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RESEARCH OF METHODS OF OBTAINING ASBESTOS CEMENT AND MICROSILICA WASTE FOR FLAMMABLE AND HEAT INSULATING BUILDING MATERIALS

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Abstract: This article reviews the debate about the safety and potential uses of chrysotile asbestos. The article presents evidence for the safety of chrysotile asbestos as opposed to amphibole asbestos. Also, information is given on the growth of the amount of waste in the world, the possibilities of processing and use of waste from asbestos cement and other asbestos materials in construction, as well as the importance of disposal of industrial waste.
Key words: chrysotile asbestos, amphibole asbestos, anti-asbestos company, asbestos cement, industrial waste, construction waste, disposal, recycling, conservation of natural resources.

The global market for chrysotile asbestos is still dominated by anti-asbestos companies. The company's calls relate to amphibole asbestos, which has been used for many years in the countries of the Eurasian Economic Union and is now banned worldwide. Amphibole asbestos was widely used in western Europe. But in Canada, Brazil, EOII and other countries - chrysotile asbestos has been used for many years due to its safety in controlled use. It is now becoming increasingly clear that anti-asbestos propaganda is at odds with science and objective truth.
Asbestos chemically reflects magnesium hydrosilicate. The chemical composition of serpentine asbestos is represented by the approximate formula (excluding water) $3MgO.2SiO_2$, and that of amphibole asbestos by $MgO.SiO_2$. It can be seen from the formulas that serpentine asbestos contains more magnesium, and amphibole asbestos contains more sand, which to some extent determines the properties and areas of application of individual asbestos types [1].
The solid waste from the production of asbestos cement (asbestos) and asbestos thermal insulation materials must be returned to production or can be used in the production of building materials (blocks with asbestos cement, asbestite perlite, etc.). The most rational direction of disposal of industrial waste, i.e. disposal, is to use it as man-made raw materials to obtain various products for construction purposes.
Processing of construction waste (utilization) is based on two concepts, that is, demolition (demolition) and recycling (recycling). According to the results of scientific research conducted in Europe, construction waste generated in the most developed countries makes up almost a third of all waste. We can draw the following conclusion from the general trend: "the more developed the country's economy is, the larger the share of waste in the total waste is."
The most important reserve that saves resources in construction is the extensive use of secondary material resources, which are production and consumption waste. The volume of industrial waste is growing at a higher rate than public production and is outstripping growth. On average, 8-10% of the cost of basic products is spent only on their disposal and storage. The use of industrial waste provides production with a rich source of cheap and often generated raw materials; leads to savings of capital investments intended for the construction of enterprises that extract and process raw materials and increase their profitability; release useful areas of land and reduce the level of

environmental pollution. Increasing the level of utilization of industrial waste is the most important task of state importance [2].

Industrial production is growing year by year all over the world, and the amount of waste is increasing in proportion to its growth, approximately doubling in 8-10 years. The total weight of solid waste generated annually in the United States is 3.5 billion tons, which is about 50 kg of mass per capita .

In Germany and the Netherlands, the share of waste is 55%, in France 70%, and in terms of income per capita - the richest country in Europe - Luxembourg, this figure is 90%. According to the European Association of Demolition, at least 2.5 billion tons of construction waste is generated in all countries. Of this, construction waste in Europe is more than 180 million tons [3].

About 10 billion tons of minerals and the same amount of organic raw materials are used annually. The processing and disposal of most of the world's essential minerals is occurring faster than the discovery of their raw material reserves. Roughly 70% of the costs in the industry of the CIS countries are accounted for by raw materials, materials, fuel and energy. It should be noted that from 10 to 99% of raw materials are emitted into the atmosphere, water bodies and land.

Now, scientific work and experiments are being conducted to improve the physical and mechanical properties of concrete. The results of the researches have shown that it is effective to add various additives, surfactants, and fibers to concrete. Today, enterprises produce concrete products by adding various fibers. These fibers include steel fiber, metal fiber, polypropylene fiber, basalt fiber, glass fiber and other fiber fibers. It is also possible to use industrial waste asbestos cement as a fiber to improve the properties of concrete products.

Many foreign publications with cement concretes in the composition g positive of the presence of dispersed reinforcements role they emphasized . of these publications analysis dispersed reinforcement as a result primary of materials structural characteristics improved indicates the optimal composition of fibers in products and constructions It increases its durability and operational properties . Many researchers have shown the effectiveness of using asbestos, cellulose and other types of fibers to improve the properties of cellular concrete and create a quality structure. It is believed that these fibers significantly thicken the wall between the pores of aerated concrete, stabilize the process of formation of pores in the aerated concrete mixture, and increase the durability of aerated concrete products.

B eton masses contains 6 % asbestos fibers input offer does As a result , asbestos p ortl a ndcement ninghydration results high adsorb ts ion potential of cellular concrete masses structural parts between mutually of influence chemical processes activates cellular of concrete consistency features to increase take will come Asbestos thermal insulation materials can be divided into groups with names reflecting their composition to a certain extent. Asbestos-cement materials consist of asbestos and hardened portland cement. It differs from ordinary asbestos-cement products by its low strength and high porosity [4]. Chrysotile asbestos is the most suitable for the production of thermal insulation materials. It has higher heat resistance than amphibole-asbestos.

The average chemical composition of chrysotile-asbestos of Bazhenov mine in %: SiO_2 42.1; MgO 40.8; Al_2O_3 0.7; Fe_2O_3 1.1; FeO 0.5; constitutional H_20; 13.0, adsorption H_2O 1.4; organic matter 0.4. Asbestos fiber has a very high strength. The breaking strength of chrysotile-asbestos undeformed fibers significantly exceeds the strength of most natural and artificial fibers, organic and inorganic.

Temperature resistance is one of the most successful technical properties of asbestos. This property depends on its chemical composition and the behavior of water present in asbestos when

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heated. Compared with amphibole asbestos, chrysotile-asbestos has a higher temperature resistance due to the large amount of MgO in its content. The sorption (absorption) property of asbestos fiber is used in the production of thermal insulation materials. Asbestos heat-insulating materials can be considered as a mixture of asbestos fiber and highly porous materials: diatomite, light magnesia, freshly tempered gypsum, etc. It is usually the second component that makes up about 70-80% of the total weight of the material. 20-30% remains due to asbestos fibers. The properties of asbestos materials (porosity, strength, temperature resistance) are mainly determined by the properties of this component of the mixture, known as filler.

The addition of asbestos fiber to the main component of the thermal insulation material improves the properties of the main component: increases strength and reduces volumetric weight. The effectiveness of adding asbestos fiber is not the same for all materials. Asbestos fiber acts as a reinforcing component in them, they resist the formation of cracks and air shrinkage during drying of products or structures, increase strength. Heat insulation boards and molds can be made by mixing asbestos and cement and mixing with water, then molding and drying. Dense and durable asbestos-cement heat-insulating products are distinguished by high porosity and strength. Asbestos-cement heat-insulating plates are much smaller in size than ordinary asbestos slates due to their low strength. Plates are 1000 mm long, 500 mm wide, and 30 mm thick. Shells are 500 mm long, 30 to 60 mm thick. Asbestos-cement tiles are divided into three brands 300, 400, 500 according to their characteristics. Shells are issued in two brands - 400 and 500 [5].

By using the best quality asbestos and careful preparation, the volume weight of the product can be reduced to 150 kg/m^3. The strength limit for this winter is 2-3 kg/cm^2, the heat transfer coefficient is 0.075-0.09 kcal/m·h·grad (at 25 ^{0}C). Asbestos cement products are bioresistant to water. They do not swell when submerged in water. The limit temperature of their use is equal to 450 ^{0}C. Type VI asbestos and 400-grade Portland cement are used for the production of asbestos-cement products. In order to save asbestos, as a fibrous component, it can be partially replaced with good mineral cotton. The mixture of raw materials in this case is as follows in percent by weight of dry mass: asbestos-43, cement-43, mineral fiber cotton-14. This direction in the use of asbestos materials is explained by the need to more effectively use the valuable properties of asbestos, in particular, its resistance to high temperatures. The following thermal insulation constructions are made of asbestos materials: a) mastic; b) solid product (plate, shell, segments); c) soft product packaging materials (cord, paper, etc.) and g) mixed materials.

Asbestos materials have a general field of application, the main of which are: energy equipment of power stations, plants and factories; surface and underground laying of heat networks; technological equipment and pipelines in chemical, oil refining, gas and other industries. However, each material has its preferred areas of application where its heat protection and other properties can be used more effectively. I heat insulation material and from him performing insulation constructions choose one a series of technical and economic to factors depend

Many companies producing asbestos-cement products have adapted to the production of products by the wet process, using low-concentration asbestos-cement suspensions. When preparing a suspension with this technology, asbestos is soaked in a large amount of water (85-90%) and mixed with cement. The asbestos-cement suspension is then filtered by a mesh rotating cylinder. As a result, a thin, water-saturated layer of asbestos cement is formed on the surface of the cylinder. This layer is dehydrated in the measuring drum, and then transferred to the vacuuming and forming equipment. As a disadvantage of this technology, we can see a large amount of man-made waste due to the use of large amounts of suspensions.

The first type of wet waste can be used directly in the production of products by adding it to the molding mixture. Due to the fact that such wastes are usually dehydrated, the need for additional water addition creates inconveniences in processing.

The second type of wet waste includes solid insoluble parts of asbestos and cement in a water-dispersed suspension, as a dispersed phase. Such waste is sent through a pipe to a specially constructed wastewater treatment plant, where solids settle and the purified water is reused. As a result, waste such as porridge accumulates in the screening equipment, which is considered unsuitable for product production [6].

As a result of the analysis of the chemical composition of wet waste, it was shown that there are components related to the used raw materials in their composition. The main oxides are CaO and SiO_2, their content is on average 60%. Asbestos content does not exceed 6-7% on average. The length of asbestos fiber is 1.35-4.8 mm in half, and 0.25-1.35 mm in the other half.

According to the statistics of EOII, in the first half of 2020, Kazakhstan exported 89.9 thousand tons of chrysotile-asbestos, during this period Uzbekistan received 45.8% of the product. If 90,000 tons of chrysotile asbestos are imported into Uzbekistan per year, and 2.5-4% man-made waste is generated by enterprises, it is estimated that 9,000-14,400 tons are produced. It should be noted that 9,000-14,400 tons of asbestos-cement waste (1.5-2% of which is wet waste from cleaning equipment) is being accumulated in the republic per year.

According to the information of asbestos-cement industry enterprises, the amount of sediment in the process of processing water is 1.5-2% compared to the mass of raw materials. Wet asbestos-cement waste is collected in the processing equipment, and as a result, these wastes occupy large areas. From an ecological, wasteful and economic point of view, it is effective to introduce recycling of waste in the production process.

Asbestos -cement products manufacturing industry produces a lot of dry waste along with wet asbestos-cement waste. These wastes are constantly generated in the production of pipe and slate products. In the production technological process of enterprises, the cement+water+asbestos fiber mixture cannot be fully used (in recuperators), if the period of hydration of cement with water exceeds 2 hours, the quality of this mixture decreases, and the remaining mixture is sent to the cleaning equipment.

Microsilica waste can be used to improve the properties of various building materials. Microsilica is an ultradisperse powder formed as a waste product as a result of the condensation of high-silica dust during the production of silicon alloys. As a result of the development of the industry, with the increase in the production of silicon alloys on a global scale in recent years, the issue of studying the properties of microsilica formed in the form of ultradispersed powder material and the possibility of their use in modern construction has become urgent.

Microsilica is an ultradispersed material consisting of spherical particles obtained during gas cleaning of technological furnaces in the production of silicon and ferrosilicon. Microsilica particles have a spherical shape and a smooth surface. Meanwhile, the average particle size is 0.1-0.2 microns, which is up to a hundred times smaller than fly ash or cement particles, and its average surface area is 20 square meters/gram.

The use of microsilica in the construction industry allows to save up to 40% of cement consumption without adversely affecting concrete properties, and to reduce thermal energy during heat and moisture treatment of products. In practical conditions, 1 kg of microsilica can provide the strength properties of 4-5 kg of porcelain cement. Improves concrete properties such as compressive strength, denting, chemical stability, frost resistance, fire resistance and resistance to melting.

In the silicate industry, microsilica is used to increase the durability and service life of silicon carbide refractories, as well as to reduce the cooking temperature of the product during their production. The use of 2% by mass of microsilica ensures high retention of silicon carbide in the refractory and lowers the firing temperature from 1350 °C to 1300 °C . Microsilica is a multifunctional additive used to improve the physical, mechanical and operational properties of cement, cement concrete, aerated concrete, refractories, etc. [7].

Asbestos-cement waste is a valuable raw material for the production of building materials, in particular, for the production of fire-resistant and heat-insulating wall materials. The use of asbestos-cement waste as a raw material for the production of refractory and heat-insulating wall materials allows to significantly reduce the cost of the product, improve the physical and mechanical properties of the product, reduce a large amount of industrial waste and expand the useful land areas occupied by such waste, and significantly improve the environmental condition of this area. .

12-20% of asbestos fiber in asbestos cement waste in fire-resistant and heat-insulating wall materials prepared by adding asbestos cement waste increases strength by dispersing reinforcement in the material.

In addition to this, 2 more indicators have been newly created in the fire safety index for the classification of materials, i.e., the flammability group and the group of surface flammability . The main principle of fire regulation is to ensure the safety of people in fire conditions based on goal-oriented processes. In addition, the development of fire regulation is carried out for the following purposes:

- the maximum required level of fire safety in construction;
- providing the design process by creating a choice for the designer with a wide range of alternative solutions;
-to make it possible to carry out quantitative analysis of fire safety of objects. The main process of fire regulation is to ensure the safety of people in the event of a fire and to achieve minimum losses. But in practice, such materials are used that threaten people's life and health, increase the development of fire and increase the loss of materials. At the same time, fire-safe materials are used in the construction - concrete, reinforced concrete, natural and artificial stone materials, as well as wall materials with high fire safety.

Limiting the use of combustible materials reduces the likelihood of fire safety impacts on humans. It is known from the practice of a large number of experiments that difficult combustible and even non-combustible materials decompose under fire conditions, releasing smoke and toxic products. As the fire progresses, the burning of these materials increases, spreading the flame across the surface and releasing additional heat.

Indicators include: low heat of combustion, oxygen index, smoke generation index and toxicity of combustible products. It is possible to connect and use the above bases through an electronic network. Standardization of their use according to the flammability of materials and the speed of flame spread is carried out in different countries by the type of room, taking into account the type of material, the functional direction of the room, the presence of fire engineering systems, the method of attaching materials to the structure, the direction of the structure.

The strength properties of wall materials, ceramic materials and mineral alloys under fire conditions are practically unchanged. Their strength does not change at temperatures of 900-1300 ^{0}C , which is the calculated baking temperature of ceramic materials . For mineral alloys, the temperature range is close to their melting point. Such a temperature cannot be reached under fire conditions. The condition of materials of this group under fire conditions depends on the fact that all processes occur as a result of the first heating, that is, at their cooking temperature, and as a result of secondary heating, physical processes (temperature deformation and the release of capillary moisture) occur. Dense ceramic materials (tombop tiles) have the property of disintegrating as a result of rapid heating.

In the production of refractory and heat-insulating wall materials, cellular concrete is used among several materials. It was analyzed that in the production of aerated concrete, which belongs to the class of cellular concrete , sand and thermal power plant ash are used as fillers, but the use of asbestos cement waste is one of the effective methods for obtaining fire-resistant and heat-insulating materials.

Refractory wall materials are distinguished by the fact that the cost of preparation by baking or pressing from raw materials such as refractory clay and fireclay is slightly more expensive than the cost of products obtained on the basis of waste. Due to the absence of a cooking part in the technological process of production of refractory and heat-insulating wall materials made on the basis of asbestos-cement waste, heat energy spent for cooking is saved. It was analyzed that this, in turn, leads to a decrease in the cost of construction materials.

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