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OPTIMIZATION OF THE ELECTRO-FENTON PROCESS FOR COD REDUCTION OF REFINERY WASTEWATER

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Abstract

This study shows the results of the experimental investigation of refinery wastewater treatment by the electro-Fenton process. The experiments were designed using Taguchi design of experiments with an orthogonal array (OA) of L_{16} runs. Four process variables (current density (CD), temperature (T), Fe^{2+} concentration (Fe^{2+}), and time (t)) at four different levels were considered for the present design. Regression analysis was performed to predict a correlation for the response function (chemical oxygen demand (COD) reduction efficiency) of the treatment process by the electro-Fenton technique. Analysis of variance (ANOVA) was carried out to verify the significant variables that control COD reduction. Moreover, a linear model analysis was implemented for the signal to noise (S/N) ratios with "larger the better" and for means. Based on S/N ratios and means responses, the operating conditions for optimum COD reduction were; CD = 8 mA/cm^2, T = 60 °C, Fe^{2+} = 0.4 mM, and t = 6 h, at which 87.35% of COD was reduced. ANOVA shows that the operating temperature has the most significant impact on COD reduction efficiency. The R-square value for the predicted COD reduction correlation was 90.00%. Considering ranks based on delta statistics, the relative magnitude of effects of the process variables were: T, Fe^{2+}, t, and CD.

Key words: COD reduction, electro-Fenton, refinery wastewater, Taguchi method

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