# The Efficiency of Iron Oxide Removal from Laterite for Industrial Applications

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**Abstract**

Laterite is used as the main alumina source for cement manufacturing process of some countries, and it decreases the lifespan of limestone deposits due to the high Fe content. This study focuses on the removal of iron oxide from laterite with studying the effect of pH, sonication time, and temperature. The iron removal from laterite was examined along with Cd and Mn. The raw and treated laterite were subjected to Loss of mass on Ignition (LOI), moisture, pH, Atomic Absorption Spectroscopy (AAS), X-ray Diffraction (XRD) and Fourier-Transform Infrared (FTIR) to understand the physical, chemical and mineralogical nature of the samples. The LOI, moisture, and pH of untreated laterite were 16.56%, 15.80% and 5.69, respectively. XRD results of untreated laterite revealed goethite and hematite as main Fe-rich minerals associated with gibbsite, kaolinite, and quartz. The solid to liquid ratio (1:10) and the particle size (63 µm) were constant, throughout the experiment. The optimal pH range for Fe, Mn and Cd removal was examined with HCl (pH 1-5) and NaOH (pH 6-10) at 300 K for 1800 s. pH 5.69 was the neutral pH value for this research. The Fe and Mn removal efficiency were gradually increased when the pH from 5 to 1 and Fe had a sudden increment from pH 2 to pH 1. Cd removal efficiency was increased from pH 1-10. Therefore, the effective pH for Fe, Cd, and Mn were 1, 7 and 1, respectively. Effective temperature and sonication time were conducted for pH 1 and 2. Fe removal with temperature was examined with 313, 333, 353 and 373 K for 3600 s and 600, 900, 1800, 2700 and 3600 s at 300 K for sonication time. All elements removal efficiencies were increased with the temperature. Fe and Mn had high removal efficiency at 900 s with pH 1, and Cd was recovered within 600 s with pH 2 when sonication. The optimal condition of Fe ion removal for industrial applications is pH 1 with 333 K temperature or pH 1 with 900 s sonication time. Under high temperature and basic pH conditions Cd can be removed effectively. The optimal condition for Mn is pH 1 with 900 s sonication time. The goethite and hematite peaks can be identified in every XRD graphs of final treated laterite samples.

**Keywords:** Cement manufacturing, Leaching, pH, Temperature, Sonication

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