Enhanced dynamics characterization of photocatalytic decolorization of hazardous dye Tartrazine using titanium dioxide

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ABSTRACT

Advanced oxidation process is a promising technology for remediation of organic pollutants at ambient conditions. Several experiments of photocatalytic decolorization of Tartrazine compound using TiO₂ and UV light have been carried out for enhancing the characteristic of the oxidation kinetics. The experimental results revealed that photo oxidation process was strongly dependent on UV light intensity, and an improvement of 98% was achieved for 75% increase in the light intensity. The reaction rate constant in respect to UV light intensity was larger by order of 10 compared to other considered parameters. The second important parameter that affecting the decolorization rate was the hydraulic time constant (τ) showed an improvement of 79.4% of the decolorization process. The catalytic oxidation process is considered similar to a batch chemical reactor and covered by the first-order reaction rate. A negative impact of 66.67% was obtained by increasing the dye concentration. The results showed that the increased level of TiO₂ concentration did not necessarily improve the rate of degradation of pollutant. The repeatability of photocatalytic process was also tested and after reusing the recycled TiO₂, the rate of color degradation was still efficient with respect to initial dye concentration. It appeared that the photo-oxidation process was favorable at neutrality conditions or slightly higher pH for solutions consisting of anions.

Keywords: Dynamic behavior; Photocatalyst; TiO₂; Tartrazine