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Application of Electrochemical Degradation of Wastewater Composed of Mixtures of Phenol - Formaldehyde

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Abstract

Environmental problems caused by industrial processes are of great concern to society due to the possible introduction of toxic waste from products generated by the industry. Thus, researchers increasingly study new techniques to reduce or eliminate the toxicity of industrial effluents, always respecting the laws and regulations aimed at environmental protection. Electrochemical degradation is a promising alternative for the treatment of wastewater that contains organic compounds.

In this work a dimensionally stable anode (DSA®) of nominal composition $Ti/Ru_{0,3}Ti_{0,7}O_2$ was used to study the degradation of solutions containing a mixture of phenol and formaldehyde.

The oxides electrodes were characterized by Scanning Electron Microscopy and Energy Dispersive X-ray analysis (EDX). The galvanostatic degradation of mixtures of phenol – formaldehyde were monitored by High Performance Liquid Chromatography (HPLC) and Total Organic Carbon Analysis (TOC). The effect of current density (10, 20, 40 and 50 mA cm^{-2}), pH (3, 5, 7, 9 and 12) and supporting electrolytes (NaCl, $NaNO_3$ and Na_2SO_4) was investigated. Energy consumption during electrolysis is also presented. The electro degradation of mixtures of phenol – formaldehyde proceeds via two different mechanism: active and non-active. The non active mechanism results in the complete combustion of organics to carbon dioxide. The active mechanism results in a selective oxidation, via degradation products.

The results demonstrate that the electrochemical removal of organics is pH- dependent. In the most an effective current density (40 mA cm^{-2}) 60% of TOC is removed.

Keywords: dimensionally stable anodes, phenol, formaldehyde.