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Degradation of alizarin red promoted by electrogenerated HO radicals: A kinetic study

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Alizarin Red (AR, 1,2-dihydroxyanthraquinone) is a dye used in textile industry since early antiquity. Nowadays it is used in several biochemical assays in studies involving bone growth, osteoporosis, bone marrow, calcium deposits, cellular signaling, gene expression, tissue engineering, and mesenchymal stem cells.

Reactions of electrochemically generated hydroxyl radicals, by the oxidation of water, depend on the reactivity of these radicals according to their adsorption degree at the anode surface. At Pt HO radicals keep strongly adsorbed and display lower reactivity than those formed in anodes like BDD. This effect has been already demonstrated by means of a kinetic study of benzoic acid and p-hydroxybenzoic acid oxidation.

The study of the AR oxidation by HO radicals can bring important insight on the reactivity of chemical functions such as aromatic rings, hydroxyl and carbonyl groups, that are common in antioxidant molecules. Therefore, using a single molecule it is possible to investigate the relative reactivity of these functional groups towards HO radical in identical conditions of surface coverage, what cannot be warranted when the different molecules are considered.

The AR UV-Vis absorption spectrum displays three distinct peaks corresponding to the anthracene ring, the carbonyl groups and quinonyl. Therefore by means of the absorbance variation of the three UV-vis bands it was possible to evaluate the reactivity of the different functional groups.

Keywords: Alizarin red, hydroxyl radicals, platinum, dye removal