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## **Possibilities of using red bauxite sludge in construction**

A constant increase in the volume of products of the metallurgical industry entails an increase in anthropogenic impact on the environment in the form of accumulated production waste. As a result, the urgency of the problem of recycling by retrieval of the contained useful components increases.

In the Pavlodar region, sludge from alumina production is one of the types of such waste.

In addition to the issue of storage (dust formation, soil impact) of existing waste, the urgent problem is the preparation of new sludge settlers, which are usually suitable lands for agricultural activities.

In the production of aluminum, bauxite is used as the main raw material, as a result of which waste is generated in large quantities in the form of aqueous suspensions of dispersed particles - sludges. About one ton of alumina produces about four tons of sludge. A characteristic feature of bauxite sludge is a high content of iron and aluminum oxides.

For the production of building materials, nepheline, bauxite, sulfate, white and mono-calcium sludges are of industrial importance. Bauxite is used at the aluminum smelter; accordingly, bauxite sludge is a waste.

A preliminary analysis of the chemical composition of the sludge allows us to make an assumption about the appropriateness of their processing with the extraction of iron oxides contained in them. As scientific studies have shown, the use of red mud is possible as: additives for sintering, sintering, blast-furnace smelting of iron ores, raw materials for producing iron, a slag-forming agent for refining cast iron and steel, a partial substitute for clay in the manufacture of foundry molds, additives in the production of cement and ceramics, additives in the manufacture of building bricks and refractories, as the basis for mineral fertilizers.

Also, red mud can be used in road construction. The issue of increasing the durability of roads and reducing the cost of construction has been and remains one of the main tasks of builders.

Road construction is the most material-intensive construction industry, so the longevity of roads and their efficiency is largely determined by the quality and cost of the materials used in their construction. The durability and reliability of pavement is largely ensured by the use of monolithic bases in its design.

The durability and cost of building pavement are influenced by the construction technology and construction time. Therefore, the materials used should be able to maintain the invariance of technological properties throughout the entire technological cycle and immediately after compaction should allow the overlying layers of the coating to be arranged without any interruption.

One of these materials that meet the above requirements are bauxite sludge from Pavlodar aluminum smelter.

The advantage of binders based on bauxite sludge over cement or cement concrete (cement-mineral mixtures) is the lack of quick setting and the slowing down of hardening processes. If, when working with materials reinforced with cement, the time between the preparation of the mixture and its compaction should usually not exceed 4-6 hours, otherwise the quality of the layer being set up sharply decreases, then when using slurry binders this time can reach up to 3 days. This, in turn, will allow to increase the length of the interchangeable gripper, expand the front of work, increase productivity, and also eliminate the negative impact on the final strength of the material of unforeseen stops in the production schedule associated with breakdown of equipment or with a delay in the mixture.

The bauxite sludge was tested for frost resistance and the results show that the sludge with 25 and 30% (from 17.6 to 21.8 MPa) sludge binder can withstand 200 cycles of freezing - thawing, a decrease in strength compared with the strength of control samples hardening 90 days in normal conditions, is 9.1 and 6.9%, respectively, which meets the requirements of GOST 10060.1-95. This concrete can be used according to SNiP RK 3.03.09-2003 for the device of a single-layer or upper

layer of a two-layer coating on roads of all technical categories, in III-V - in the climatic zone.

Rolled concrete based on slurry binders have better operational properties compared to cement concrete, since at the same strength they have increased tensile strength in bending and a lower elastic modulus, which is one of the indicators of the durability of materials based on slow-hardening binders. Rolled concrete based on slurry binders has the ability to restore its strength characteristics, reduced due to the negative effect of freezing - thawing, with further hardening at positive temperatures for three months, which is also one of the main indicators confirming the durability of road structures made of such materials.

Bayer sludge is widely used abroad: in Germany, France, Great Britain, Australia, India, Hungary, Japan.

In France, studies have shown the possibility of using slurry concrete in mortars and pressed shaped products of high density and strength.

Researchers in the UK have developed bauxite sludge and crude chalk technology for producing cement.

The German company Ferainigte aluminum verke uses sludge in the production of expanded clay to lower the sintering temperature of the mixture.

Construction companies in Japan receive slurry based concrete mixtures for road construction and various compositions for the production of pressed wall products.

Australian and Indian researchers have determined that bauxite sludge mixed with carbonaceous shale is suitable for the manufacture of tiles, pigments, varnishes.

The existing development of construction materials based on sludge is not related by a general direction, not systematized enough. All this causes an urgent need for targeted comprehensive research, both the sludge itself and materials based on it.

Thus, the development and research of various construction materials based on sludge is carried out very actively both in our country and abroad. However, the problem of disposal of sludge in construction continues to be relevant, since almost all studies are completed only at the stage of pilot development. Bauxite sludge can

improve workability of mixtures, increase strength, as well as reduce the cost of concrete by replacing part of the sand and cement.

#### Literature:

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