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## OPTIMIZATION OF THE COMBINED UV/ELECTROCOAGULATION PROCESS FOR DYE REMOVAL FROM TEXTILE WASTEWATER USING RESPONSE SURFACE METHODOLOGY

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## Abstract

In this study, response surface methodology (RSM) method was applied based on a five-level and four-variable central composite design. The optimization of the C.I. Direct Red 81 (DR81) removal by the combination of electrocoagulation (EC) and UV processes was also performed. The effect of initial pH, reaction time, current density and initial dye concentration on the dye removal was investigated to obtain the optimal experimental conditions. The optimal conditions with the dye removal of 95% were found to be at initial pH of 3.78, reaction time of 6.44 min, current density of 62 A/m<sup>2</sup> and initial dye concentration of 111.5 mg/L. The experimental value for dye removal (94.36%) was in a satisfactory agreement with the predicted value. The kinetic of dye removal was investigated at various initial pH and high correlation coefficients (R<sup>2</sup> > 0.95) indicated that the DR81 removal has followed second order kinetic model. The results showed that UV irradiation has enhanced the EC performance and COD removal efficiency. The results also indicate that the proposed combined method has a high efficiency and RSM experimental design is a proper method for modeling the removal processing of DR81.

Key words: C.I. Direct Red 81, electrocoagulation, optimization, response surface methodology (RSM), UV

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## 1. Introduction

Textile industry introduces large amounts of effluents containing a wide range of contaminants specifically dyes to the environment, which makes it one of the main sources of severe pollution problems worldwide. Therefore, the removal of dyes from wastewaters in an economic way remains a major problem for textile industries (Aksu, 2005; Errais et al., 2011; Salleh et al., 2011). Dyes are gradually emerging as a class of anthropogenic organic substances that pose serious threat to the environment (Tanyildizi, 2011). The colored and toxic wastewaters released into the ecosystem undergo chemical as well as biological changes, and consume dissolved oxygen from the streams, where they cause not only esthetic problems, but can also be dangerous due to the toxicity of dyes and their by-products (Cruz-González et al., 2012; Mittal et al., 2012).

The generated wastewaters can be treated using different techniques like adsorption, precipitation, chemical coagulation, advanced oxidation processes and biodegradation (Kurade et al., 2012; Safa and Bhatti, 2011; Salazar et al., 2012; Shakir et al., 2010; Turhan et al., 2012). Although these methods have been widely applied, they have some disadvantages like the regeneration process, high waste disposal cost, extra pollution, in addition to the time consumed, respectively (Du et al., 2012; Safa and Bhatti, 2011; Salazar et al., 2012; Turhan et al., 2012). Furthermore, these methods are usually expensive and their treatment efficiency is inadequate because of the large variability of the composition of textile wastewaters (Kurade et al., 2012).

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