

Mechanisms of photocatalytic degradation of Victoria Blue R using nano-TiO₂

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摘要.

Abstract

The TiO₂-mediated photocatalysis process was used to successfully degrade dye pollutants. To better understand the mechanistic details of this TiO₂-assisted photodegradation of the Victoria Blue R (VBR) dye with UV irradiation, forty-four intermediates of the process were separated, identified and characterized by HPLC-PDA-ESI-MS (high performance liquid chromatography-photodiode array-electrospray ionization-mass spectrometry) technique in this study, and their evolution during the photocatalytic reaction is presented. The results indicated that the N-de-alkylation degradation of VBR dye took place in a stepwise manner to yield mono-, di-, tri-, tetra-, penta-, hexa-N-de-methylated and mono-N-de-ethylated VBR species, with N-hydroxyalkylated intermediates generated during the process. Moreover, the oxidative degradation yielded 4-diethylaminophenol, 4-diethylamino-4'-diethylaminobenzophenone, 4-(N,N-dimethylaminophenyl)-4'-(N'-ethylaminonaphthyl)ketone, 4-(N-ethylamino)naphthenol and their N-de-alkylated products. The reaction mechanisms of TiO₂/UV proposed in this study should be useful for future application of the technology to the degradation of dyes.