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Stabilization of Chromite Ore Processing Residues (COPR) using Ferrous Sulfate

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ABSTRACT

Batch experiments were conducted to stabilize chromite ore processing residues using ferrous sulfate. The COPR material was generated using the high lime/soda ash process which result in alkaline matrix with pH value of approximately 12.5. The treatment results were evaluated for particle size, pH, chemical dosage, and the mineralogical transformation of the COPR matrix. No noticeable effects were observed when mesh-4 or mesh-100 particle size was used within the experimental time frame of 80 days. Better treatment results were obtained when the pH of the treated material was adjusted to 9 as compared to no pH adjustment for the same chemical dosage. Higher chemical dosages resulted in better treatment results. Non stoichiometric amounts of ferrous were needed to reduce Cr(VI) in the COPR matrix due to the alkaline pH of COPR. Part of the reductant was oxidized due the favorable kinetic rates of the reaction of ferrous with oxygen at alkaline pH. In addition, unreacted ferrous may have transformed from the highly ferrous sulfate to the sparingly soluble ferrous hydroxide and ferrous carbonate upon curing and thus became less available to reduce Cr(VI). Mineralogical characterization of the treated material indicated that the ferrous sulfate treatment caused the formation of ettrringite, a heaving culprit, at pH greater than 9. Sulfate influx may prove detrimental to COPR treatment if pH was not controlled below the stability region of ettringite.