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SIMULTANEOUS ELECTROCHEMICAL PRODUCTION OF OXIDANTS USING A TWO-COMPARTMENT REACTOR EQUIPPED WITH A PL6C-BASED GDE CATHODE AND A BDD ANODE

Resumo: Conventional chemical wastewater treatment processes focus on the use of hypochlorite, but this has a disadvantage related to the formation of toxic byproducts, such as organochlorines [1,2]. An alternative that can further increase sustainability is the use of electrochemical technology for the *in situ* simultaneous formation of oxidants such as peroxodicarbonate (C2O6 2-) through anodic reactions and hydrogen peroxide (H2O2) through cathodic reduction of oxygen, which are common precursors of the hydroxyl radical (•OH) [3]. Thus, the present work aimed at the simultaneous production of oxidants using a two-compartment electrochemical reactor. In the cathodic compartment a gaseous diffusion electrode (GDE), made of Printex L6 carbon on a carbon cloth is used as cathode and NaClO4 as the main component of the supporting electrolyte (pH~2). A boron doped diamond (BDD) anode was used in the anode compartment and Na2CO3 to compose the electrolyte (pH~7). To find the optimal production conditions, the electrolyte concentration (0.05 to 0.5 mol L-1) and the applied current density (3.125 to 25 mA cm-2) were varied on both sides. It was noted from the results that by increasing the applied current, the oxidant production increased, reaching a maximum at 25 mA cm-2 of 341 and 280 mg L-1 for the production of H2O2 and C2O6 2-, respectively. However, when varying the electrolyte concentration, H2O2 production were close (error~10% between analyses) at all current densities, while C2O6 2- production increased. Analyzing the energy consumption (EC) and current efficiency (CE) for each case, it was noted that for H2O2 electrogeneration CE values were high (~100% at 6.25 mA cm-2) with a low EC (5.5 to 6.25 mA cm-2). High CE values for H2O2 production can be explained by the minimization of parallel reactions because the use of a cationic membrane which only allows the crossing of protons (H+) to cathodic side. As for $C_2O_6^{2-}$ production, the lower current density led to higher CE (37.4%) and lower EC (3.9 kWh kg-1) while at 25 mA cm-2 the CE decreased to 6.80% with an EC ~79 kWh kg-1. Therefore, the work allowed for more sustainable production of two oxidants simultaneously from a single applied current, using two-compartment reactor and achieving optimal results for energy consumption and current efficiency.

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