Photocatalysis with semiconductors: a comparative discussion of the photodegradation mechanisms of rhodamine and atrazine

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There is great concern about the current environmental situation of our planet. The rapid development of society has been creating serious environmental problems, particularly in the contamination of water by organic compounds. Semiconductors (TiO_2, SnO_2, among others) can be used as photocatalysts to degradate organic compounds. When a photon focuses on the surface of a semiconductor with energy hυ equal to or greater than their bandgap energy, an electron (e-) is promoted to the conduction band, leaving a hole (h +) in valence band, with high oxidative performance. Despite other mechanisms are possible, most of the photodegradation reactions of organics in semiconductor surfaces uses the oxidant behavior of holes, either by transfer of an electron adsorbed to the surface of the substrate of photocatalyst to the hole or the formation of free radicals ($OH^{\cdot}$), due to oxidation of hidroxyl groups, to promote degradation by radical attack on the molecules of substrates in solution[1]. Thus, this work presents a discussion of the mechanisms involved in the degradation of atrazine (pesticide) and rhodamine (dye), under visible radiation and UV-A radiation, using TiO_2 nanoparticles obtained from polymeric precursors method as photocatalyst.

Different photodegradation mechanisms were observed in the pesticide atrazine and the dye rhodamine. However, radical attack and the assumption of the existence of a mechanism for pre-adsorption were observed for both substrates. For atrazine molecules the photodegradation only occurred when the radiation used was enough to excite the catalyst (UV-A). However, for the molecules of rhodamine, photodegradation was observed even when using visible radiation (radiation insufficient to excite the semiconductor) and a surfactant[2] to help adsorption on semiconductor surface. In this case, only the molecules of rhodamine can be excited and the proposed mechanism is the injection of electrons in conduction band of the semiconductor, operating only as an electronic transfer mediator, thus contributing to the process of photodegradation.

Keywords: photodegradation, semiconductor, photocatalyst, rhodamine, atrazine.

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