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Chelating surfactant for the removal of heavy metals from wastewater and surfactant recovery

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ABSTRACT

The treatment of soil leaching solutions contaminated by heavy metals is challenging because it is necessary to remove the heavy metal ions while attempting to reduce washing costs through strategies like using recycled detergent. In the present study, micellar-enhanced ultrafiltration (MEUF) was used to purify simulated wastewater containing the chelating surfactant, C_{14}-ED3A3Na, and three heavy metal ions: Cu(II), Pb(II), and Zn(II). Additionally, this research also investigated the effectiveness of using MEUF to recover the used surfactant. The results showed that increasing the membrane's molecular weight cutoff (MWCO) caused an increase in the permeate flux and a decrease in the solute removal rate. The results also showed that the surfactant concentration significantly influenced the solute removal rate. The metal ion removal rate was highest when the surfactant concentration was between 5 and 10 critical micelle concentration (CMC), with peak removal rates of 93%, 95%, and 85% for Cu(II), Pb(II), and Zn(II), respectively. A peak surfactant removal rate of 88% was achieved at a concentration of 50 CMC. The results also revealed that feed solution pH had a minimal effect on surfactant and metal ion removal. Similarly, the recovery test showed that the relationship between the surfactant recovery rate and the pH value and type of acidifier was insignificant. In contrast, the removal rate of the three metal ions increased as the pH value decreased. A pH value of 1 yielded removal rates of 68%, 76%, and 90% for Cu(II), Pb(II), and Zn(II), respectively. It is suggested that, with regards to forming a chelate with C_{14}-ED3A3Na, Cu(II) was the most effective, followed by Pb(II) and Zn(II), respectively. Ultimately, the results of this research show that C_{14}-ED3A3Na MEUF technology is an effective method for treating heavy metal ion wastewater, and that surfactant can be effectively recovered by using a concentrated acidification solution.

Keywords: Chelating surfactant; MEUF; Heavy metal; Wastewater; Surfactant recovery

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