Study of the photoactivated electronic transference from Rhodamine B to TiO_2 – SnO_2 encapsulated nanoparticles.

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In the last 15 years the search for systems that get to convert solar energy in electric energy with larger efficiency and smaller cost than the conventional methods are growing, as a future option for the electric power provisioning in the world. In the decades of 70 and 80, Kiwi and Grätzel began studies in photodegradation of organic dyes and semiconductor – catalyzed water cleavage; the advances in the studies indicated the investigation of new applications to the mechanisms, especially in using the electrical potential generated in the degradation process [1].

According the oxidation potential of Rhodamine B (RB) and the bandgap of TiO_2 (3,2 eV), the RB molecules excited by the visible light can inject electrons directly in the TiO_2 conduction band, those can be captured and sent to a electrical circuit to generate work. In the mechanism of electron transference by the organic dye to the semiconductor the main challenge is avoid recombination effects, to improve the efficiency of the system. This control can be done using an energy barrier sufficient to the tunneling of the electron into the conduction band of TiO_2. This barrier can be an interface with insulating material or another semiconductor, with band distribution intermediary to the RB and TiO_2.

In this work, this electronic transference was investigated by means of UV-Vis spectroscopy in nanoparticles with SnO_2 coating in commercial TiO_2 nanoparticles (Malinkrodt). For the obtain SnO_2 coating, two methods were used: Polymeryc Precursors [2] and the hydrolysis/ policondensation [3].

The colloidal samples were submitted to measures of zeta potential, for the study of the stability and modification of the surface of the samples. Nanoparticles dispersed in a dilute solution of RB were treated in visible light during several times to observe the kinetics of degradation of RB. The results shows that the TiO_2 is effective as a catalyst to their degradation and the SnO_2 modify the tunneling of electrons from dye to the semiconductor. These results will be used to project photoactive systems with the coated oxide and to understand the mechanism of electron transference in these conditions.

References:

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