Poly(amidoxime) ligand derived from waste palm fiber for the removal of heavy metals from electroplating wastewater

ABSTRACT

A waste material known as palm oil empty fruit bunch (EFB) is used as a source of cellulose for the development of polymeric materials for the removal of metal ions from industrial wastewater. A poly(acrylonitrile)-grafted palm cellulose copolymer was synthesized by a conventional free radical initiating process followed by synthesis of a poly(amidoxime) ligand by oximation reaction. The resulting products were characterized by FT-IR, FE-SEM, EDX, TGA, DSC, and XPS. The poly(amidoxime) ligand was used to coordinate with and extract a series of transition metal ions from water samples. The binding capacity (qe) of the ligand with the metal ions such as copper, iron, cobalt, nickel, and lead were 260, 210, 168, 172, and 272 mg g−1 , respectively at pH 6. The adsorption process followed the pseudo-first-order kinetic model (R2 > 0.99) and as well as the Freundlich isotherm model (R2 > 0.99) indicating the occurrence of a multi-layer adsorption process in the amidoxime ligand adsorbent. Results from reusability studies show that the ligand can be recycled for at least 10 cycles without any significant losses to its initial adsorption capacity. The synthesized polymeric ligand was shown to absorb heavy metals from electroplating wastewater with up to 95% efficiency.