Boron removal from industrial wastewaters by means of optimized sequential chemical precipitation and coagulation processes

Baran Özyurt[a], Şule Camcıoğlu[a,*], Mert Fırtın[a], Çağlar Ateş[b], Hale Hapoglu[a]

[a]*Department of Chemical Engineering, Faculty of Engineering, Ankara University, 06100, Tandoğan/Ankara/Turkey,*
Tel. +90 312 203 34 65; emails: camcioglu@eng.ankara.edu.tr (Ş. Camcıoğlu), bozyurt@ankara.edu.tr (B. Özyurt),
mertfirtin@gmail.com (M. Fırtın), hapoglu@eng.ankara.edu.tr (H. Hapoglu)
[b]*Eti Maden Operations General Directorate, 06010, Etlik/Ankara/Turkey, email: caglarates@etimaden.gov.tr*

ABSTRACT

In this work, the removal results of the application of sequential chemical precipitation (CP) and coagulation (CC) over boron-containing industrial wastewater were presented. Effect of amount of $Ca(OH)_2/B_2O_3$ concentration ratio, initial pH and $Al_2(SO_4)_3 \cdot 18H_2O$ concentration on B_2O_3 removal was investigated using Box–Behnken based custom experimental design. Response surface methodology (RSM) was used to evaluate the effect of process variables and their interactions on boron removal. Results show that selected operational parameters and obtained regression model were statistically significant. The coefficient of determination was found as 0.9846, indicating that the model has a good fit with experimental data. Water has been obtained in a dischargeable quality according to Water Pollution Control Regulation of Turkish Authorities with 95% B_2O_3 removal from an initial concentration of 13.23 g/L under optimum operating conditions of 2.01 g $Ca(OH)_2/1$ g/L B_2O_3 ratio, pH 8.12 and 13.5 g/L $Al_2(SO_4)_3 \cdot 18H_2O$.

Keywords: Wastewater treatment; Boron removal; Precipitation; Coagulation; Optimization

* Corresponding author.