TITLE: ***Optimization of the photocatalytic decolorization of direct orange 34 azo dye in an aqueous suspension of TiO2.***

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ABSTRACT

Dye degradation/decolorization has drawn considerable attention in the last years due to the several environmentally problems generated by dye-contamined industrial waste streams. Furthermore, these solutions can be potentially toxic and carcinogenic as consequence of the existence of aromatic groups and heteroatoms in their chemical structures. On mixing with water bodies, they threat all forms of life, including human. The photocatalytic degradation through the titanium dioxide has been one of the potential alternatives to decolorize and to reduce recalcitrant wastewater loads from textile dyeing and finishing effluents. This process is characterized by the generation and subsequent reaction of radicals, mainly hydroxyl radical. In this work the decolorization of a mono azo dye, direct orange 34 (DO34), in TiO2 aqueous suspension under artificial radiation was investigated. The optimized experimental conditions were carried out using a 25 full factorial design to evaluate the concentrations of DO34 and TiO2, the stirring speed, the air saturation, and the adsorption time with closed reactor at 30ºC. The decolorization percentage after 4 h irradiation was used as analytical response. Among 32 (25) assays, the largest decolorization percentage of 75% was obtained, when 2.0x10-4 mol L-1 DO34, 1.0 g L-1 TiO2, with a stirring speed of 600 rpm without air saturation and an adsorption time of 15 min for an irradiance of 0.75 mW cm-2 were used. In these conditions the azo dye expended 780 min to decolorize 94.78%, resulting in a rate constant of 0.54x10-3 min-1. When the irradiance was enhanced to 1.5 mW cm-2, the azo dye decolorized 99.13% in 180 min, giving a rate constant of 2.2x10-2 min-1. Under solar irradiation (4.08 mW cm-2) the azo dye decolorization reached 98.90% in 120 min, or a rate constant of 2.7x10-2 min-1. The oxidants addition, such as hydrogen peroxide and periodate ion from 0.1 to 5.0 g L-1 concentration range, enhanced the rate constant. The largest decolorization percentage (89.45%) took place in 4 h, when 0.5 g L-1 H2O2 was added, whereas with the addition of 1.0 g L-1 periodate, the azo dye was decolorized 98.45% in 45 min. This azo dye was decolorized 70.58% in the presence of Botryosphaeria rhodina fungus after five days cultivation. The water quality, obtained after optimization of the photocatalytic treatment, in terms of chemical oxygen demand (COD), biochemical oxygen demand (BOD), dissolved

oxygen (DO), colour, turbidity, and pH indicated that only the pH needs an adjustment, according to nº 357 CONAMA Resolution of March 17, 2005.

Keywords: decolorization photocatalytic, direct orange 34, TiO2, oxidants, factorial design, Botryosphaeria rhodina.