TITLE: ***Treatment and purification of waters contaminated with azo dyes by advanced oxidation processes.***

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ABSTRACT

The azo dyes are synthetic organic compounds widely used in textile dyeing, paper printing, and other industrial processes such as manufacture of pharmaceutical drugs, toys, and food. These dyes have been produced to resist the chemical and biological degradation. Besides, these compounds may cause serious danger to the environment because they are potentially carcinogenic, toxic, and non-biodegradable. Among the effluent treatment techniques the Advanced Oxidation Processes (AOPs), characterized by the hydroxyl radical production, have been used as alternative for waste treatment or degradation of several organic pollutants. In this work the degradation of two monoazo (AO7, acid orange 7 and DR23, direct orange 34) and two diazo dyes (DR23, direct red 23 and DY86, direct yellow 86) was investigated using processes such as direct photolysis (UV, photolysis by H2O2, H2O2/UV, and Fenton (Fe2+/H2O2)), and photo-Fenton (Fe2+/H2O2/UV). Preliminary data, obtained for DR23, were used to optimize Fenton and photo-Fenton processes through the 23 factorial design, taking into place the pH, Fe2+, and H2O2 concentrations for each azo dye. The azo dyes degradation by direct photolysis and by H2O2/UV were not satisfactory in closed reactor, since very low decolorization percentages were obtained during 6 h irradiation at 30ºC. On the other hand, the decolorization of AO7 and DO34 monoazo dyes were respectively 96% and 82%, whereas DR23 and DY86 diazo dyes were 32% and 45% degraded in the presence of hydrogen peroxide (1,5x10-1 mol L-1) under UV radiation in open reactor during 3 h at 30 ºC. Conversely, all the azo dyes were completely degraded up to 3 h at 30 ºC in Fenton and photo-Fenton processes with closed reactor. Among these, the AO7 presented a rate constant of 2,08x10-1 min-1 for Fenton and 1,46x10-1 min-1 for photo-Fenton. The synthetic wastewater containing four azo dyes degraded 71% by photo-Fenton process using 7,5x10-2 mol L-1 H2O2 and 5,0x10-4 mol L-1 Fe2+ in 3 h. The treated water, through the Fenton and photo-Fenton processes, was satisfactory, because it presented the recommended parameters by CONAMA (march 17, 2005). The Botryosphaeria rhodina fungus did not grow in this treated water due to the absence of carbon source, indicanting the azo dyes

mineralization. The non-toxicity of the treated water was confirmed by the non-mortality of Artemia salina microcrustaceous in different concentrations of salt solutions.

Keywords: Advanced Oxidation Processes; photolysis; H2O2/UV; Fenton; phot-Fenton; azo dye; water quality; Botryosphaeria rhodina; Artemia salina.