

**Identification of Impurities and Optimization of Acid  
Leaching of Rare Earth Elements in Eppawala  
Apatite**

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by

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## **Abstract**

Apatite ore at Eppawala has vast areas of advantages other than production of phosphorus fertilizer. Major impurities contain in apatite are Ca (17.29%) and Fe (0.68%). Apart from those it includes rare earth elements (REE), in smaller quantities (0.1%–0.6%) such as Y, La, Pr, Nd, Ce, Pm, Tb, Dy, Ho, Er, Yb and Lu, which are rich with technological advantages, hence their extraction is very useful. There are two ways to extract REEs from the ore. One way is crushing the ore and physically separating the rare earth oxides from the ore. Other process is leaching. In the case of apatite REEs usually occur as ionic substitutions for Ca within the crystal lattice and not as discrete mineral form. Therefore, leaching is the suitable process. This is a study on effective extraction of REEs from apatite to investigate the influences of acid type, its concentration, temperature and time on the REE leaching level, was experimented under basic leaching tests with sulfuric, hydrochloric and nitric acids. Hydrochloric acid was the most effective leaching agent according to the results because it was able to remove a significant amount of REEs within fewer hours using low concentrations. In the case of sulfuric acid, most of the REEs in the solutions were lost due to precipitation as insoluble gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ). Apart from the above, two methods were investigated for the selective recovery of lanthanides from the leach solution; specifically, REEs were leached from the sample with nitric solution. One method was to precipitate lanthanides by ammonia and the precipitant was dissolved by nitric acid and was precipitated again by oxalic acid. Though lanthanides were recovered, Ca has been also co-precipitated, making this method unsuccessful. The other method was to shake nitrophosphate leach with amyl alcohol.

**Key words-** Rare Earth elements, Lanthanides, Apatite, Acid Leaching, Amyl Alcohol