

# Effect of several commercial rubbers as substrates for zinc oxide in the photocatalytic degradation of methylene blue under visible irradiation

## Abstract

A new approach of mechanical preparation of photocatalyst zinc oxide (ZnO)/rubbers from four types of rubbers: styrene butadiene rubber (SBR), ethylene propylene diene monomer (EPDM), natural rubber (NR), and epoxidized natural rubber (ENR) with 50% epoxidation is presented. This technique is simple, fast and cost effective as ZnO/rubbers were mechanically mixed using conventional two-roll mill at 27 °C for 10 min and compressed into flat sheet. The characteristics of photocatalyst were studied by X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), ultraviolet-visible spectroscopy (UV-Vis) and field emission scanning electron microscope (FESEM). The photocatalytic activity of ZnO/rubbers was evaluated using methylene blue (MB) as a model pollutant under visible light for 300 min. The photocatalytic degradation efficiency of ZnO/SBR is nearly as good as that of ZnO powder (87.32%) compared to ZnO/NR, ZnO/EPDM and ZnO/ENR. This is due to the highest index of conjugated carbon-carbon bond of SBR and hydrogen bonding between ZnO and SBR. The formation of hydrogen bonding was confirmed by FTIR and reduction of energy band gap of ZnO/SBR. The photocatalytic degradation of MB with ZnO/SBR was could be fitted by pseudo-first-order kinetics of the Langmuir-Hinshelwood model.

## Keywords

Methylene blue; Photocatalytic; Rubber; Visible irradiation; Zinc oxide