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Removal of sulfate by fluidized bed crystallization process

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Highlights

- Sulfate conversion and removal increased with increased seed dosage
- Sulfate conversion and removal increased as initial sulfate concentration increased
- No sludge formation for sulfate recovery using fluidized bed reactor

Abstract

This study investigated the behavior of sulfate removal and gypsum crystallization in an FBR with varying seed dosage, initial sulfate concentration and calcium to sulfate concentration ratio. The effect of recycling and use of silica carriers were also evaluated. A bench-scale glass fluidized-bed reactor (FBR) with gypsum seed crystals was used. Results showed that sulfate removal and gypsum crystallization increased with the tested parameters. Sulfate conversion increased from 70.29% to 77.69% and sulfate removal from 52.34% to 65.87% when seed dosage was increased from 4.0 g/L to 11.0 g/L. Similar trend was observed when the initial sulfate concentration was increased from 80 mM to 160 mM, sulfate conversion also increased from 75.05% to 85.40% and removal from 55.29% to 77.88%. When calcium to sulfate concentration ratio was increased from 1.0 to 2.0, sulfate conversion increased from 70.40% to 79.19% and removal increased from 49.45% to 65.08%. Product crystals and silica sand carriers were found to be as effective as fresh gypsum seed crystals, hence, the potential for economic recovery of sulfate.

Keywords: fluidized bed crystallization; gypsum; silica carriers; sulfate removal