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POSSIBILITIES OF OBTAINING AND UTILIZING FERTILIZERS FROM SULFUR BY-PRODUCTS OF THE GALKYNYSH GAS FIELD

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Nowadays, any type of production and industry at a particular level depends on the production of chemical products. In order to expand the scope and increase the effectiveness of inspections in this sector, the "State Program for the Comprehensive Development of Chemical Science and Technologies for 2021-2025" initiated by the National Leader is being successfully implemented by our Honorable President Serdar Berdimuhamedov. Therefore, state support for the development of science in Turkmenistan is constantly growing, the necessary conditions are being created for conducting fundamental and practical research and expanding the sphere of development of new technologies.

For the comprehensive development of chemical science and technology, which is one of the main directions of the country's policy, we must use the capabilities of chemical science in the production of products that are environmentally friendly and replace goods imported from abroad. This scientific work examines the possibilities of obtaining and using sulfur bentonite fertilizers by using sulfur residues from the Galkynysh gas field. Disposal of sulfur waste from the Galkynysh gas field makes it possible to maintain environmental stability and achieve economic development.

As one of the largest fields in the world, natural gas from the Galkynysh gas field is processed and large amounts of sulfur are extracted. This sulfur, which is usually treated as an industrial waste, can be used as a useful product, in particular as a sulfur-bentonite fertilizer needed in agriculture. This research includes several stages in the development of sulfur bentonite fertilizer. First, bentonite clay ($Al_2O_3 \cdot 2SiO_2 \cdot H_2O$) is purified using the “acid activation” method and then treated with sulfur (S_8). In the first step of this process, the bentonite clay is mixed with water, then the bentonite slurry is kept at room temperature for 24 hours to allow complete precipitation.

When bentonite clay is mixed with water, a suspension containing colloidal particles is formed. In the second stage, this suspension is placed in a centrifuge for 5 minutes at a speed of 7000 rpm. At this stage, the bentonite fraction appears. At the third stage, the resulting bentonite is dried at room temperature for 12 hours. In the fourth stage, it is kept in the oven at 65°C for 12 hours to better remove water molecules. In the fifth step, 1.8 M hydrochloric acid (HCl) solution is added and heated at 88°C for 2 hours. At this stage, some silica (SiO_2) is removed from the bentonite clay, some metal cations are replaced by hydrogen ions, the adsorbing properties are increased, and the insoluble residues in the bentonite clay are dissolved by the action of acid. At the sixth stage, after heating with hydrochloric acid for 2 hours, the sample is filled with water to cool it and placed in a centrifuge for 5 minutes at a speed of 7000 rpm. At the seventh stage, the resulting bentonite is dried at room temperature for 12 hours. At the eighth stage, the bentonite is kept in an oven at a temperature of 65°C for 12 hours. Here it is. This step results in pure bentonite clay activated with 1.8 M hydrochloric acid. At the ninth stage, elemental sulfur is melted at a temperature of 112.85°C. At the tenth stage, pure bentonite suspension, activated with dissolved sulfur and hydrochloric acid, is stirred at a temperature of 95°C for 30 minutes [4]. As a result, sulfur bentonite fertilizer is obtained. After the resulting fertilizer has cooled slightly, it is shaped.

The goal of the work is to reduce waste and ensure sustainability by using sulfur waste from the Galkynysh gas field to produce sulfur bentonite fertilizer, important for the country's agriculture.

The novelty of the work lies in the development of new technology through chemical science, combining innovations in waste management, sustainable agriculture and creating an integrated system that improves the environmental and economic conditions of the country.

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The production process described involves several stages for obtaining sulfur bentonite fertilizer from the sulfur by-products of the Galkynysh gas field. Initially, bentonite clay is mixed with water and then kept in order to precipitate bentonite clay. Then it is separated into fractions in centrifuge. Subsequently, bentonite clay completely dried. The dried bentonite clay is heated with hydrochloric acid for acid activation process.

After the stage ended, our solution immediately cooled by adding water. In the next stage centrifugation and drying processes proceeding. In order to add sulfur for making fertilizer more efficient, it is melted and then mixed with acid activated bentonite clay to obtain sulfur bentonite fertilizer. The process represents a groundbreaking approach to promoting sustainable agriculture, mitigating environmental challenges and maximizing the value of industrial waste.

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