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Solar photo-assisted electrochemical peroxidation process for the sustainable treatment of tannery industry wastewater

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ABSTRACT

Tannery wastewater is a complex mixture of organic and inorganic components from various processes with high concentrations of Cr, BOD, COD, TDS, strong colour and pH. The goal of the present work was to determine the optimal solar photo-assisted electrochemical peroxidation process (SPECP) experimental conditions for the treatment of tannery wastewater. Experiments were conducted in a bench-scale stirred tank SPECP reactor of 5 L with iron plates as anode and cathode in a contact effective area of 218 cm^2. In the stirred tank reactor at optimal conditions, the SPECP yielded 97% COD, 98% of colour and 92% of chromium (III) removal after 60 min at 15 mA/cm^2. SPECP improved the biodegradability (BOD_5/COD) of tannery wastewater from 0.4 to 0.6 in 15 min. These results showed that wastewater from tannery industries could be treated up to the level of the minimal national standards of India for waste disposal; COD=90 mg/L, BOD=30 mg/L and chromium (III)=1.2 mg/L at a treatment time of 60 min. The operating cost of the best economic condition with maximum degradation was \$8.2/m^3.

Key words: bench scale reactor, electrochemical process, energy consumption, solar energy, tannery wastewater

HIGHLIGHTS

- SPECP using iron electrodes was very effective for the treatment of tannery wastewater.
- Effect of process parameters was investigated with CCD design.
- The closeness of experimental & CCD predicated shows great model roundness.
- 97% of COD, 96% of BOD, 98% of colour and 92% of Cr (III) removal efficiency was obtained.
- Less energy consumption and higher degradation efficiency provided SPECP as a cost-effective approach.

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