Treatment of Aqueous Selenocyanate Anions Using Electrocoagulation

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This study removed selenocyanate anions (SeCN^-) from synthetic wastewater using a lab-scale batch electrocoagulation (EC) process. SeCN^- removal increased with an increase in the applied current (0.4-1.2 A) and EC time (up to 8 hrs) but reduced with an increase in the initial concentration (10-50 mg/L) and pH (4-8). The SeCN^- species was initially oxidized to selenite (SeO_3^{2-}) and selenate (SeO_4^{2-}), which were then adsorbed onto iron hydroxide or aluminium hydroxide sludge produced from Fe or Al ions released at the anode. This was confirmed by the periodic analysis of water samples from the reactor and the characterization studies done on the sludge, including SEM and EDX. The glassy carbon and graphite electrodes only oxidized selenocyanate anions to selenite and selenate without forming precipitants for adsorption of these Se species. The zeta potential results for steel electrodes showed that surface charge of sludge changed from positive at low pH (pH 4) to negative at high pH (pH 8) thus negatively influencing the adsorption of selenium species. The SEM/EDX results explained the superior adsorption capacity of iron hydroxide compared to aluminium hydroxide. Molecular level simulation results indicated that the van der Waals cohesive energy density (CED) supports the higher removal efficiency of steel electrodes for selenium species in comparison to aluminium electrodes.

Keywords: Electrocoagulation, Selenocyanate anions, Selenite, Selenate, Molecular simulation

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