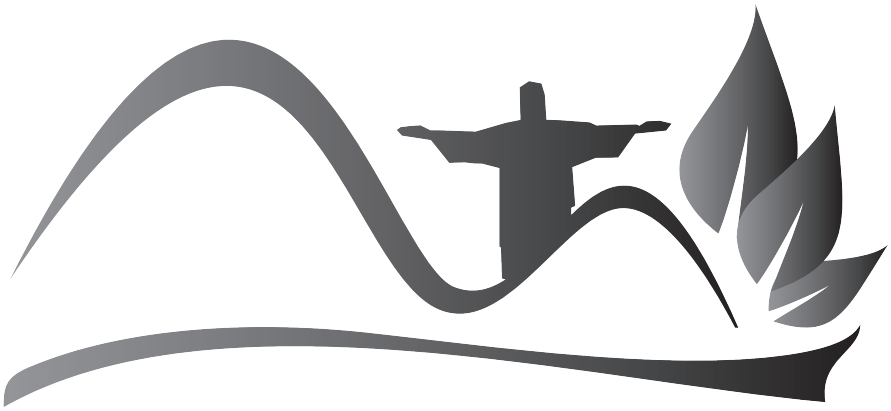
16th WORLD FERTILIZER CONGRESS OF CIEC

TECHNOLOGICAL INNOVATION FOR A SUSTAINABLE TROPICAL AGRICULTURE

PROCEEDINGS

International Scientific Centre of Fertilizers (CIEC)



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PROCEEDINGS

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THERMOPHOSPHATES OBTAINED OF THE COMBINATION OF ALUMINUM PHOSPHATE AND SLAG

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Introduction

The use “in natura” of aluminum phosphate (AP) is infeasible agronomically due to its low solubility, caused by the high bond strength between phosphate and aluminum in the mineral. Studies show that this kind of phosphate is their increased solubility, when it is subjected to thermal calcination process, favoring breakage of the crystalline structure of the mineral, increasing the phosphorus available to plants.

The use of aluminous phosphates from State of Pará, obtained of the mixture with molten slag mass (liquid), removes the energetic restriction on production process of thermophosphate, favoring the reduction of the environmental liabilities of the steel companies in the production of pig iron, as well as contributing for the development of agriculture in the state of Pará and Amazon, which have high dependence of phosphate fertilizers from other regions of the country.

The work aims to develop technology strategies to enable the production of a thermophosphate from the use of slag mixed with aluminum phosphate, in deposits originating from the Northeast of Pará.

Methods

The development of production process of thermophosphate was conducted at the Technology Research Institute of the State of Sao Paulo. The work in experimental scale involved tests of calcination, for the use of rock phosphate of aluminum originating in the Northeast Para, in mixtures of different ratios of masses with molten slag, to obtain thermophosphates that were evaluated in terms of their final content of P_2O_5.

Treatments involving mixing of different proportions of mass /mass of raw material to define of relations that contain levels more acceptable of P_2O_5 in desirable terms of solubility of final products. The aluminum phosphate rock was initially assessed for total phosphorus content of the sample and samples with content of P_2O_5 total suitable, in order to allow acceptable minimum levels of thermophosphates produced, since after the mixture there is reduction of initial levels of phosphorus in different combinations of the mass.

For the tests of calcination, in bench scale, combinations of mass of raw materials were established. To compose the AP mixtures, samples of blast furnace slag were used and subjected to different calcination temperatures. The products obtained of calcination tests were evaluated on the basis of the contents of P_2O_5, using the official method of the Ministry of Agriculture of Brazil.

Results and discussion

Based on the composition of the raw material, the AP had appropriate content of P_2O_5 to allow the mixture of mass with slag, for the obtaining of thermophosphate. The phosphate also showed high levels of aluminum oxide, which is not available for uptake by plants and thus without the possibility of damaging their growth. The slag of the blast furnace is the largest portion of the total waste generated in the steel industry, being obtained by the reaction of flux and impurities of iron ore, which results in high levels of oxides of silicon (SiO_2), aluminum (Al_2O_3), iron (Fe_2O_3) and calcium (CaO). The slag composition varies according to the chemical composition of the raw material (iron ore, coal, limestone) used in the manufacturing process of pig iron.

Considering the contents of P_2O_5 in thermophosphates obtained by combining masses of AP and slag, in general, the solubility of ther-

mophosphates increased as there was an increase in temperature, in differents combinations of aluminum phosphate and slag.

The calcination promoted reduction of the total levels of P_2O_5 in AP in the temperatures used. The low water solubility of thermophosphates indicates the reduced availability of phosphorus fertilizer for plants. When the extracting solution of citric acid 2% was used, there was an inverse effect on the P_2O_5 levels, observing an increase in the solubility of thermophosphates with the increase of temperature. In this solution, the variation in the concentration of P_2O_5 was about 8%.

Among the thermophosphates obtained, some combinations of AP and slag showed total levels of P_2O_5 above of the values minimum requirements, established by Brazilian legislation.

Conclusions

The total content of P_2O_5 in thermophosphates produced, ranged within different combinations of aluminum phosphate and slag. The solubility of thermophosphates increased with the increase of temperature. Some combinations of AP and slag showed total levels of P_2O_5 within the minimum requirements established by Brazilian legislation.

Keywords: Fertilizer, phosphorus, solubility

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