Abstract

The photochemistry of organic acids in their free form or bound by transition metals has received considerable attention from environmentalists, due to the production of hydroxyl radicals able to degrade organic pollutants.

In this research work, we were interested, in a first part, the study of the photolysis of aliphatic and aromatic organic carboxylic acids (Malic (MA), Oxalic (OX), Iminodiacetic (IDA), Salicylic (SA), Benzoic (BE)) under artificial and natural irradiation. The results show that these acids are able to produce hydroxyl radicals under the effect of radiation, whether natural or simulated. However, the nature of the acid considerably influences the course of the photochemical process. Moreover, the quantification of these radicals shows that the quantity formed during the photochemical process depends on the organic acid used. The degradation of carbamazepine (CBZ) induced by an organic acid/UV system in aqueous solution has been tested and confirms that the photocatalytic efficiency is optimal with oxalic acid.

In a second step, photolysis of Fe(III)-organic complexes (Fe^{III}-salicylate) under artificial and natural irradiation also shows the formation of hydroxyl radicals by ligand-metal charge separation at the organic complex. Fe(III) is then reduced to Fe(II). The photoinduced degradation of CBZ by the Fe^{III}-SA complex was demonstrated under irradiation at 365 nm in the Fe^{III}-SA/CBZ/UVA mixture. The photochemical process depended on the pH value, the initial concentration of CBZ, the molar ratio of the complex, the nature of the reactor. The mineralization followed by TOC (total organic carbon) requires more time than the disappearance of CBZ. Carbamazepine photoproducts have been identified by HPLC-MS and the degradation mechanism has been proposed.

To activate the photocatalytic process, the addition of hydrogen peroxide or PMS in the CBZ/ Fe^{III}–SA/UVA mixture significantly improves the rate of substrate disappearance. To approximate the environmental conditions, the CBZ/Fe^{III}–SA mixture was exposed to sunlight and the degradation of CBZ was demonstrated with a more pronounced rate. The effect of cationic traces on the course of the photocatalytic process has given very interesting results in understanding the interactions in the aquatic environment.

Key words: Carbamazepine, Fe^{III}–SA, hydroxyl $HO^{\bullet}$, carboxylic acids, Photolysis.