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Removal of ammonia nitrogen from washing wastewater resulting from the process of rare-earth elements precipitation by the formation of struvite

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ABSTRACT

This paper presents a study of the removal of ammonia nitrogen (NH_3-N) from washing wastewater resulting from the process of rare-earth elements precipitation using struvite precipitation. Experiments were conducted in batches to examine the effect of an excess of magnesium and phosphate on the removal of NH_3-N, and to investigate the feasibility of the reuse of the produced struvite for NH_3-N removal. Experimental results showed that any separate excess of magnesium and phosphate did not provide significant increase in NH_3-N removal. However, a simultaneous excess of magnesium and phosphate can provide an obvious increase in NH_3-N removal, with the remaining NH_3-N as a minimum of 8.7 mg/L at the Mg:N:P molar ratio of 1.2:1:1.2. A stable NH_3-N concentration of effluents (around 15 mg/L) was maintained through recycling struvite for six cycles. (In each cycle, fresh magnesium and phosphate was supplemented for keeping a steady Mg:N:P molar ratio (1.2:1:1.2) and the decomposition residue of struvite was dissolved by acid.) X-ray diffraction (XRD) analysis showed that struvite was the main composition of the precipitates obtained in the sixth reuse cycle. Scanning electron microscopy with energy dispersive X-ray (SEM-EDX) analysis indicated that the struvite crystal was fragmented and its size was irregular, and its surface composition was mainly P, Mg, O. An economic estimation indicated that reusing struvite for six cycles could save 30.8% and 60.9% treatment cost under the conditions of consideration and non-consideration of the struvite value, respectively.

Keywords: Ammonia nitrogen; Rare-earth; Recycling struvite; Washing wastewater

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