ABSTRACT

To date, very few prescriptive studies have been reported in the literature concerning the catalytic removal of pharmaceutical substances in wastewater using H2 in the presence of O2 for the in situ formation of H2O2, while the mechanism of the reaction has not been studied in detail yet. Hydrogen peroxide is a potent oxidizing agent used extensively in catalytic wet air oxidation (CWAO) applications and can be used for the elimination of pharmaceuticals from waste water. In the present work, an attempt has been made to elucidate the actual effects of the in situ production of hydrogen peroxide on the CWAO of pharmaceuticals. Therefore, the effects of the nature of the active phase (Pd, Pt, and Rh), as well as the feed gas composition have been examined toward the reaction at hand. The results showed that 1% Pd/Al2O3 and 1% Rh/Al2O3 are the most effective catalysts for the elimination of paracetamol from the reaction medium using hydrogen-rich streams, having a conversion of up to 70% in 2 h. A maximum conversion of paracetamol of 90% was obtained in just 30 min of reaction over 1 wt.% Rh/Al2O3, when using pure hydrogen in the feed. Total organic carbon measurements performed over the latter catalyst showed that practically no organic carbon is removed from the liquid phase, indicating the conversion of paracetamol to a different organic (probably aromatic) compound, through hydrogenation. Toxicity tests that followed showed a dramatic decrease in the toxicity of the products solution, indicating that paracetamol hydrogenation might be a promising method for the elimination of its toxicity.

Keywords: Reduction; Pharmaceuticals; Catalytic removal; Hydrogen peroxide; Xenobiotics