

Abstract

Phosphorus has exclusive value for activity processes, being irreplaceable components of nervous, brain tissues, bones, and other proteinaceous compounds. Plants absorb a significant amount of phosphorus which is replenished with entering into it of phosphorus-containing fertilizers into the soil. The main product of the phosphoric industry – the compounds of phosphorus used as fertilizers: ammophos, superphosphate, precipitated calcium superphosphate, etc.

The world need for fertilizers increases in proportion to growth of population. By the end of the first ten years of the 21st century annual consumption of phosphatic raw materials reached 166 million tons. Aggravation of nonclosure of a phosphoric cycle is a consequence of it. In spite of the fact that world reserves of phosphatic ores are huge, they are exhaustible resources, and natural return of phosphorus to a natural cycle does not compensate its expense.

There are estimates according to which the depletion of the rich ores operated in the current time can occur within 60-130 years, 61 years, 93 years, 69-100 years. The scenario at which about 40-60% of the current resources can be depleted by 2100 is considered. Russia's Murmansk sources, in case of preservation of the current outputs, can be enough for 49-54 years of mining.

At the same time increase in production of food demands involvement in the agricultural sector of new lands which processing is impossible without use of fertilizers; therefore, growth of consumption of phosphates can advance growth of population.

The agricultural land of the Russian Federation in the majority has low natural fertility and belongs to zones of risky agriculture. Increase in their efficiency is possible only by means of introduction of mineral fertilizers. In the territory of the Russian Federation 8061 thousand hectares or 26.3% of arable land is a soils with very low and low (up to 50 mg of P_2O_5 on one kg of soils) the content of mobile phosphorus. To raise efficiency of our agricultural grounds to the level of the most developed countries, significant increase in the outputs and consumption of

mineral, first of all phosphoric, fertilizers is required: at least by 3-8 times, by other estimates, by 10 times. Now production of phosphoric fertilizers is based on processing of apatite concentrates. The fields of phosphorites quite suitable for extraction of ore, are almost not involved currently. Meanwhile, the need of completion of balance for the soil of nutritious elements shows necessary of involvement in production of mineral fertilizers by the fosforite ores. Without it ensuring requirement of the state for a phosphate raw ores even on condition of reorientation of his largest producers from export on domestic market is represented impossible. It will allow to keep, on the one hand, the range of fertilizers, and also to provide economy of an apatite concentrate.

Involvement of phosphorites in processing is especially relevant because of lack of a possibility of opening on the available horizons in Khibiny Mountains of new fields nepheline - apatite ores. It is predicted that neither in short, nor increase in volumes of extraction of apatite ore and production of a concentrate on acting with Russian Federation Mining Plants will happen in a long term. At the same time, phosphorites are located territorially more favourably in relation to the consumer and 91% of a phosphorites is located near with them.

Rapid changes in political alignment of forces in the world makes the problems of ensuring food security of Russia and import substitution to problems of prime importance in recent years. It is obvious that this task cannot be solved without all-round development of production of mineral fertilizers for orientation to providing domestic manufacturers and without participation of the state support in the solution of these questions. Based of mentioned above, the matter of development of alternative sources of phosphorus, such as poor phosphorites ores, becomes the more and more relevance.

Scientific novelty

1. New experimental data about influence on decomposition of phosphate rock of temperature in the range of 20 - 50 °C, concentration of nitric acid of 0.01 - 9.8 M and the relation liquid and solid phases from 1÷0.01 to 3:1 are obtained/
2. Influence of physical and chemical factors on extent of extraction of impurity from the Polpinsky phosphorite is established by various acids.
3. Rheological properties of pulps at stages of acid decomposition, ammoniation and introduction of potassium chloride are established.
4. Physical and chemical properties of the received complex fertilizers are studied.

Practical importance of work

1. Technological conditions of separate stages of process are defined: acid decomposition, ammonization and adding of an additional nutritious component during processing of phosphate rock of the polpinsk's field on complex NPK fertilizers.
2. Dependences of viscosity of reactionary pulps on their moisture content at stages of acid decomposition and $H_3PO_4:NH_3$ ratio at an ammonization stage are obtained.
3. The values of moisture content and a ratio of $H_3PO_4:NH_3$ allowing to carry out their transportation in the technological scheme of production of complex fertilizers are defined.
4. NPK fertilizers with the total content of nutritious components of 27÷45%, comparable on quality with industrially produced nitroammosky with the total content of nutritious components of 33÷42% are obtained.

The claims for discussion

1. Parameters of the technological modes of stages of acid decomposition, ammonization of a sour pulp, the adding of an additional nutritious component providing NPK fertilizers with the set properties.

2. Rheological characteristics of the pulps obtained during acid decomposition and the subsequent stage of ammonization.
3. The mathematical description of influence of temperature and concentration of nitric acid on kinetics of process of decomposition of phosphatic raw materials.
4. Characteristics of ready-made products, their chemical and phase composition, hygroscopicity, humidity.
5. Technological flow-sheet of the process taking into account features of processing of poor raw materials.