Pak. j. sci. ind. res., vol. 32, no. 10, October 1989

ACIDULATION OF ROCK PHOSPHATE OF HAZARA FOR THE PRODUCTION OF PHOSPHATIC FERTILIZER

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(Received December 17, 1988, revised September 7, 1989)

Investigation of an ideal mesh size for maximum recovery of P_2O_5 from rock phosphate of Hazara by acidulation with Sulphuric acid was undertaken. Different mesh sizes of the rock were treated with various concentrations of the acid. Effect of temperature and H_2SO_4 concentration were studied. As a result of a number of experiments it was found that maximum recovery of P_2O_5 occurs at a mesh size of -100+125.

Key Words: Acidulation, Phosphate rock, Phosphatic fertilizer.

Introduction

Hazara phosphate rock was first discovered by Latif [1]. Bhatti [2] indentified the rock phosphate of this area. Tahir Kheli [3] also described the occurance of phosphate rock at Hazara. Ishaq [4] undertook studies on the utilization of this rock. Khattak, *et.al.* [5] presented a monograph on the exploration, beneficiation and utilization of Hazara rock phosphate. The decomposition of Jordan and Lagarhen phosphate rock with Nitric, Hydrochloric and Sulphuric acids were studied by Ishaque *et. al.* [6]. The acidulation of Egyptian rock with fluorosilicic acid was studied by Zatout and Hussain [7]. Habushi, Fabbi *et. al.* [8] studied the leaching of low grade carbonate phosphate with hydrochloric and nitric acids. The effect of denning time on the extractable phosphate was studied by Headly *et. al.* [9]. Acid leaching of phosphate rock was also studied by Belchenko *et. al.* [10].

Keeping in view the importance of phosphate rocks the present studies were carried out to produce more concentrated super phosphate and better utilization of our phosphate resources.

Materials and Methods

Chemical Analysis of the Rock. Chemical analysis of the kakul rock of Hazara region was undertaken by conventional methods [11] and the results are shown in Table 1.

Representative samples of Kakul rock of Hazara were grounded into desired particle size (Fig. I) and were subjected to acidulation experiments on 1 Litre capacity. Weighed amounts of sulphuric acid and phosphate rock were thoroughly mixed, digested on steam bath and evaluated for P_2O_5 content by Molybdate Method [11].

Effects of Various Parameters on the Recovery of P_2O_5.

(i) *Mesh size.* The powdered rock was cured with conc. H_2SO_4. Various mesh sizes of the rock were studied and the P_2O_5 calculated. The results are shown graphically in Fig. I. From these results it was concluded that maximum recovery of P_2O_5 occurred at a mesh size of- 100 + 125.

TABLE - I

Loss on ignition	=	1.90%
Silica as (SiO_2)	=	21.04%
Phosphorous pentoxide as (P_2O_5)	=	270.34%
Iron Oxide + Aluminium Oxide as P_2O_3	=	8.75%
Calcium Oxide as (CaO)	=	38.83%
Magnesium Oxide as (MgO)	=	1.20%
Sodium Oxide as (Na_2O)	=	1.00%
Potassium Oxide as (K_2O)	=	0.15%
Total	=	100.23%

(ii) *Sulfuric acid concentration.* Different concentrations of H_2SO_4 were studied. The results are shown graphically in Fig. 2. It was found that the maximum recovery of P_2O_5 occured at a concentration of 8N H_2SO_4. The experiments were performed at the mesh size –100+125.

(iii) *Volume of sulfuric acid.* The rock of mesh size –100+125 was treated with different volumes of H_2SO_4 (8N). The results are shown graphically in Fig. 3. These results indicate that the maximum recovery of P_2O_5 occurred at a volume of 30ml of H_2SO_4 (8N).

(iv) *Temperature.* Temperature had negligible effect on the recovery of P_2O_5.

Results and Discussions

The development and utilization work on the phosphate deposits of Hazara for the production of phosphate fertilizer was taken up around 1969. Earlier workers had suggested the utilization of this rock at fine mesh (200 B.S.S.) even after calcination. In the present studies the -100+125 B.S.S. was found to give a maximum recovery of P_2O_5.

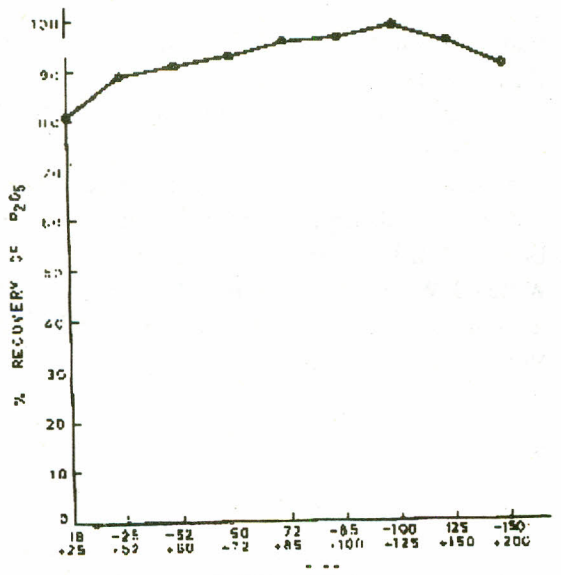

Fig. 1. Effect of Mesh size variations on P_2O_5 recovery

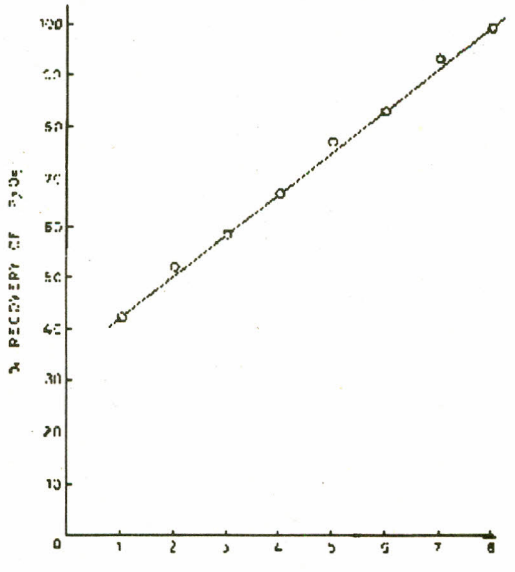

Fig. 2. Effect of H_2SO_4 concentration on the P_2O_5 recovery.

The effect of temperature and sulphuric acid concentration were also studied to obtain the parameters for maximum recovery of P_2O_5. As there was not much difference in the % recovery of P_2O_5 at room temperature and at higher temperature, therefore, there would be a large saving of energy in processing the ore at room temperature. It was also found that there was a sharp increase in the recovery of P_2O_5 as the concentration of H_2SO_4 was increased to 8N. Beyond this concentration a thick slurry forms which was difficult to handle.

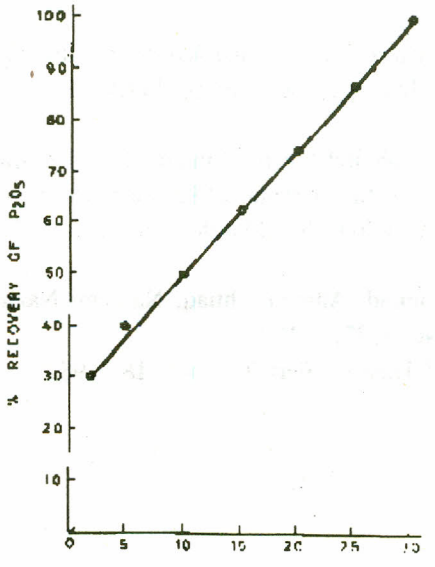

Fig. 3. Effect of volume of H_2SO_4 (8N) on recovery of P_2S_5

Conclusion

On the basis of these studies undertaken, it is concluded that the rock phosphate of Hazara could be easily attacked by sulfuric acid after grinding to -100+125 mesh size. Under the stated conditions maximum amount of P_2O_5 could be recovered from the rock phosphate of Hazara. The observation in the present investigation has an improvement over the previous work where 200 B.S.S. has been reported as the ideal mesh size, where as in the present studies -100+125 B.S.S. has been found to give maximum recovery of P_2O_5 (Table 2)

Table 2

S.No.	Mesh size (B.S.S.)	Temperature (°C)	%Recovery of P_2O_3
1.	–100+125	R.T.	98.90
2.	"	60	99.08
3.	"	70	99.15
4.	"	80	99.13
5.	"	100	99.12
6.	"	120	99.15
7.	"	140	99.12
8.	"	160	99.05

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