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Synthesis and application of Friedel's salt in arsenic removal from caustic solution

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Abstract:

Conventional way to remove arsenic from caustic solution is neutralization-precipitation process, which costs a large amount of acidic reagents while huge wastes are generated. This study proposed a method for arsenic removal from caustic solution using Friedel's salt as an adsorbent. Friedel's salt was synthesized by coprecipitation in different feeding ways and characterized by XRD, FESEM, DSC-TGA and FT-IR techniques. The Friedel's salt synthesized in forward feeding way showed smallest crystallite size and exhibited the highest adsorption capacity of As(V). The As(V) adsorption properties of Friedel's salt was evaluated in detail under the effects of contact time, temperature, OH^- concentration and adsorbent dosage. Kinetic experiments were done and the data was well predicted by pseudo-second-order model, indicating the adsorption process is controlled by the chemisorption. Temperature shows positive effect on As(V) adsorption, which indicated an endothermic interaction between As(V) and Friedel's salt. The adsorption process could be well described by Langmuir isotherm model, with a maximum adsorption capacity of 172.41 $mg \cdot g^{-1}$ at 70 ^oC. Moreover, the adsorption mechanism was elucidated with the characterizations of the Friedel's salt after adsorption.

Key words: Friedel's salt; Synthesis; Arsenic removal; Caustic solution

1. Introduction

Alkaline processes, such as alkaline leaching, alkali-roasting and alkali-fusion, are usually applied to the treatment of arsenic-bearing materials (e.g., anode slime, enargite and metallurgical dust) and produce caustic solutions of high alkalinity [1-3]. Usually, arsenic removal should be considered in priority when these alkaline liquors were reused or recycled. Two typical ways were adopted to remove arsenic from caustic solutions. The first way is to precipitate arsenic into insoluble forms such as

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