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OBTAINING A COMPLEX FERTILIZER BASED ON NITRIC AND SULFURIC ACID DECOMPOSITION OF PHOSPHATES

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Abstract
The article describes the results of the analysis of complex fertilizers. In order to save scarce sulfuric acid and obtain a complex fertilizer, the obtained intermediate products of nitric and sulfuric acid decomposition of phosphorites were mixed, granulated on a plate granulator and dried in a thermostat at 100-105 ℃. During the decomposition of phosphorite with a mixture of acids, losses of nitric acid are observed, i.e. nitrogen oxides are released. A similar release is observed upon sequential feeding of acids. Therefore, we have proposed a method for obtaining a complex fertilizer by mixing intermediate products.

Keywords: complex fertilizers, complex fertilizers, nutrient, phosphate rock.

Introduction
Experiments show that the production of granular fertilizers is easily feasible. The fertilizer has satisfactory commercial properties. It does not cake. In addition to nitrogen and phosphorus, a complex fertilizer contains an additional nutrient - calcium in the form of calcium nitrate. The amount of nutrient components when

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receiving fertilizer from unfortified phosphate rock is ($N+P_2O_5+CaO$) 20-21%, and from poor phosphorites - 17-18% [1-7]. The optimal condition is:

– Sulfuric acid norms - 50%;
– The norm of nitric acid - 30%.

Table 1. Chemical composition of complex fertilizer,%

Norm		Content			
HNO_3	H_2SO_4	P_2O_5	N	CaO	H_2O
From unfortified phosphate rock					
20	20	16,47	1,13	2,30	1,75
40	20	15,21	1,87	3,64	1,84
20	50	15,03	1,15	2,30	1,78
40	50	14,02	2,01	4,02	2,01
20	70	14,25	1,19	2,38	1,95
40	70	13,46	2,07	4,15	2,25
From poor phosphorites					
20	20	10,58	1,15	2,31	1,56
40	20	9,96	2,51	5,02	2,32
20	50	10,02	1,21	2,43	2,00
40	50	9,56	2,84	5,68	2,12
20	70	9,78	1,22	2,44	2,01
40	70	9,06	2,89	5,78	2,34

On the basis of the data obtained, a basic technological scheme for obtaining new generations of nitrogen-phosphorus-containing complex fertilizers from low-grade phosphorites of the Central Kyzyl Kum was developed by decomposition of unenriched phosphate rock and poor phosphorites of the Central Kyzyl Kum at an incomplete rate of sulfuric and nitric acids. It is proposed to use a screw-type reactor as the main apparatus [8-14].

The technological process for the production of complex fertilizers consists of the following main stages:

- Reception, storage and transportation of phosphate raw materials;
- Reception, storage and transportation of sulfuric acid;
- Reception, storage and transportation of nitric acid;
- Decomposition of phosphate raw materials with sulfuric acid;
- Decomposition of phosphate raw materials with nitric acid;
- Mixing of semi-finished products, granulation and drying of the finished product;

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- Transportation of the finished product to the finished product warehouse;
- Storage of the finished product and its shipment to consumers,
- Cleaning of outgoing dust and gas streams.

In accordance with the stated research results, a basic technological scheme for obtaining a complex fertilizer by a two-stage method of decomposition of high-carbonate phosphorites of the Central Kyzyl Kum is developed. Phosphate raw material from the hopper is fed by a tape dispenser to a screw reactor, where sulfuric acid with a concentration of 93% H2SO4 is simultaneously supplied from the collector. Due to the thermal effect, the temperature reaction in the screw reactor rises to 120-130 ° C. The resulting decarbonized intermediate product enters the mixer. Here, mixing with the intermediate product obtained by nitric acid decomposition of phosphorite takes place. To obtain a semi-product by nitric acid decomposition of phosphorite, raw materials from the hopper with a tape dispenser are fed into a screw reactor, where they are simultaneously supplied from a nitric acid collector with a concentration of 57% HNO_3. Further, the intermediate product enters the mixer [15-21].

Waste gases from the screw reactors, granulator and mixer are directed to the lower part of the absorber; after cleaning in the absorber, the gases are released into the atmosphere. The resulting homogeneous mass from the mixer is sent to the stage of granulation and drying in a drum granulator. The resulting granules are dried in the flue gas stream. The dried granules are fed through a classifier along with an elevator to a screen, where they are scattered into three fractions. Coarse (+ 4mm) is crushed on a crusher and scattered again, fine (-1mm) and dust from the technological cyclone and aspiration systems are returned to the drum granulator as external recycling. A fraction with a granule size of 1-4 mm in the form of a finished product is directed along a conveyor belt for cooling, after which the fertilizer enters the finished product warehouse [22-34].

Reception, storage and transportation of phosphate raw materials. Phosphate raw materials are supplied in standard railway pneumatic tanks and are unloaded directly into the silo-type phosphate raw materials warehouse through aerating devices or immediately sent to the consumer workshop by pneumatic or mechanical transport (through chamber pneumatic pumps).

Reception, storage and transportation of sulfuric acid. Sulfuric acid is transported in steel rail tank cars and discharged into storage using compressed air siphons. From the storage it enters the sulfuric acid tank and then through the pump and flow meter sends it to the screw reactor [31-38]. Reception, storage and transportation of nitric acid. Non-concentrated nitric acid is transported in special rail tank cars and unloaded into storage using compressed air siphons. It is fed from the storage to the nitric acid tank and then through the pump and flow meter is sent to the screw reactor. The systems for the introduction of acids into the apparatus are a manifold made of a pipe with four (6) nozzles, which, in turn, go inside. At the ends of the nozzles, two nozzles are mounted with the help of which the acid introduced through them is sprayed volumetrically into the mixing zone of the initial components of the apparatus, thereby providing an optimal condition for the contact of the particles of phosphate raw material with the acid reagent. The screw reactor is a closed top tube, which goes into a rectangular box with a lid. A screw mixer is installed along the entire length of the apparatus in the central part of the circle, and the pitch of the screw in the initial part (in the mixing zone of the initial reagents) is more bowl than in the rest of the length [39-42].

Conclusion

The main stages of the decomposition of phosphate raw materials occur within the first section of the apparatus within a short time of 5-8 minutes. The rate of decomposition of carbonate minerals of phosphorite is very high and it is practically completed within 1-3 minutes. The decomposition reaction of phosphorite is exothermic. As a result, the temperature of the resulting mass in the initial section of the apparatus reaches, depending on the acid content, up to 100-110 °C. The high temperature of the mixture in the initial phase of mixing phosphorite with sulfuric acid makes it possible to obtain a dry decarbonated intermediate product. The semi-finished product from the lower nozzle at the end of the apparatus enters the mixer through the chutes. When phosphorite is treated with nitric acid, the temperature rises to 40 °C. The semi-product of nitric acid decomposition with a moisture content of up to 10% H_2O from the lower nozzle at the end of the apparatus enters the mixer through the chutes. Thus, the results of laboratory studies indicate the fundamental possibility of obtaining a complex fertilizer by nitric-sulfuric acid decomposition of low-grade phosphorites of the Central Kyzyl Kum at an incomplete rate of sulfuric and nitric acids.

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