Treatment of Cr, Ni and Zn from galvanic rinsing wastewater by electrocoagulation process using iron electrodes

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ABSTRACT

Galvanizing plants contain reasonable amounts of heavy metal ions which pose a serious risk to humans, animals and the environment. In the present study, removal efficiencies of Cr, Ni and Zn from galvanic rinse wastewater (GRW) by electrocoagulation (EC) process using iron plate electrodes were investigated in a laboratory scale EC reactor. The effects of operational variables, such as operating time (0–50 min), current density (10–40 A/m²), initial pH (2.4–6.4) and electrode connection modes (MP-P: monopolar-parallel, MP-S: monopolar-serial and BP-S: bipolar-serial), on the removal efficiencies of heavy metals were explored to determine the optimum operating conditions. Removal efficiencies of 99.77% for Cr, 85.62% for Ni and 99.04% for Zn at the optimum operating conditions (pH 5.4, current density of 30 A/m², operating time of 30 min and MP-P electrode connection mode) were obtained. The results showed that Cr, Ni and Zn removal efficiencies from GRW increased with increasing current density and pH at MP-P electrode connection mode. The results showed that EC can effectively reduce metal ions to a very low level. Amount of sludge generated and operating cost at the optimum conditions during the EC process were calculated as 2.32 kg/m³ and 0.70 €/m³. This study revealed that the EC process was very effective for removal of Cr, Ni and Zn from GRW.

Keywords: Galvanic rinse wastewater; Electrocoagulation; Operating cost; Iron electrodes; Electrode connection modes

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