

## **Kinetics of UV-Assisted and MnO<sub>2</sub> Photocatalysed Degradation of Dinaphthophenazine**

The treatment of the dye-contaminated wastewater using ultraviolet (UV)-induced photodegradation, metal oxides and photocatalysts continues to be investigated by chemists towards improving dye-pollutant remediation technologies for environmental protection. In this study, a Dinaphthophenazine (DNPz.) textile dye was subjected to degradation experiments to characterise its degradation rates and highlight the photocatalytic degradation effect of manganese (IV) oxide (MnO<sub>2</sub>) by comparing the kinetics of UV-induced degradation against MnO<sub>2</sub> – catalyzed photodegradation. Kinetic experiments were conducted by acquiring time-dependent wavelength scan absorption spectra at intervals using double-beam UV-Vis-NIR spectroscopy and a photo-cell setup. A multicurve kinetic profile plot analysis of the three experiments: exposure of DNPz to UV irradiation [DNPz.+UV irradiat.], exposure of DNPz to MnO<sub>2</sub> only [DNPz.+MnO<sub>2</sub>], and the exposure of DNPz to a similar dose of MnO<sub>2</sub> in the presence of UV 254 nm irradiation revealed a decrease in absorbance related to the DNPz molecule over time, indicating degradation of DNPz molecules under acidic conditions, pH 5.0 and at room temperature. A comparative analysis of the pseudo-1st-Order degradation rates shows that exposure of DNPz to MnO<sub>2</sub> in the presence of UV irradiation gave the most significant average rate constant, which is about 9.65 times faster than in the case of the UV-assisted photodegradation based on kinetics monitored using DNPz's Lambda max. Absorptions at 621 nm. This is due to the photocatalytic effect of MnO<sub>2</sub>. The exposure to MnO<sub>2</sub> showed a marked increase in DNPz degradation rate that was about 3.31 times that of the average photodegradation rate recorded by exposure to UV 254 nm irradiation only. These results show that MnO<sub>2</sub> in the presence of UV 254 nm can significantly enhance the degradation of the DNPz textile dye.