Photodegradation of Crystal Violet: A Three Parameter Comparative Study

M.F.Ghorab, N.Filali, A.Douafer

LTEVDI, Chemistry Department, Faculty of Sciences, University Badji Mokhtar Annaba, Algeria
mfghorab@yahoo.com

Several specific new techniques, called advanced oxidation processes (AOPs) (1) constitute a promising way for the treatment of wastewaters (2) containing non-easily removable organic compounds in contrast to conventional techniques such as granulated activated carbon (GAC) or air stripping that only transfer the contaminants from one phase to another. Among these techniques the system TiO₂/O₂/UV seems attracting considerable attention in view of the non negligible number of publications. The interesting feature of this system is its simplicity of usage and its efficiency in destructing many recalcitrant organic substances to CO₂, H₂O and the corresponding mineral acids. Titanium dioxide can be used as commercially available or prepared using several methods such as the sol-gel method. Degussa P-25 powder, which is recognized as the most efficient form of titanium dioxide is frequently used as reference. In this study we compare the performance of another commercial form of TiO₂ (PC500 Millénium) to that of Degussa P-25 for the degradation of a basic dye namely the Crystal Violet (CV) in aqueous solution under UVA radiations (λₘₐₓ= 365nm). The degradation of the dye was performed in a photoreactor consisting of a Becker placed under a metallic cylinder. The evolution of the degradation of the substrate was followed by UV-Vis spectrometry. The three parameters targeted in this study were the concentration of the photocatalyst (0.2 – 3.0 g/L), the initial concentration of the substrate (0.5*10⁻⁷M - 3.0*10⁻⁵M) and the pH solution (2.0-11.0). The system under investigation was also studied under photolysis (absence of TiO₂). Under the experimental conditions used in this study although TiO₂ (PC500) gives a total degradation in a shorter time (20 minutes) compared to TiO₂ Degussa P25 the pH of the latter seems to present a major draw back (pH 9.23). TiO₂ Degussa P25 gives a total decomposition after 120 minutes of irradiation but at natural pH (6.23). The difference between the two results may be explained by the difference in the mechanisms involved during the degradation of CV. While in the case of the TiO₂ (PC500) the degradation may be interpreted solely in terms of a mechanism involving the radical OH° in the case of TiO₂ Degussa the degradation involves besides the radical OH° an adsorption of the substrate.

REFERENCES