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Removal of heavy metals (Cr, Cu, and Zn) from electroplating wastewater by electrocoagulation and adsorption processes

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ABSTRACT

Heavy metal intrusion into the water systems is a global environmental problem. Rivers, lakes, and ponds are usually contaminated by direct discharge from industries and these contaminants may leach into groundwater systems via the transport mechanisms. While some of the heavy metals are essential for the metabolic activities of living organisms but their presence in high concentrations in water may be very hazardous. The present study deals with the removal of trace metals including chromium (Cr), copper (Cu), and zinc (Zn) using electrocoagulation and adsorption techniques. The removal of Cr, Cu, and Zn was found to increase with the increase in electrocoagulation time, sodium chloride concentration and applied an electric current. The optimum conditions evaluated were pH around 4, applied electric current 2 A, and 60 min of electrolysis time. This experimental study showed that under the optimal conditions, 87.6% Cr, 100% Cu and 99.2% Zn were successfully removed. The adsorption percentages of these ions by TiO_2:AC increased sharply by increasing adsorbent dose. The results show that an optimum dose of 5 and 4 g/L of TiO_2:AC can remove about 97% Cr(VI), 97.45% Cu, and 96% Zn from the wastewater sample containing initially 50 mg/L concentration of each heavy metal. Electrocoagulation and TiO_2:AC exhibited a high degree of Cr, Cu, and Zn removal and therefore they can be utilized for the treatment of industrial effluents.

Keywords: Electrocoagulation; Adsorption; Electroplating wastewater; Trace metals

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