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Photocatalytic degradation of dyes with TiO_2: efficiency studies

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Abstract - In recent years the responsibility to the environment has been the object of the global community entire attention. Most of all, water pollution has a great impact on various ecosystems, so the treatment of industrial effluents and others contamination potentials sources have a great importance for whole industry and society. Some of the substances are toxic, low reactive or inert and their removal is difficult. These persistent compounds usually are only transferred from one stage to another, thus without aware to the environmental risk. Currently, methods used to remove these substances involve filtration, extraction by organic solvents or biological treatments and often still unable to completely remove the pollutants, only reducing their levels [1]. The degradation of these substances by photo assisted catalysis using TiO_2 as the catalyst is able to degrade poorly reactive organic substances, such as the benzene family. [2]. The photocatalytics properties of TiO_2 combined with the solar energy use presents great interest for industrial application [3]. Several factors affect the capacity for absorption of photons by TiO_2, showing a direct influence on their photocatalytic efficiency. The allotropic form anatase shows great photocatalytic activity, but studies show that a combination between this and rutile has a higher efficiency [4, 5, 6, 7]. It is possible to obtain different configurations of allotropic mixture through annealing [7] converting the anatase phase into rutile. The grain size can also influence the photocatalytic process [8]. Among the ways to increase the degradation efficiency is the TiO_2 and ZrO_2 mixture [9, 10] doped with transition metals [11] which increases the TiO_2 absorption range bringing it to the solar visible spectrum range[12,13]. Thin film sol-gel techniques production can be effective to control process variables as structure and thickness [10], and then obtained nanometer-scale grain sizes [14]. This work seeks evaluate the activity of TiO_2 efficiency on the photo assisted degradation of dyes methyl red and methylene blue, using different configurations of mixed allotropics, comparing each other preparation methods by mechanical mixing, annealing and sol-gel. The films and mixtures obtained will be characterized by X-ray diffraction and Raman spectroscopy. The dyes degradation efficiency will be measured by UV-Vis spectroscopy and gas chromatography.

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