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A Process for Making Phosphate Fertilizers from Eppawala Apatite

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Sri Lanka geological survey has discovered a very large deposit of apatite at Eppawala in the North Central province. This deposit will have a tremendous potential as a source of phosphate fertilizers for Sri Lanka if methods are found for converting it into forms containing available phosphorus using locally produced chemicals. The method used in most countries to convert apatite into superphosphate involves the use of either sulphuric acid or orthophosphoric acid. Sulphuric acid is an expensive commodity in the world market. As sulphur or sulphur bearing ores that could be used for the manufacture of sulphuric acid are not known to occur in Sri Lanka, the use of sulphuric acid to produce superphosphate from Eppawala apatite would not be profitable even in the near future. Although apatite itself could be used to make orthophosphoric acid using cheap raw materials like silica or coke, the process is complicated and the construction of a plant would involve a very high initial expenditure.

In this note we describe a method for producing a phosphate fertilizer containing a high percentage of available phosphorus from Eppawala apatite using locally manufactured hydrochloric acid. The process is extremely simple and an elaborate chemical plant involving complicated operations is probably not needed. The details of the method is given below.

Step 1

Powdered Eppawala apatite from the phosphate enriched zone is mixed with 35% hydrochloric acid in the proportion one litre of hydrochloric acid per 20kg of apatite. When the effervescene due to the evolution of carbon dioxide ceases the mixture is heated to a temperature 120–140°C for about 45 minutes in a container with a closed but not tight lid. Fumes containing a small percentage of flurine compounds are evolved and the calcium phosphate part of apatite gets converted into dicalcium phosphate.

Step 2

The Step 1 completely breaks the apatite lattice, the resulting mixture containing dicalcium phosphate and calcium chloride is crushed, mixed with ammonium sulphate in the proportion 14 kg of ammonium sulphate for every 20 kg of apatite. Water is added to the above mixture in the proportion one litre for every 20 kg of apatite initially used. The mixture is then stirred and slowly evaporated. Once a thick paste is formed, the container is given a rocking motion while the stirring is being continued. The mixture then tuns into pellets. During this operation the temperature should not exceed 100°C Hydrochloric acid used in the Step 2 converts dicalcium phosphate into mono-calcium phosphate (superphosphate). Ammonium sulphate converts hygro scopic calcium chloride produced in Steps 1 and 2 into calcium sulphate and ammonium chloride. The calcium sulphate assists the formation of granuels The final product in the form of white granules is very convenient to handle. It is very slighdly hygroscopic and can be stored in polythene bags.

The final product contains 15-17% avai able P_2O_5 of which 6-7% is water soluble and 9-10% is citric acid soluble, the nitrogen content of the-product is about 7%. The water soluble part is mainly in the form of mono calcium phosphate and ammonium phosphate. The citric acid soluble part is dicalcium phosphate. The advantage of the process is that ammonium sulphate used to make a non-hygroscopic product is itself a nitrogen containing substance. There is no loss of nitrogen, ammonium sulphate merely gets converted into ammonium chloride. Thus no substantial increase in ammonium sulphate imports is necessary for implementation of this process.