

# Ethanol mediated photoinduced reversible adsorption of methylene blue on nano titanium dioxide

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## Abstract

The photocatalytic activity of nano titanium dioxide ( $\text{TiO}_2$ ) on aqueous commercial dyes such as methylene blue (MB) is widely reported in literature. However, similar photocatalytic studies carried out in non-aqueous solvents are scarce. A series of ethanolic MB solutions were irradiated by ultraviolet (UV) radiation in the presence of  $\text{TiO}_2$ . Effects of exposure time, adsorbate concentration and dispersion medium were considered. UV-Visible (UV-Vis) spectrophotometry and Fourier transform infrared spectroscopy were employed for characterization. The results show that photocatalytic activity of  $\text{TiO}_2$  on MB strongly depends on the dispersion medium. Contrary to the photocatalytic degradation of dyes that is generally seen in the aqueous medium, we report for the first time a photoinduced reversible adsorption of MB on nano  $\text{TiO}_2$  in ethanol. We further demonstrate that our newly reported phenomenon is mediated by the photocatalytic degradation of ethanol of which its resultant intermediates temporarily modify the nano  $\text{TiO}_2$  surface. Hence, our experimental findings differentiate photoinduced adsorption and photocatalytic degradation, where nano  $\text{TiO}_2$  acts an adsorbent and a catalyst, respectively.

## Graphical abstract

