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Comparative study of hydrogen peroxide electro-generation on gas-diffusion electrodes in undivided and membrane cells

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Abstract

The generation of hydrogen peroxide by means of the cathodic reduction of oxygen at gas-diffusion electrodes with a near 100% current efficiency was achieved in concentrations sufficient for the mineralization of refractory organics in Fenton treatment. A decrease in current efficiency over time at high temperatures and high current densities was observed. The polarization study carried out in potentiostatic, potentiodynamic and galvanostatic modes in 0.5 M Na_2SO_4 solution at pH 3 showed that the destruction of hydrogen peroxide at the cathode of the electrochemical reactor, as well as its chemical decomposition in the bulk solution, takes place at a significantly lower rate than the oxidation of H_2O_2 at the Ti–IrO_2 anode. Preparative electrolysis in the membrane

reactor showed much higher current efficiencies for H_2O_2 electro-generation in comparison with tests carried out in an undivided cell. The performance of different proton-exchange membrane in this process was studied and a membrane cell with a heterogeneous MK-40 type PEM was found to be suitable. An optimized cell design, the appropriate selection of electrodes, supporting electrolytes, and a membrane resulted in a lower voltage in the membrane cell in comparison with the undivided cell.

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