Treatment of Biotreated Coking Wastewater by a Heterogeneous Electro-Fenton Process Using a Novel Fe/Activated Carbon/Ni Composite Cathode

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A novel composite electrode was successfully developed that consisted of an activated carbon-supported iron salt and foamed nickel as the electrode material. Heterogeneous electro-Fenton (HEF) technology was applied to treat the biotreated coking wastewater (BTCW) with the electrode performing as the cathode. A response surface methodology combined with a single factor discussion was used to investigate individual parameters and the interaction of the three main parameters, namely, the applied voltage, plate spacing and initial pH; the removal rate of the COD from the BTCW was selected as the response index. The results demonstrated that the plate spacing was the most influential parameter under the selected conditions. The optimized conditions, which were based on a Box-Behnken design (BBD), were as follows: applied voltage: 10 V, plate spacing: 1 cm, and initial pH: 3.42. Under these conditions, the COD removal efficiency could reach almost 100% after reacting for 3 h. A spectroscopic analysis showed that the process could effectively remove aromatic protein analogs, microbial byproduct analogs, lactones and amide compounds in the coking wastewater. In addition, repetitive experiments indicated that the prepared electrode demonstrated good reusability. Therefore, the application of the novel composite electrode in the HEF process shows promising prospects for degrading organic contaminants in wastewater.

Keywords: Activated carbon; BBD; Biotreated coking wastewater; Heterogeneous electro-Fenton; Response surface methodology

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