Optimization and kinetics of treating cassava bioethanol wastewater with low-grade pyrolusite in sulfuric acid solution

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ABSTRACT
Cassava bioethanol wastewater treatment using low-grade pyrolusite as oxidant in sulfuric acid solution was investigated. In order to obtain the optimal level and optimal combination of factors for high COD (chemical oxygen demand) removal rate of cassava bioethanol wastewater, orthogonal experiment was employed. The results indicated that the COD removal rate which depended more on the H2SO4 concentration, could reach 94.56% under the conditions of H2SO4 concentration of 2.5 mol/L, temperature of 90˚C, reaction time of 90 min, and liquid-to-solid ratio of 2 mL/g. A shrinking core model was applied to describe the treating process, and the results revealed that the leaching rate increased with the increase in temperature, concentration of cassava bioethanol wastewater and sulfuric acid. Apparent activation energy for this model was calculated to be 33.05 kJ/mol, the reaction order of H2SO4 concentration was 1.12 and cassava bioethanol wastewater concentration was 0.73. And the kinetics analysis showed that the reaction was controlled by the diffusion through the product layer composed of the associated minerals.

Keywords: Cassava bioethanol wastewater; Pyrolusite; Orthogonal experiment; COD (chemical oxygen demand); Kinetics

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