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Enhancement of Dissolved Oxygen Concentration during the Electrocoagulation Process Using an Innovative Flow Columns-Electrocoagulation Reactor

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Abstract : Dissolved oxygen concentration (DO) plays a key role in the electrocoagulation process (EC) as it oxidizes the heavy metals, ammonia, and cyanide into other forms that can be removed easily from water. For instance, the DO oxidises Fe (II) to Fe (III), As (III) to As (V), and cyanide to cyanate and then to ammonia. As well as, removal of nitrogenous compounds accomplishes by the presence of DO. Hence, many of the previous investigations used external aerators to provide the required DO inside EC reactors especially when the water being treated has low DO (such as leachate and highly polluted waters with organic matter); or when the DO depleted during the EC treatment. Although the external aeration process effectively enhances the DO concentration, it has a significant impact on energy consumption. Where, the presence of air bubbles increases the electrical resistance of the EC cell that increase the energy consumption in consequence. Thus, the present project aims to fill this gap by an innovative use of perforated flow columns in the designing of a new EC reactor (ECR1). The new reactor (ECR1) consisted of a Perspex made cylinder container having a controllable working volume of 0.5 to 1 L. It supplied with a flow column that consisted of perorated discoid electrodes that made from aluminium. In order to investigate the performance of ECR1; water samples with a controlled DO concentration were pumped at different flow rates (110, 220, and 440 ml/min) to the ECR1 for 10 min. The obtained results demonstrated that the ECR1 increased the DO concentration from 5.0 to 9.54, 10.53, and 11.0 mg/L which equivalent to 90.8%, 110.6%, and 120% at flow rates of 110, 220, and 440 mL/min respectively.

Keywords : dissolved oxygen, flow column, electrocoagulation, aluminium electrodes
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