

## Complex treatment of the ammonium nitrogen wastewater from rare-earth separation plant

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### ABSTRACT

In order to treat rare-earth wastewater to the requisite discharge standard, a complex treatment system consisting essentially of evaporation crystallization, ammonia stripping and breakpoint chlorination was studied. The results indicated that the complex treatment system offered a suitable treatment alternative for rare-earth wastewater. This system enabled high rates of removal of heavy metals, TOC and ammonium nitrogen. For high concentrations of ammonium nitrogen wastewater (ammonium chloride content of 130 g/L), evaporation crystallization was employed at a pressure between 22 kPa and 55 kPa and an approximate pH value of 4. The quality of crystalline ammonium chloride from the pretreated wastewater reached industry-level standards, and the condensate with  $\text{NH}_4^+\text{-N}$  content of around 12 mg/L could be returned to the reverse osmosis (RO) system in the plant to produce pure water for use in the production process. For middle level concentrations of ammonium nitrogen wastewater (1556 mg/L),  $\text{NH}_4^+\text{-N}$  removal reached a level of about 95% by employing the ammonia stripping method at a temperature in the range of 35–45°C, aeration flow of 27 L/min and a pH value of 12 for 2 h of aeration. The  $\text{NH}_4^+\text{-N}$  content in the effluent was restricted to around 80 mg/L. For low concentrations of ammonium nitrogen wastewater (68 mg/L), maximum  $\text{NH}_4^+\text{-N}$  removal was observed to be 97.4% by breakpoint chlorination at a pH of 7 and  $\text{Cl}/\text{NH}_4^+$  ratio of 8:1. TN was measured to be 3.4 mg/L and TOC was reduced from 140 mg/L to 14.7 mg/L. An economic appraisal was performed. It shows that an attractive economic benefit could be obtained.

**Keywords:** Rare-earth; Ammonium nitrogen; Evaporation crystallization; Ammonia stripping; Breakpoint chlorination

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