in bulk and in money terms, the main exporters and importers of bentonite, estimate of regional structure of supplies.

The fifth Section is devoted to estimation of domestic consumption of bentonite in Russia. The Section presents supply-demand balance of bentonite, estimates regional and sectoral structure of consumption, as well as data on volumes of bentonite supplies to the greatest consumers by railway transport. Description of the greatest Russian company-consumers of bentonite is given too.

The sixth Section is devoted to price analysis. It presents data on changes of prices on bentonite products of some Russian producers in 2005-2007, dynamics of export-import prices on bentonite products, forecast of price conjuncture of the market up to 2015.

The seventh Section of the report describes current tendencies of development of bentonite market and presents forecast of production and consumption of the product in Russia up to 2015.

The Appendix presents contact information on leading Russian producers of bentonite products.

Introduction

The absorbent clay was given the name bentonite by an American geologist sometime after its discovery in about 1890 — after the Benton Formation (a geological stratum, at one time Fort Benton) in Montana's Rock Creek area. Bentonite is an absorbent aluminium phyllosilicate generally impure clay, consisting mostly of montmorillonite, also known as hydrous silicate of alumina. In more simplistic terms, the structure of bentonite is much like a sandwiched deck of cards. When placed in water, these cards or clay platelets shift apart. Bentonite attracts water to its negative face and magnetically holds the water in place. Because of this unique characteristic, bentonite is capable of absorbing 7 to 10 times its own weight in water, and swelling up to 18 times its dry volume.

There are a few types of bentonites and their names depend on the dominant elements, such as K, Na, Ca, and Al. Bentonite usually forms from weathering of volcanic ash, most often in the presence of water. For industrial purposes, two main classes of bentonite exist: sodium and calcium bentonite. Besides, in stratigraphy and tephrochronology, completely devitrified (weathered volcanic glass) ash-fall beds are commonly referred to as K-bentonites when the dominant clay species is illite. Other common clay species, and sometimes dominant, are montmorillinite and kaolinite.

Sodium bentonite expands when wet, possibly absorbing several times its dry mass in water. Because of its excellent colloidal properties it is often used in drilling mud for oil and gas wells and for geotechnical and environmental investigations.

The property of swelling also makes sodium bentonite useful as a sealant, especially for the sealing of subsurface disposal systems for spent nuclear fuel and for quarantining metal pollutants of groundwater. Similar uses include making slurry walls, waterproofing of below-grade walls and forming other impermeable barriers: e.g., to seal off the annulus of a water well, to plug old wells, or as a liner in the base of landfills to prevent migration of leachate.

Sodium bentonite can also be "sandwiched" between synthetic materials to create geo-synthetic liners for the aforementioned purposes. This technique allows for more convenient transport and installation and it greatly reduces the volume of sodium bentonite required.

Various surface modifications to sodium bentonite improve some rheological or sealing performance in geoenviromental applications, for example the addidtion of polymers.

Calcium bentonite is a useful absorbent of ions in solution, as well as fats and oils, being a main active ingredient of Fuller's Earth, probably one mankind's the first industrial cleaning agents. Calcium bentonite may be converted to sodium bentonite (termed sodium beneficiation or sodium activation) to exhibit many of sodium bentonite's properties by a process known as "ion exchange". Commonly this means adding 5-10% of a soluble sodium salt such as sodium carbonate to wet bentonite, mixing well, and allowing time for the ion exchange to take place and

water to remove the exchanged calcium. Some properties, such as viscosity and fluid loss of suspensions, of sodium beneficiated calcium bentonite (or sodium activated bentonite) may not be fully equivalent to natural sodium bentonite.

Pascalite is a commercial name for the calcium bentonite clay.

Both the bentonite types find wide and steadily growing uses.

Much of bentonite's usefulness in the drilling and geotechnical engineering industry comes from its unique rheological properties. Relatively small quantities of bentonite suspended in water form a viscous, shear thinning material. Most often, bentonite suspensions are also thixotropic, although rare cases of rheopectic behavior have also been reported. At high enough concentrations (~60 grams of bentonite per litre of suspension), bentonite suspensions begin to take on the characteristics of a gel (a fluid with a minimum yield strength required to make it move). For these reasons it is a common component of drilling mud used to curtail drilling fluid invasion by its propensity for aiding in the formation of mud cake.

Bentonite can be used in cement, adhesives, ceramic bodies, and cat litter. Bentonite is also used as a binding agent in the manufacture of taconite pellets as used in the steelmaking industry. Fuller's earth, an ancient dry cleaning substance, is finely ground bentonite, typically used for purifying transformer oil. Bentonite, in small percentages, is used as an ingredient in commercially designed clay bodies and ceramic glazes. Bentonite clay is also used in pyrotechnics to make end plugs and rocket nozzles, and can also be used as a therapeutic face pack for the treatment of acne/oily skin.

The ionic surface of bentonite has a useful property in making a sticky coating on sand grains. When a small proportion of finely ground bentonite clay is added to hard sand and wetted, the clay binds the sand particles into a moldable aggregate known as green sand used for making molds in sand casting. Some river deltas naturally deposit just such a blend of such clay silt and sand, creating a natural source of excellent molding sand that was critical to ancient metalworking technology. Modern chemical processes to modify the ionic surface of bentonite greatly intensify this stickiness, resulting in remarkably dough-like yet strong casting sand mixes that stand up to molten metal temperatures.

The same effluvial deposition of bentonite clay onto beaches accounts for the variety of plasticity of sand from place to place for building sand castles. Beach sand consisting of only silica and shell grains does not mold well compared to grains coated with bentonite clay. This is why some beaches are so much better for building sand castles than others.

The self-stickiness of bentonite allows high-pressure ramming or pressing of the clay in molds to produce hard, refractory shapes, such as model rocket nozzles. Indeed, to test whether a particular brand cat litter is bentonite, simply ram a sample with a hammer into a sturdy tube with a close-fitting rod; bentonite will form a very hard, consolidated plug that is not easily crumbled.

Bentonite also has the interesting property of adsorbing relatively large amounts of protein molecules from aqueous solutions. It is therefore uniquely useful in the process of winemaking, where it is used to remove excessive amounts

of protein from white wines. Were it not for this use of bentonite, many or most white wines would precipitate undesirable flocculent clouds or hazes upon exposure to warmer temperatures, as these proteins denature. It also has the incidental use of inducing more rapid clarification of both red and white wines.

Bentonite is used in medicine as a bulk laxative and for pruritis. Also it is used in acne medication such as Clearasil lotion with benzoyl peroxide as an agent that absorbs excess sebum, clearing pores.

At present time, mining and production of high-grade bentonite clays in Russia is much inferior of domestic demand for the products, especially for high-grade bentonite clays for ferrous metallurgy, casting production, making drilling mud.

Note: hereinafter, throughout the whole report, terms “mud powder” and “bentonite powder” are used as synonyms.

1. World mineral resources base and conjuncture of world market of bentonite

World reserves bentonite exceed 5.5 bln t, of which 44% belong to China, around 15% − to USA, around 7% − to Turkey. Most of deposits in all countries contain calcium (alkali-earth) bentonites, whereas high-grade sodium (alkaline) bentonites are of much lower abundance, contained in deposits of sedimentary-volcanogenic and hydrothermal-metasomatic geological-commercial type. The greatest reserves of alkaline bentonites are available in USA, Turkey, and Azerbaijan.

Most high-grade natural sodium bentonite is produced from the western United States in an area between the Black Hills of South Dakota and the Big Horn Basin of Wyoming. Mixed sodium/calcium bentonite is mined in Greece, Australia, India, Russia and the Ukraine. In the United States, calcium bentonite is primarily mined in Mississippi and Alabama. Other major locations producing calcium bentonite include Germany, Greece, Turkey, and China.

It should be noted that in some countries like the UK and US, calcium bentonite is known as fuller's earth, a term which is also used to refer to attapulgite, a mineralogically distinct clay mineral but exhibiting similar properties.

Notice that annual volume of mining of bentonite clays for the latest 4 years demonstrates uptrend. From data of United States Geological Survey (USGS), for the period from 2002 to 2006, volume of bentonite mining in the world increased by 14.5% up to 11.8 mln t. U.S. is the top producer of bentonite with almost 40% world share followed by Greece (8%), Turkey (7.6%), CIS countries, etc. Volumes of mining of bentonite in various countries of the world in 1998-2006 are presented in Table 1.

Table 1. Volume of world mining of bentonite in 1998-2006, by countries, kt

Country	***Volume of mining, kt***								
	1998	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***
USA	3820	4070	3760	3970	3970	3770	4550	4710	4620
Greece	950	950	950	950	950	950	950	950	950
Turkey	565	900	636	674	559	831	850	925	900
CIS countries	700	750	750	750	750	750	750	750	800
Italy	590	500	500	500	500	500	500	500	500
Japan	443	428	415	406	438	426	455	450	450
Mexico	185	208	270	415	488	464	564	426	450
Germany	500	500	500	448	495	479	405	410	400
Brazil	220	275	275	179	185	199	227	227	221
Czech	125	160	280	224	174	199	201	200	200
Australia	104	180	180	180	200	200	200	200	200
Other	2398	1579	1784	1704	1591	1732	1848	1952	2109
Total in the world	***10600***	***10500***	***10300***	***10400***	***10300***	***10500***	***11500***	***11700***	***11800***

Source: United States Geological Survey

Structure of bentonite consumption in USA 2006 (2005) was as follows: for making molding sands – 23% (24%), for making drilling mud – 22% (21%), in production of iron ore pellets – 13% (15%), for production of adsorbents – 26% (23%), other – 16% (17%).

Notice that world prices on bentonite in latest years are rather stable, being in range 20-120$/t, depending on chemical composition and grades of the products. Slight annual growth of the prices, around 1-3%, is owed by increasing prices on power resources. Prices on bentonite in some countries of the world in 2005-2007 are presented in Table 2.

Table 2. Prices on bentonite in some countries of the world in 2005-2007

Country	***Product***	***Terms of delivery***	***Price, $/t***		
			2005	***2006***	***2007***
USA, Wyoming	all grades, rough, in bulk	ex-works	30-63	36-82	36-82
	casting grade in bags		50-76	55-80	55-80
	grade API in bags		45-53	55-80	55-80
Europe (the main ports)	for cat litter 1-5 mm	FOB	32-55*	32-55*	32-55*
	casting grade		55-60	55-60	55-60
	API grade 6		52-57	52-57	52-57
Canada	*Indian grinded and dried, loose, in bulk:*	FOB			
	grade OCMA/API		43-53	43-53	43-53
	for cat litter		32-40	32-40	32-40
	casting grade		59-76	59-76	59-76

** - price in EURO/t*

Source: BIKI, Industrial Minerals

2. Reserves and deposits of bentonite in the CIS

2.1. Reserves and deposits of bentonite in Russia

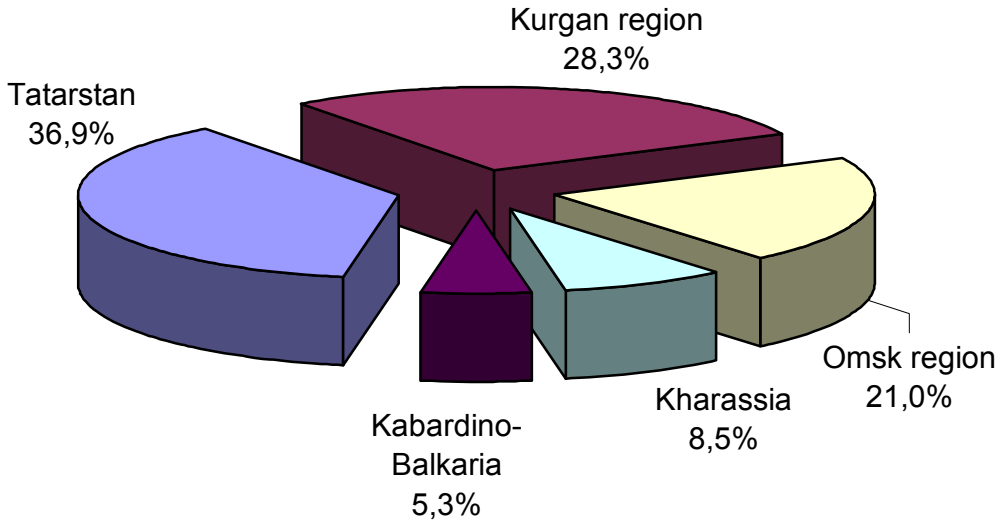
From data of Federal Agency on Subsurface Use, as of 2006 total balance reserves of bentonite clays in Russia were 278 mln t.

Predicted resources of alkaline and alkali-earth bentonites in Russia were 269 mln t, including in category P_3 – 30 mln t, P_2 – 193 mln t and P_1 – 46 mln t. The bulk of the predicted reserves in categories P_1+P_2 and all the reserves in category P_3 are confined to European part of Russia.

Reserves of bentonite clays, included into State balance of mineral resources of Russia "Bentonite clays", are now 97.1 mln t in categories $A+B+C_1$ and 29.9 mln t in category C_2. The reserves are taken into account in 9 deposits, including 5 mined, 2 deposits being prepared for mining and 2 standby deposits.

Breakage of reserves of bentonite clays, included into State balance, by regions is presented in Fig.1.

Figure 1. Regional structure of reserves of bentonite clays in Russia, %



Source: State balance of reserves of Russia (bentonite clays), 2003

At present time, the following deposits are mined: Biklyanskoe, Tarn-Varskoe, Zyryanskoe, Desyaty Khutor and Zerkal'noe (Table 3). Total reserves of the deposits are 45731 kt in categories $A+B+C_1$.

Nurlatskoe and Lyubinskoe deposits are being prepared for mining (Table 3), same to Eastern section of Zyryanskoe deposit, total reserves of which in categories $A+B+C_1$ are 34447 kt and in category C_2 – 578 kt.