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Production of Microelement-Containing Superphosphate on the Basis of Thermoconcentrate and Secondary Raw Materials of Hydrometallurgy

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Abstract

To date, nitrogen, phosphorus and potassium fertilizers in agriculture are produced and widely used in our republic. However, the production of microelement-containing fertilizers (MCF) has not been carried out. The main problem of production of MCF is the lack of raw materials. One of the ways to solve this problem is to use the secondary raw materials of the hydrometallurgical industry. In the Almalyk Mining and Metallurgical Combine, the secondary raw materials, containing a trace element, are obtained during the processing of molybdenum. This material can be used as a component for obtaining a microelement containing fertilizer. The aim of the work is to obtain microelement-containing fertilizers based on the secondary raw materials of the hydrometallurgical industry and powdered superphosphate, obtained by decomposing the thermoconcentrate at different rates of sulfuric acid. The secondary raw materials of the hydrometallurgical industry were used to produce microelement-containing fertilizers. Optimum conditions for granulation of powdered superphosphate obtained by decomposition of phosphorite thermoconcentrate at various sulfuric acid standards with secondary raw materials of the hydrometallurgical industry are determined. The optimal conditions for the production of trace elements containing fertilizers are established: the stoichiometric norm of sulfuric acid for decomposition of the thermal concentrate is 40-100%; Humidity at granulation is of 13-15%; the content of microelements in superphosphate is 0.5-2.0%. Preparation of micronutrient-containing fertilizers based on the secondary row materials of hydrometallurgy, This suitable for using in agriculture.

Keywords: thermoconcentrate, sulfuric acid, decomposition, secondary raw materials, molybdenum-containing ores, granulation

Introduction

Hence, the intensification of agricultural production and increase in insertion doses of nitrogen, phosphorus and potassium fertilizers significantly increased the value of micronutrients, lack of which is becoming a limiting factor in obtaining high yields and high quality at agriculture crops. Reducing the quality of agricultural products and feeds, due to the lack of microelements, results in inadequate production of livestock. Many human diseases are associated with the deficiency of iron, diet, copper, zinc, cobalt, manganese, molybdenum, iodine, and other elements. Therefore, the problem of production and rational use of micronutrients is essential for the implementation of the food securities programs and the production of high-quality food products that allow improving the health of people [1-5].

Such microelements as copper, boron, zinc, manganese, etc. and ultramicroelements - cobalt, nickel, lithium, vanadium in total amount to less than 1-2% of the living organism, while the need for them is not lower than in the macroelements. Microelements are necessary for the flow of many important biochemical processes. Activity of almost 1/4 of all enzymes - catalysts of biological reactions - is regulated by metal ions: for example, amylase, hydrolyzing starch (Ca, Zn); ATPase hydrolysing ATP (Mg); Nitrate reductase, which reduces HNO_3 in HNO_2 (Mo, Fe); Some peptidases, hydrolyzing proteins and peptides (Zn, Mn, Co, Cu, Ca) [6].

One of the factors contributing to the increase in the effectiveness of fertilizers is the use of microelement-containing fertilizers, the importance of which increases with the increase in crop yields. Microelements

take part in many physiological and biochemical processes, are an indispensable part of many enzymes, vitamins, growth substances, so the lack of a certain microelement can dramatically affect both the yield and its quality [7].

The balanced nutrition of plants with macro- and microelements controls the numerous metabolic processes and plays a key role in the formation of the crop and its chemical composition. All biogenic elements perform vital functions in the plant. Their content determines the productivity of crops, the shortage of food elements will inevitably affect the yield and quality of products. Plants are practically indifferent to what is the source of nutrients - the solid phase of the soil or the fertilizers introduced. It is important that they are in the soil in sufficient quantities and the optimum ratio. At any level of chemicalization of agriculture, it is necessary to monitor the state of the balance of nutrients in the soil-plant system [8].

Well-known that Russian scientist-agrochemist A. V. Petersburg called catalyzers of catalysts. Microelements increase metabolism in plants, increase their yield and improve quality. With the complete absence of any element in the soil, the plant can not grow and develop normally [9].

Finally, this led to sharp decline in the yield of basic agricultural products. For example, in the Rostov and Lipetsk regions, the usual limiting factor - precipitation, which is already habitual here, can be added, one more is the presence in the soil of a sufficient number of micro- and ultramicroelements necessary for the plant. Even favorable weather conditions of the year and full mineral nutrition with basic elements (NPK) does not guarantee high yields. To obtain high and high yields of agricultural crops it is necessary to use microelements together with mineral fertilizers [10].

Micro elements are involved in many physiological and biochemical processes occurring in plant development. Therefore, even if the normal security soil with nitrogen, phosphorus and potassium, increase in crop yields is limited by the lack of certain microelements. Lack of micronutrients in the soil not only leads to reduction of yield, but also can cause a various of diseases in plants with a sharp lead to starvation of their death [11-12].

Micro elements are essential for plants. They are the active sites of enzymes, improves metabolism in plants, increase the rate of photosynthesis and significantly affect the processes of synthesishlorofilla [13-16].

In the production of high quality and yield of the crop fertilizer, micro element containing role is of particular importance. Therefore, organization of production of micro element containing fertilizer is an urgent task. One way of obtaining new types of fertilizers is the rational use of micro element containing industrial secondary wastes. [17].

Object and Methods of Research

Lack of micronutrients in crops can be achieved with a combination of macro-elements, which are often used in various agro-technical terms. Representatives of the macronutrients are nitrogen (ammonium nitrate, urea), potash (potassium chloride, potassium nitrate) and phosphorus (simple and triple superphosphate) fertilizer. Superphosphate is widely and successfully used by the farmers and the combination of it with micro elements is of great scientific and practical interest.

For the synthesis of micro element containing fertilizer used thermoconsentrate containing (P_2O_5 - 27.40%; CaO - 54.68%; CO_2 – 4.52%;) and 92.5% - sulfuric acid. Norm sulfuric acid varied in the range of 40-100% of stoichiometry on the decomposition of phosphate to form calcium phosphate and calcium sulfate.

The resulting powder was treated and granulated micro element containing solution (Mo-6.5%, Cu-1.94%, pH-8.95, ρ-1.058, μ-1.40) using secondary raw materials of the Almalyk mining and metallurgical industry. To obtain a microelement-containing superphosphate, the granular products of the sulfuric acid decomposition of the phosphorite thermoconcentrate of the Central Kyzylkum were treated with a microelement containing the solution. After drying, the new fertilizers obtained were transferred to determine the agronomic efficiency in the research institute of selection, seed production and agrotechnology of cotton growing in the Republic of Uzbekistan. Superphosphate with molybdenum and copper contains P_2O_{5Total} from 16.15% to 21.05%, Mo from 0.053% to 0.070 %, Cu from 0.107% to 0.139 %.

Further dried in a dryer furnace at a temperature of 100-110^oC. Microelement containing superphosphate was analyzed using a known standard method. In order to obtain products in granular form, the raw samples of complex fertilizer with a moisture content of 13-15% were balled using plate granulator. Components by conventional techniques, the nitrogen content was determined by Kjeldahl method, and P_2O_5 photocolorimetry method, Calcium complex metric titration was determined, and the content of microelements spectrometry. pH environment was measured at pH meter METTLER TOLEDO[18-21].

Research results. The interaction between the components occurs within 15-20 minutes and a big amount of heat is generated. Micro element containing superphosphate is thermoconsentrate with intensive mixing treated with the calculated amount of concentrated sulfuric acid. The results are summarized in Table 1.

Table 1. The chemical composition of thermoconsentrate, obtained on the basis of intensive technologies%

Norm H_2SO_4 %	P_2O_5		CaO			SO_3	H_2O	CO_2	Dd
	Total	Digestible	Total	Digestible	Gypsum				
40	21.05	10.30	13.88	8.22	24.99	14.70	2.53	1.97	48.95
50	19.90	11.14	16.40	8.89	29.52	17.37	2.99	1.51	58.01
60	18.87	12.65	18.66	9.98	33.58	19.76	3.40	1.10	67.04
70	17.94	13.45	20.70	10.71	37.25	21.91	3.77	0.72	74.99
80	17.10	14.37	21.80	11.43	40.58	23.87	4.10	0.38	84.05
90	16.33	15.35	24.21	12.25	43.60	25.65	4.41	0.07	93.99
100	16.15	15.83	24.61	12.62	44.32	26.07	4.76	-	97.99

As seen from the data tables, there is an increase in the degree of decomposition of phosphate rock with a rise in the rate of sulfuric acid. For example, at a rate of 60% acid content and the overall shape of P_2O_5 18.87% in the product relative to the content of P_2O_5 assimilable form plants is 67.04%. At norms of 70% and 100%, decomposition degree is 74.99% and 97.99% respectively. Along with the increase of the sulfuric acid increases the degree of de-carbonization. So at norms of 60 and 100% of the content of the degree of de-carbonization (Dd) of the product was 75.66 % and 100 % respectively.

The resulting powder was treated and granulated micro element containing solution at Almalyk mining and metallurgical industry. Laboratory on a plate granulator in the presence retour. Micro element containing superphosphate was analyzed using a known standard method. The results of studies of the chemical composition of raw and ready-dried products are summarized in Table 2.

Table 2. Chemical composition micro element containing superphosphate obtained on the basis of intensive technologies %**.**

Norm H_2SO_4 %	P_2O_5		CaO			Mo	Cu	SO_3	H_2O	CO_2	Digestible P_2O_5 %	pH env
	Total	Digestible	Total	Digestible	Gypsum							
40	20.90	10.41	13.55	8.33	24.86	0.07	0.28	14.53	2.52	1.96	49.80	6.34
50	19.76	11.24	16.10	8.90	29.48	0.07	0.26	17.30	2.98	1.50	56.88	6.21
60	18.74	12.75	18.41	10.16	33.42	0.06	0.25	19.57	3.39	1.09	68.04	5.92
70	17.82	13.44	20.45	10.71	37.11	0.06	0.24	21.72	3.76	0.71	75.42	5.79
80	16.99	14.46	21.58	11.51	40.43	0.06	0.23	23.66	4.09	0.37	85.11	5.64
90	16.24	15.44	23.99	12.31	43.47	0.05	0.22	25.43	4.40	0.06	95.07	5.53
100	16.07	15.91	24.39	12.69	44.18	0.05	0.21	25.84	4.75	-	99.00	5.39

150 kg P_2O_5, 0.5 kg Mo, 2.0 kg Cu are requested for cotton each hectare

Intensive ways to recycle microelement containing fertilizers complex nutrients were analyzed using standard methods. The table shows that 40% of the norm from the complex micronutrient fertilizers plants digestible P_2O_5 takes part if 49.80%, 80% and 100% in accordance with the norms of assisted 85.11% and 99.00% respectively. Microelements are consisted of, 0.05 to 0.7% as well as from 0.21 to 0,28%. It should be noted that the studies investigated pH values fertilizer samples ranged from 5.39 to 6.34. These results suggest that these types of products are not physiologically acidic and can be recommended as a fertilizer Seed.

Samples of all fertilizers humidity, depending on the weight, friability, and the angle of inclination, hygroscopic point and the theoretical properties of granularity in accordance with the requirements of the agricultural tests confirmed the result. Superphosphate accelerated technology camera unlike the method of obtaining phosphate raw product was created to break down acid neutralization, drying and granulation, another equipment; that is screw mixer takes a short, 10-15 minutes.

Phosphorite decay process in a short time with a large amount of heat isolation. Due to the lack of substance in relation to the amount of water involved in the reaction, foam is not observed. Technological processes, as opposed to the technology of the camera superphosphate diluted acid, the raw material crushing camera device for 1.5-2 hours, sour superphosphate break up the stores by the end of 4-6 days,

reduced granularity and drying stages. Superphosphate with the structure and properties do not different products produced by other methods.

Conclusion

Thus, the results of laboratory studies have shown the possibility of obtaining micro element containing fertilizers based on the interaction of superphosphate weight degradation product of the Central Kyzylkum phosphate at various rates of sulfuric acid and waste micro element containing or chelates shaped molybdenum sulfate. On the basis of this development, this solves the problem of disposing of industrial waste molybdenum production Almalyk mining and metallurgical industry.

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