Proceedings of Online International Conference on Innovative Solutions and Advanced Research
Organized by Novateur Publications, Pune, Maharashtra, India
JournalNX- A Multidisciplinary Peer Reviewed Journal
ISSN: 2581-4230, Website: journalnx.com, October 11th, 2020

DOLOMITE USE IN THE PRODUCTION OF SINGLE PHOSPHATE FERTILIZERS

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Abstract

The results of studies on the use of dolomite for the neutralization of phosphoric acid are presented. It has been shown that to obtain single phosphoric fertilizers, phosphoric acid containing 1% ammonium nitrate must be neutralized with dolomite at a stoichiometric rate for the formation of monocalcium phosphate at a temperature of 60° C and a process duration of 30 minutes. After drying, phosphate fertilizers contain at least 98.58% digestible and at least 93.44% water-soluble P_2O_5.

Key words: Dolomite, extraction phosphoric acid, phosphoric fertilizers, decomposition, neutralization, monocalcium phosphate, drying.

INTRODUCTION

In connection with the reduction of fertile soils natural for agriculture and the growth of the planet's population, the provision of food products is a paramount task. Therefore, the provision of the agro-industrial complex with mineral fertilizers is one of the main problems of increasing the productivity of agricultural crops. The growth in the consumption of phosphate raw materials, the depletion of rich deposits contributes to the involvement of low-grade phosphorites in the production, and in the distant and calcium-magnesium-containing mineral raw materials.

In the Republic of Uzbekistan, calcite, limestone, dolomite and other nonmetallic minerals containing calcium and magnesium carbonates are found in large quantities, and which meet the technological requirements for the production of phosphate fertilizers [1]. In this regard, from a technological point of view, a comprehensive study of calcium- and magnesium-containing carbonate raw materials is of great importance.

In order to increase the volume of industrial production of phosphorus fertilizers, reduce its cost (relative to ammophos), reduce the consumption of valuable raw materials - phosphorite (compared with double superphosphate), the process of obtaining digestible calcium and magnesium-containing phosphoric fertilizers by neutralizing the extraction phosphoric acid obtained from washed calcined fosconcentrate of Central Kyzyl Kum, dolomite raw material.

For these purposes, we used extraction phosphoric acid (EPA) with the composition, wt%: P_2O_5 – 17,23, CaO – 0,32, MgO – 0,66, Fe_2O_3 – 0,30, Al_2O_3 – 0,41, F – 1,18 and dolomite composition, (wt.%): CaO – 32,36, MgO – 18,68, R_2O_3 – 0,53, CO_2 – 45,76.

Previously, the processes of neutralization of EPA with calcium and magnesium-containing carbonate raw materials (chalk, limestone, waste water treatment plants) and products of their calcination in the temperature range 100÷1050ºC, as well as the processes occurring during this [2]. It was found that when using uncalcined calcium- and magnesium-carbonate-containing raw materials in the neutralization process for the formation of stable foam and its extinguishing, a rather long time is required (from 50 to 150 minutes), which leads to a decrease in the rate of the fertilizer production process, and when using calcined in the interval temperatures of 700 ÷ 850 ° C of calcium- and magnesium-containing carbonate raw materials for extinguishing stable foam is enough only 5-10 minutes.

The process of neutralizing EPC with dolomite differs from carbonate raw materials. When dolomites are used in the neutralization process, stable foaming is practically absent, which makes it possible to increase the neutralization rate.

To obtain phosphate calcium-magnesium-containing fertilizers, the processes of netralization of EPA and EPA with the addition of 1% ammonium nitrate with dolomite and the production of fertilizers by evaporation and drying of suspensions were studied.

Table 1.

Chemical composition of the suspension obtained by neutralizing EPA with dolomite raw materials, products of its calcination and technological parameters of the process

Indicators	Suspension		Dried product	
	–	in the presence NH_4NO_3	–	in the presence NH_4NO_3
P_2O_5 (total),%	16,15	15,99	49,21	49,57
P_2O_5 (assim.),%	15,92	15,77	48,60	49,03
P_2O_5 (w.r.),%	15,09	14,96	45,94	46,51
CaO (total),%	4,04	4,02	12,31	12,46
MgO (total),%	2,78	2,76	8,46	8,56
R_2O_3 (total),%	1,11	1,10	3,39	3,41
SO_3 (total),%	1,17	1,16	3,57	3,60
F, %	1,07	1,06	2,70	2,55
N (total),%	-	0,32	-	1,01
H_2O, %	69,16	69,58	5,96	5,68
($P_2O_{5\ learned.}$:$P_2O_{5\ total.}$)×100, %	98,58	98,62	98,76	98,91
($P_2O_{5\ in\ r.}$:$P_2O_{5\ total}$)×100, %	93,44	93,56	93,35	93,83

The neutralization process was carried out at room temperature (20-25 ° C) for 30 minutes at a stoichiometric norm for the formation of monocalcium phosphate. The resulting suspensions were dried at a temperature of 95-100 ° C. Technological parameters of the

process, chemical compositions of intermediate suspensions and final products are shown in Table 1.

As a result of the studies carried out, suspensions were obtained, which are formed in the process of neutralization of EPA with dolomite of the composition (wt%): P_2O_5 total. – 16,15 и 15,99; P_2O_5 learned – 15,92 и 15,77; P_2O_5 in r. – 15,09 and 14,96; CaO – 4,04 и 4,02; MgO – 2,78 and 2,76; R_2O_3 – 1,11 and 1,10; SO_3 – 1,17 and 1,16; F – 1,07 and 1,06; N – 0 and 0,32; H_2O – 69,16 and 69,58. B suspension content of assimilable phosphorus, i.e. attitude (P_2O_5 learned.:P_2O_5 total.)×100 is 98.58% and 98.62%, respectively.

As a result of drying the resulting suspensions at a temperature of 95 ÷ 100° C, calcium and magnesium-containing phosphorus fertilizers were obtained with the following composition (wt%): P_2O_5 total. – 49,21 and 49,57; P_2O_5 learned. – 48,60 and 49,03; P_2O_5 in r. – 45,94 and 46,51; CaO – 12,31 and 12,46; MgO – 8,46 and 8,56; R_2O_3 – 3,39 and 3,41; SO_3 – 3,57 and 3,60; F – 2,70 and 2,55; N – 0 and 1,01; H_2O – 5,96 and 5,68. Attitude (P_2O_5 learned.:P_2O_5 total)×100 is 98.76% and 98.91%, and the ratio (P_2O_5 in r.:P_2O_5 total.)× 100 is equal to 93.35% and 93.83%, respectively.

Thus, the conducted studies have shown the possibility of obtaining single phosphorus fertilizers by neutralizing EPA and EPA containing 1% ammonium nitrate with dolomite. For this, it is advisable to maintain the temperature of the process at 60° C, duration 30 minutes at a rate of 100% acid for the formation of monocalcium phosphate.

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