Generation of H_2O_2 in Electrochemical Reactor using Gas Diffusion Electrodes (GDE)

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Due of the reactivity of hydrogen peroxide, the main challenge is the development of processes of formation of this oxidant and one of the most innovative technologies is the use of gas diffusion electrodes (GDE) associated with electrochemical techniques, in which hydrogen peroxide is electrochemically generated *in situ* from the reduction of O_2. The aim of this work was study the electrogeneration of H_2O_2 in an electrochemical reactor using gas diffusion electrodes by applying constant potentials.

For the study of the electrogeneration of H_2O_2 was used an electrochemical filter press type reactor, with cathode of GDE and anode of DSA®. As electrolyte was used 3L of K_2SO_4 0.05 mol L^{-1} L (pH 2) at flow rate of 160 L h^{-1}. In the experiments by constant potential was used potentiostat PGSTAT-30 (Autolab / Metrohm) with high module current in experiments of 90 minutes at a pressure of 0.2 bar of O_2 in GDE.

The results demonstrate the formation of H_2O_2 in the electrochemical reactor using a gas diffusion electrode (GDE), where it can be seen that the variation of hydrogen peroxide increases linearly with time of the experiment (Figure 1A), indicating that the formation of H_2O_2 follows a kinetics of pseudo zero order overall at a flow rate of 160 L h^{-1}. This flow rate was chosen due to the hydrodynamic regime to be laminar with a Reynolds number of 1350.

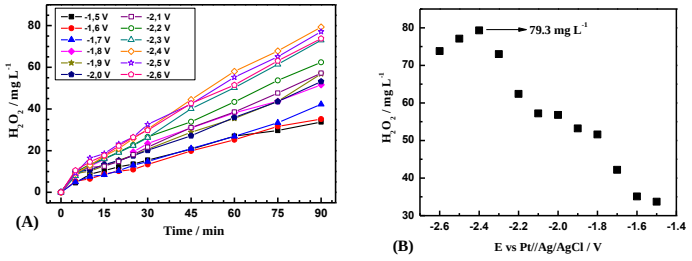

Figure 1: Variation of the (A) concentration of H_2O_2 in function of time of experiment and (B) variation the final concentration of H_2O_2 in function of the applied potential

In Figure 1B can be seen that the final concentrations of H_2O_2 increase with the applied potential, reaching 79.3 mg L^{-1} at the end of 90 minutes in the potential of -2.4 V vs Pt//Ag/AgCl, with formation rate of 0.86 mg L^{-1} min^{-1} and consumption of 42.3 kWh per kg of H_2O_2 formed at the same potential.

ACKNOWLEDGMENTS
FAPESP, CNPq and CAPES for financial support.