



Removal of fluoride from aluminum fluoride manufacturing wastewater by precipitation and adsorption processes

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ABSTRACT

In this study, the treatment of aluminum fluoride manufacturing Wastewaters (AFMW) by precipitation–neutralization using calcium hydroxide (lime) or calcium carbonate (limestone) and adsorption using activated clay has been investigated. Effects of experimental conditions such as lime or limestone dose, clay mass, initial fluoride concentration and initial pH on the fluoride removal efficiency and the final pH have been evaluated. Results of this study indicated that precipitation–neutralization processes can be successfully used to remove more than 90% of fluoride from AFMW. The treatment of AFMW containing different fluoride concentrations ranging from 167 to 5295 mg/L by precipitation with lime using $[\text{Ca}^{2+}]/[\text{F}^-]$ molar ratio of 0.8 led to fluoride removal higher than 95% with a final pH within the range 6.5 ± 0.1 to 8.5 ± 0.1 . Precipitation with CaCO_3 needed higher $[\text{Ca}^{2+}]/[\text{F}^-]$ molar ratio of 2 to reach 90% of fluoride removal and obtain a final pH in the range from 6.5 ± 0.1 to 8.5 ± 0.1 . The results of the treatment of AFMW by adsorption on activated bentonite clay indicated that using $[\text{clay}]/[\text{F}^-]$ mass ratio of 60 under different pH varying from $\text{pH } 2 \pm 0.1$ to $\text{pH } 12 \pm 0.1$ can lead to 80% fluoride removal. Synthetic calcium fluoride (SCFL) generated by precipitation–neutralization with lime SCFL contains 77.9% of CaF_2 ; however, only 48.3% of CaF_2 are contained in solids generated from precipitation–neutralization with limestone SCFLS.

Keywords: Fluoride; Precipitation–neutralization; Adsorption; Lime; Limestone; Synthetic calcium fluoride; Aluminum fluoride manufacturing; Activated clay

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