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ADSORPTION OF Cr3+, Cu2+ AND Fe3+ ONTO AMBERLITE XAD 2 RESIN FUNCTIONALIZED WITH ACID BLUE 193

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Introduction

Heavy metals are produced by many industries such as mining, pharmaceutical, leather, tanning, painting, agricultural, etc. Pollution with heavy metals represents a serious issue to the aquatic environment, plants, animals and humans. Sometimes significant amounts of effluents polluted with heavy metals can be discharged due to inefficient technologies. In this regard, it is necessary to applied efficient technologies for removal of heavy metals. Adsorption can be applied for dangerous pollutants removal that are non-biodegradable. It is known that functionalized Amberlite class resins are used for the removal and recovery of metal ions. Chelating resin can be obtained by two methodologies first by impregnation (resin–chelating agent) and other directly through synthesis method. Thus, in this paper a new chelating resin Amberlite XAD 2 was functionalized with Acid Blue 193 (AB 193) in order to obtain a new material (XAD 2-AB 193) with adsorption characteristics for metal ions.

Materials and methods

Purfification of the Amberlite XAD 2 resin

Amberlite XAD 2 beads (5 g) were treated with 40 mL 4 M HCl. The obtained mixture was stirred at 25±2°C in 250 mL Erlenmayer flask for 60 min. At the end of stirring time, the resin was washed with ultra pure-water to remove all traces of HCl. The resin obtained was dried and kept for functionalization.

Procedures for obtaining chelating resin

Functionalization through the batch method was done as follows 0.5 g of Amberlite XAD 2 resin was stirred with 0.1 L of AB 193 (1 g/L). The obtained mixture was stirred for 90 min with the horizontal mechanic shaker (GFL 3017). At the end of stirring, the mixture was filtered and the functionalized resin was keep to dry for 48 h in laboratory. The quantity of AB 193 that was not retained in the resin mass was determined by UV-Vis from the filtered solution by measuring the absorbance at 578 nm.

Results and conclusions

Metal ions adsorption from wastewater samples onto chelating resin

The functionalized resin was tested using five wastewater samples (S1, S2, S3, S4 and S5) for removal of Cr^{3+}, Cu^{2+} and Fe^{3+}. The adsorption capacity (Qe) and percent removal (R) of resin functionalized regarding metal ions are presented in Figures 1 a, b and c. For this, 0.5 g of functionalized resin were stirred for 60 min with 0.1L wastewater. The concentration of metal ions from S1, S2, S3, S4 and S5 before and after contact with resin loaded by atomic adsorption spectrometry (AAS) was detected. The initial metal ions concentration for S1 was: 15 µg/L Cr^{3+}, 9 µg/L Cu^{2+}, 70 µg/L Fe^{3+}, for S2 7 µg/L Cr^{3+}, 12 µg/L Cu^{2+}, 112 µg/L Fe^{3+}, for S3 23 µg/L Cr^{3+}, 5 µg/L Cu^{2+}, 90 µg/L Fe^{3+}, for S4 16 µg/L Cr^{3+}, 14 µg/L Cu^{2+}, 172 µg/L Fe^{3+}, and for S5 9 µg/L Cr^{3+}, 30 µg/L Cu^{2+}, 145 µg/L Fe^{3+}, respectively.

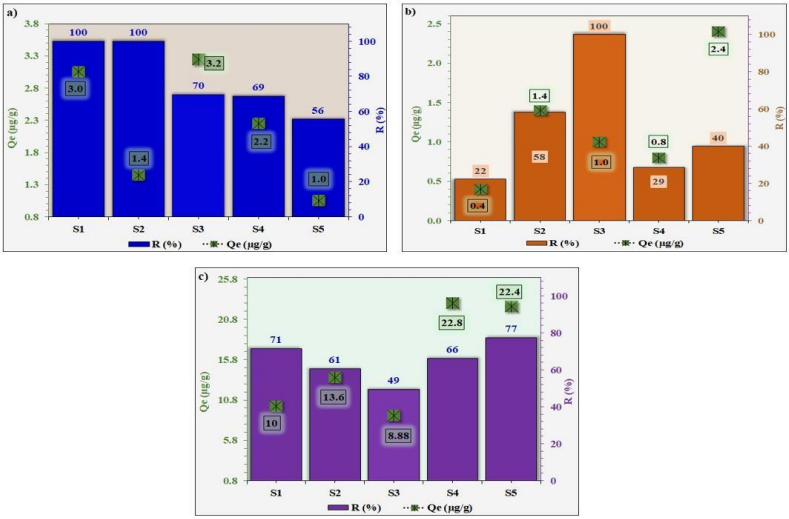

Fig. 1. Adsorption of a) Cr^{3+} b) Cu^{2+} and c) Fe^{3+} from wastewaters onto XAD 2-AB 193

As one can observe from Figures 1 a, b and c the best adsorption capacity of functionalized resin was obtained for Fe^{3+} followed by Cr^{3+} and Cu^{2+}. High values of percent removal suggests the efficiency of the resin tested for metal ion from S1, S2, S3, S4 and S5. Moreover, stability, flexibility and huge adsorption capacity of functionalized resin offers an efficient alternative for removal of metal ions from wastewater.

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