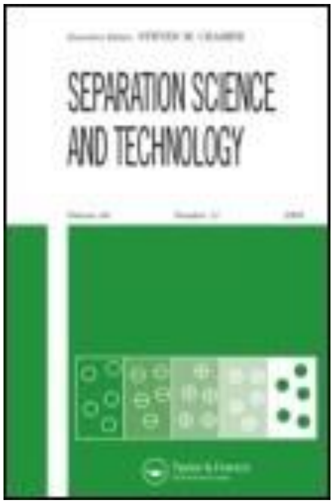

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Degradation of Disperse Red 167 Azo Dye by Bipolar Electrocoagulation

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This study investigates the influence of variables on the removal efficiency of solution containing azo dye Disperse Red 167 by bipolar electrocoagulation (BEC). Current density, time of electrolysis, interelectrode distance, supporting electrolyte concentration, and total surface area were the variables that mostly influenced the azo dye removal. The efficiency of different electrode materials (Fe, Al) for azo dye removal is compared. The obtained results showed the effectiveness of the aluminum and iron electrodes for azo dye removal. The present study allows achieving a high level of decolorization (100%) with a short reaction time for both electrodes. The method was found to be highly efficient and relatively fast compared to conventional existing techniques.

Keywords bipolar electrocoagulation; chemical processes; coagulation; separation; textile dyes

INTRODUCTION

Nowadays, synthetic dyes represent a large group of organic chemicals that present an increasing environmental hazard. Among the factories that involve the production of large quantities of wastewaters are found textile manufacturing processes. They are also used in food, paper, cosmetic, and plastic industries. These effluents are highly variable in composition with relatively low BOD and high COD contents.

Given the complex and bioresistant character of textile wastewaters, their effective treatment usually requires a combination of various physical, chemical, and biological technologies.

Various wastewater treatment methods, such as physico-chemical (1,2) and biological methods (3) usually in a combination (4,5) are applied to treat dye wastewater to meet the discharge limits.

These methods require the addition of chemicals and also generate large amounts of sludge.

In the recent years, investigations have been focused on the treatment of wastewaters using electrocoagulation (EC) because of the increase in environmental restrictions on effluent wastewater. Electrochemical treatment is an emerging technology, and its application to dye decontamination has received increasing attention recently due to such advantages as high efficiency, short reaction time, low sludge production, ease of operation, and environmental compatibility (6,7). A simple and efficient method for the treatment of most drinking waters and wastewaters was found and was competitive when biological treatments fail, while it avoids the formation of secondary pollutants.

EC is a complicated process involving many chemical and physical phenomena that use consumable electrodes (Fe/Al) to supply ions into the water stream (8).

Fe/Al is dissolved from the anode generating corresponding metal ions, which immediately hydrolyze to polymeric iron or aluminum hydroxide. These polymeric hydroxides are excellent coagulating agents.

A simple electrocoagulation reactor is made up of one anode and one cathode. When a potential is applied from an external power source, the anode material undergoes oxidation, while the cathode will be subjected to reduction or reductive deposition of elemental metals (9). The electrochemical reactions with metal M as anode may be summarized as follows:

At the anode:

$$M_{(s)} \rightarrow M^{n+}_{(aq)} + ne^-$$

$$2H_2O_{(l)} \rightarrow 4H^+_{(aq)} + O_2 + 4e^-$$

At the cathode:

$$M^{n+}_{(aq)} + ne^- \rightarrow M_{(s)}$$

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