

# High Sulfate Mining Wastewater Treatment by Two-Stage Chemical Precipitation Process<sup>1</sup>

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**Abstract:** A treatment process was developed to treat high sulfate wastewaters for sulfate removal to less than 100 mg/l. The treatment system is comprised of a two-stage chemical precipitation process. The first stage uses a one-time addition of seed material and sludge recirculation to reduce sulfate to less than 1,800 mg/L. The second stage process precipitates sulfate as a highly insoluble calcium sulfoaluminate mineral known as Ettringite. The sludge from the second stage is treated to recover the aluminum from the Ettringite solids as aluminum hydroxide which is reused in the Ettringite precipitation process. Two methods of treatment can be employed for Ettringite destruction and aluminum hydroxide recovery; either by using hydrochloric acid and solid/liquid separation equipment or by using sulfuric acid and solid/solid separation equipment. A pilot study (4 m<sup>3</sup>/hr design flow) was conducted on gold mine wastewater in South Africa to evaluate the performance of both processes. The impacts of sludge recirculation ratio and chemical dosages were investigated. Dissolved sulfate and total aluminum were analyzed by Ion Chromatography (IC) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) methods respectively. Using X-ray diffraction (XRD) and X-ray fluorescence (XRF) methods, the characteristics of the Ettringite and recovered aluminum hydroxide solids were determined. Pilot study results and chemical consumption along with preliminary operating and capital cost will be presented and discussed for the proposed processes.

Additional Key Words: Ettringite, Aluminum Recovery, Gypsum Desaturation.

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