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CHEMICAL ACTIVATION OF NATURAL PHOSPHORITES

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Abstract. *Phosphorite activation (decomposition) is the process of converting the phosphorus nutrient contained in it into a state that can be absorbed by plants using various methods. This article provides brief information about the activation of natural phosphorus and how this process works.*

Key words: *Phosphorite, reactant, twisted planetary, differentiation, mechanical activation of phosphorites, activation of natural phosphates using acids.*

ХИМИЧЕСКАЯ АКТИВАЦИЯ ПРИРОДНЫХ ФОСФОРИТОВ

Аннотация. *Активация (разложение) фосфорита — это процесс перевода содержащегося в нем питательного фосфора в состояние, пригодное для усвоения растениями различными способами. В этой статье представлена краткая информация об активации природного фосфора и о том, как происходит этот процесс.*

Ключевые слова: *Фосфорит, реагент, скрученная планетарка, дифференциация, механоактивация фосфоритов, активация природных фосфатов кислотами.*

INTRODUCTION

Phosphorite activation (decomposition) is the process of converting the phosphorus nutrient element contained in it into a state that can be absorbed by plants using various methods.

Today, it is necessary to reduce the shortage of water-soluble phosphorus fertilizers produced in industry by rationally using local phosphate raw materials that are not of industrial importance. It is known that when phosphorite flour is used in gray and peaty soils, which are weakly acidic, the acid salts of phosphates formed as a result of the increase in the solubility of calciftorapatite contained in it have a positive effect on the growth and development of plants. Their use in neutral and alkaline soils is ineffective. Obtaining activated phosphorites is much easier and more effective than water-soluble fertilizers obtained by traditional methods.

Currently, in all countries, in order to effectively use low-quality phosphorites and reagents, mechanical, chemical, mechano-chemical, thermal, complexometric, and microbiological methods of activation have been developed to transfer phosphorus anhydride in the form of phosphorite from a form that is not absorbed by plants to a state that is absorbed by plants. Methods of activation of phosphate raw materials have been developed. Methods of activation of phosphate raw materials are presented in scientific and technical sources.

Mechanical activation of natural phosphates, i.e., their softening processes, is carried out in separate grinding shock devices with high tension energy: shredder, dismemberer, central escapement, flow, ring, circle, twist planetary, differential, etc. mills. After mechanical activation, the granularity of the products -+0.4 mm 1.4%, -04 -+ 0.2 mm 6.8%, -0.2 -+0.16 mm 5.0%, -0.16 - + 0.1 mm 10.4%, 0.1 -+0.071 mm 14.4%, -0.071 -+0.05 mm 14.6%, 0.05 mm 47.4 is %.

It is mechanically activated to increase the absorbable fraction of R2O5 in unenriched phosphorite and to effectively use it in agricultural production as a phosphorus fertilizer.

Phosphorus from the Bogdanis mine was softened until 0.16 mm grains were formed; R2O5 total 10%, SiO2 60.7%, CaO 12.7%, MgO 0.6%, K2O 1.7%, Fe2O3 3.4%, Al2O3 4.1%, F 0.9% up to 50% water is mixed to obtain a suspension product. Then, the suspension is obtained by recycling it for five hours in a two-electrode 10kV shock electric pulse device with an amplitude of 10-4 seconds. The total R2O5 content of the solid phase of the product is 5.4%, and its decomposition rate is 54%.

In the process of mechanical activation of phosphorites, its plant-absorbable R2O5 form increases, but it is not without some drawbacks. According to European standards, the degree of fineness of phosphorite flour (0.063 mm) should not be less than 90%. Due to the small size of the grains in the activated phosphorites, during its use as a fertilizer, phosphorite can be lost by 50% due to its strong dusting.

When using Jer-Sardor phosphorite flour ground to 0.1 mm on sour soils, its agrochemical efficiency increases by 70-80%. However, phosphorite flour cannot be used in the soils of Uzbekistan, because phosphorite is in an inert state under these conditions.

One of the ways to overcome these problems in the activation of raw materials using a mechanical method is to mechano-chemically process softened phosphorites with the help of active reagents, to make them granulated or in the form of tablets. In this case, together with maintaining the necessary strength of the product, the size of the grains of which is not larger than 2.5 mm, it is also ensured that it is well compacted in moist conditions of the soil.

Mechanical-chemical activation is carried out with the participation of chemical reagents, high level softening of phosphate raw materials. In this method, its crystallinity decreases, its surface area increases, and it changes to an amorphous state due to the destruction of the structural rings of phosphates under the influence of strong impact and reagents. As a result of mechanical and chemical activation, a plant-absorbable form of R2O5 in phosphorites is formed.

Activation of low-grade and ordinary phosphorites by mechanochemical methods is shown in several scientific and technical sources. For example, a technology for the production of granular phosphorous and phosphorous-calcium fertilizers using an additional quality ammonium sulfate solution that activates and binds carbonated phosphorite flour (R2O5) softened to a grain size of <0.063 mm is recommended.

The ideas of using natural phosphorites as cheap phosphorus fertilizers in agricultural production were put forward by the great agrochemical scientist, academician D.N. Pryanishnikov and proved in his research. At that time, it was known that some soils transfer R2O5 from phosphorite flour into a plant-absorbable form, and some plants absorb R2O5 directly from phosphorite flour. Based on these results, several methods of chemical activation of natural phosphates were developed.

While many cultivated plants, i.e. alfalfa and grain, cannot use phosphorus directly, black wheat, peas, mustard, and lupine have been found to absorb phosphorus. Mainly lupine occupies an important place among these plants. Lupine's thick root system has the ability to dissolve apatite minerals.

1900 Pryanishnikov D.N. proved in his experiments that phosphorite dissolves under the influence of the activity of plant roots with the help of ammonium salts.

Olite sulfur also has the property of disintegrating phosphorite. American Waxman and Lipman showed in their research that a large amount of soluble R2O5 accumulated in composts made of soil, phosphorite and sulfur. In this case, sulfur is oxidized under the influence of bacteria and forms sulfuric acid. In Russia, in the experiments of A. A. Kalushki in the city of Saratov, it was found that when sulfur is mixed with phosphorite and placed in black soil, the effect of phosphorite is equal to the effect of superphosphate. Phosphorite flour can be treated with a small amount of acid and its agrochemical productivity can be increased by increasing the solubility of phosphate minerals in it.

In research, Egorev (Egorovsky) phosphorite was treated with 3.8%, 7.6% and 15.2% (relative to the raw material) phosphorus, nitrogen and hydrochloric acids. The obtained product was tested on corn and oats by breaking it down in incomplete acid. Good agrochemical indicators were obtained in the variants of phosphorite activated with phosphoric acid. It was observed that the efficiency indicators of fertilizers obtained by partial decomposition of phosphorite flour under the influence of hydrochloric and nitric acids are lower than those obtained by activation with phosphoric acid.

It has been determined that a convenient level of phosphoric acid for processing phosphorite flour is equal to 7-8%. It is observed that the coefficient of beneficial effect on the plant of the products obtained on the basis of decomposition of phosphorite with incomplete neutral acid is 5-8 times higher than that of phosphorite. On the basis of experiments, it was found that the result of the interaction of soluble phosphates with the soil is less, on the contrary, under these conditions, phosphates treated with a small amount of acid are more active. Also, the partial decomposition of this raw material at different concentrations of phosphoric acid was studied.

The process of decomposition of phosphorite with phosphoric acid was studied at the stoichiometric rate of acid required for the production of double superphosphate: 12.5%, 25%, 37.5%, 50%. By decomposing phosphorite under the influence of a 25% favorable standard of phosphoric acid, it was found that the beneficial effect of phosphates on plants in the obtained product is practically close to superphosphate.

Granulation of activated phosphorites did not decrease their effectiveness, on the contrary, their agrochemical productivity increased due to the improvement of their physical and mechanical properties. Experiments carried out in field conditions show that the agrochemical qualities of the product obtained on the basis of reducing the consumption of acid in the stoichiometry necessary for obtaining double superphosphate by 4 times are not inferior to double superphosphate.

Many scientists have been engaged in methods of obtaining new types of fertilizers by activating natural phosphates with the help of acids. For example, phosphate raw materials with a moisture content of 3-15% and particles smaller than 1 mm, or its mixture with inorganic or organic fertilizers, mineral acids (sulphate, nitrogen or their mixture) necessary to break down phosphate) is intensively mixed with a rate of 50%. The resulting hot product is cooled and dried or stored in a warehouse in a layer of up to 20 cm.

In another method, the prepared mixture is processed in a long mixer with the help of 30-40% of concentrated phosphorous or sulfuric or nitric acids, and at the end of the process, 10-20% of water is added to the product mass. In a plate granulator, the finished product is transferred to a granular form with binding agents for small particles (silicate solution, clay, sulfite waste, alcohol industry waste) or urea alloy or ammonium nitrate potassium salt. The following 0-18-18 of cooled granular fertilizers; 10-10-10; 13-13-15 marks can be obtained.

Phosphorite was decomposed with a small amount of phosphoric acid, and superphos fertilizer was obtained, with 50-60% of phosphorus content in water-soluble form, and testing it on various agricultural crops showed that it has high agrochemical efficiency.

Phosphate raw materials can be activated by adding sulfur, ammonium sulfate, sulfate urea.

For example, 5-7% of sulfur, microelements and bacteria (nutrient medium or nitrate solution) are added to low-quality phosphorites. It accelerates biochemical processes in the soil and helps increase plant productivity.

There are various microorganisms that dissolve phosphates. As a result of the separation of free organic acids during their life, they dissolve three calcium phosphates and form acidic phosphate salts necessary for plants.

Phosphate dissolving fungi include Aspergilus niger, Penicillium digitatum, Penicilliim sp, Asp avotoru. Phosphorite-decomposing microorganisms include azobacteria, aluminosilicate bacteria, thion bacteria, bacilli, Bac cerius, Bac polymyxa, Bac megeterium, Bac subtilis sporeless bacteria Pseudomonas fluoresens Ps. striata can also be included.

Currently, great research is being conducted in this direction, and new types of phosphate-dissolving bacteria are being discovered.

CONCLUSION

Phosphorus (P) is one of the main elements of plant nutrition, it is included in the nucleus of cells, enzymes, vitamins and other important compounds. Phosphorus participates in the processes of conversion of carbohydrates and nitrogenous substances.

Phosphorus is present in plants in organic and mineral forms. Mineral compounds of phosphorus (orthophosphoric acid salts) are used in the synthesis of carbohydrates and other biochemical processes. These processes affect the accumulation of sugar in sugar beets and grapes, and the accumulation of starch in potato tubers.

In case of a strong phosphate deficiency of the plant, the growth of stems and leaves, the formation of seeds stops, and the tissues begin to dry up. Phosphorus accelerates the development of the plant, increases its winter resistance. Phosphorus is especially important for young plants.

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