

Toxic Metal Ions Removal from Electroplating Wastewater Using Polymer Chelating Ligands

ABSTRACT

Background: Empty fruit bunch (EFB) is a type of biomass waste product formed during the production process of palm oil. In the present work, EFB was used to prepare a cellulose-graftcopolymer which can be converted into poly(amidoxime)-poly(hydroxamic acid) ligands suitable for the removal of heavy metals from electroplating wastewater.

Methods and Results: Poly(amidoxime)-poly(hydroxamic acid) ligands were synthesized from the poly(acrylonitrile-co-methyl acrylate) grafted palm cellulose and were analyzed via FT-IR and FESEM. The binding capacity (q_e) with the metals ions such as copper (Cu^{2+}), iron (Fe^{3+}), cobalt (Co^{2+}), nickel (Ni^{2+}) and lead (Pb^{2+}) were 341, 290, 284, 204 and 482 mg g⁻¹, respectively at pH 6. The pseudo-first-order kinetic model is fitted with the results confirming heavy metal adsorption. The isotherm study was conducted using a linear plot of the Langmuir isotherm where results were significantly different from the experimental value (maximum adsorption, q_e), indicating that adsorption does not occur on a single layer. However, the coefficient of the correlation values obtained using the Freundlich isotherm model were acceptable ($R^2 > 0.99$), and it was concluded that adsorption was multilayered with some metal ions.

Conclusion: The polymeric ligands synthesized here showed excellent adsorption of heavy metals from electroplating wastewater containing a notable amount of copper and iron metal ions.