

A Kinetic Study of Oxalic Acid Electrochemical Oxidation on a Manganese Dioxide Rotating Cylinder Anode

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Abstract

This paper deals with the theory and kinetics of oxalic acid electrochemical oxidation, in an acidic solution containing sodium chloride, using a manganese dioxide rotating cylinder anode. Voltammetric and galvanostatic electrolysis techniques were used. The voltammetric study shows a higher anodic wave corresponding to chlorine oxidation on the MnO₂ electrode, prevailing oxalic acid indirect oxidation. Galvanostatic electrolysis studies confirmed that the rate constant is affected by chloride concentration, current density, agitation and temperature. Electrochemical oxidation rate was found to be a pseudo-first order kinetic process. A strongly linear relationship between the rate constant and chloride concentration was observed, while polynomial relations, with respect to current density and temperature, were found. The activation energy was found to be 14.541 kJ/mol, which suggests a diffusion control kinetic step in oxalic acid degradation. The findings of the present research validate that oxalic acid incineration can be successfully carried out on a MnO₂ anode, in NaCl presence.

Keywords: electrochemical incineration; oxalic acid; manganese dioxide; sodium chloride; pseudo-kinetics and activation energy.

Introduction

Oxalic acid (OA) is one of the most toxic organic compounds. OA has several manufacturing and industrial uses, including: printing and dyeing fabrics; straw hats bleaching; paint removing; varnish; rust or ink stains; and wood cleaning. After these industrial processes, this compound is discharged in the water effluents. OA also is the main and final intermediate for the catalytic and electrochemical oxidation of several other organic compounds [1]. Therefore,

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