Electro-coagulation and Electro-oxidation Sequential Process Using Low-Cost Electrodes as an Alternative for the Treatment of Polluted Industrial Wastewater

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Abstract:

Industrial textile wastewater (ITWW) contains organic and recalcitrant compounds that need elimination and/or mineralization prior to environmental release. In this work, a highly polluted ITWW sample (characterized by a COD of 3.2 g/L, TOC of 1.2 g/L, TSS of 0.07 g/L, phenols concentration of 0.8 mg/L, total Cr concentration of 20 mg/L, BOD5 of 0.61 g O2/L, and acid black dye concentration of 0.9 g/L) underwent treatment via a sequential Electro-coagulation and Electro-oxidation (EC-EO) process, employing aluminum and graphite electrodes. Optimization of process operational parameters, achieved through the application of robust statistical methodologies, resulted in near-complete decolorization, along with an 87% reduction in COD and 74% reduction in TOC. The EC-EO effluent exhibited biocompatibility, as indicated by a BOD5/COD ratio of 0.4. A kinetic investigation was performed to establish the time required to satisfy the COD discharge standards stipulated by Colombian regulations. Finally, a thorough operational cost evaluation revealed that the sequentially EC-EO process represents an effective alternative for the treatment of industrial textile effluents.

Keywords:

Electro-Coagulation, Electro-oxidation, sequential processes, acid black 194 dye, Industrial textile wastewater.