

CHARACTERIZATION OF EPPAWALA ROCK PHOSPHATE FOR MANUFACTURE OF PHOSPHATIC FERTILIZER

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Phosphate Rock is the key source of phosphorous and thus the vital raw material in the manufacture of phosphatic fertilizers and phosphate based chemicals.

The Eppawala Phosphate Rock was first characterised by the Tennessee Valley Authority (TVA) in 1975 and was reported to contain 72.7 modal percentage of apatite which is a chlor-flourapatite with a complex chemical composition. It was also revealed that this chlor-flourapatite has significant amounts of chloride and hydroxyl ions substituting for fluoride ions as well as carbonate ions substituting for phosphate ions.

The Phosphate Rock at Eppawala is of high grade with an average of 37% P_2O_5 but in the unbeneficiated state is chemically not suitable for acidulation due to the high chloride content which causes serious corrosion problems in plant and machinery and the high $Al_2O_3 + Fe_2O_3$ (R_2O_3) content which gives rise to retardation in filtration rates due to coagulation. The studies conducted by the International Fertilizer Development Centre, USA in 1979 have indicated that direct acidulation with HCl and HNO_3 is possible but economic recovery and concentration of H_3PO_4 (Phosphoric acid) by this chemical beneficiation route will require experimental development methods.

The studies conducted by an American Company during the period 1980-1984 show that $CaO/F+Cl$ molar ratio averages about 5 to 1 indicating that the principal mineral species is a flour-chlorapatite having the composition of $Ca_5(PO_4)_3 (Fo.81 Cl 0.19)$. Unlike many phosphate ores, the Eppawala Rock has a very low MgO content not exceeding 0.08%. The low P_2O_5/CaO ratio of this rock will significantly reduce the consumption of sulphuric acid during the acidulation process and such consumption is much lower than when other commercial phosphate rock such as Florida Rock is used.

The characterisation of the Eppawala Phosphate Rock has indicated the following major impediments in wet process acid production.

1. High chloride content (over 0.8 - 1%) giving rise to serious corrosion problems in plant and machinery - industry standards less than 0.05%.
2. High $Al_2O_3 + Fe_2O_3$ (8 - 10%) giving rise to coagulants in filter acid thus retarding filtration rates - industry standards less than 4%.
3. The corrosiveness of the phosphoric acid produced from Eppawala

Rock is increased further by the presence of free HF as the F/SiO₂ ratio is over 2.5. This problem may be resolved by adding active silica to the ore before digestion.

4. The corrosion - erosion rates of the phosphoric acid produced by the Eppawala Rock increases further due to the presence of MnO₂ and also ilmenite.

Therefore, the characterisation of the Phosphate Rock at Eppawala has revealed that although it is very high in P₂O₅ content, the unusually high chloride, Al₂O₃ + Fe₂O₃, presence of ilmenite and MnO₂ and the liberation of free HF during acidulation will cause serious problems in utilising the ore for wet acid production by conventional methods.

In the light of the above technical problems involved in the processing of the Eppawala Rock, it is imperative that effective pilot-plant studies should be initiated with careful consideration given to the economics of production. Further, the establishment of such a pilot-plant facility could be explored with assistance from the UN system such as UNIDO or ESCAP or other bi-lateral/multi-lateral aid agencies and such a facility could service the south and south-east Asian regions which have established priorities for assessment of Phosphate Rock in manufacture of fertilizer.

If the Government of Sri Lanka decides to embark on a joint venture project with foreign entities for establishment of a phosphate fertilizer industry, careful consideration should be given to the technical competency of such entities specially in view of the unusually inherent chemical character of the Eppawala Rock.

References

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