UNIVERSITI TEKNOLOGI MARA

SYNTHESIS OF TiO_2/ ZnO CO-DOPED WITH NITROGEN AND SULFUR AND ITS PHOTOCATALYTIC ACTIVITY IN REMOVAL OF REACTIVE BLACK 5

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Thesis submitted in fulfilment of
the requirements for the degree of
Master of Science
(Chemical Engineering)

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Photocatalytic degradation is identified as one of the effective, eco-friendly and fast process, but high energy-intensive as it utilizes UV irradiation. This drawback is possibly overcome by utilization of visible light, another readily abundant and free resource. In this study, TiO_2/ ZnO co-doped N, S was used since the presence of N and S gives the finer grain size, red absorption and high photocatalytic activity. The precursor of TiO_2, ZnO were titanium (IV) isopropoxide (TTIP) and zinc acetate respectively. Meanwhile the sources of nitrogen and sulfur were ammonium nitrate and thiourea. TiO_2/ ZnO co-doped N, S photocatalyst was prepared via sol-gel method. The photocatalyst was analysed by using XRD, BET, FESEM and UV-vis DRS. The synthesized photocatalyst able to produce good crystallinity, small crystallite size (15.6 nm) and low surface area. The surface morphology of the photocatalyst is dense and has a little agglomeration. However, the energy band gap was reduced to 2.89 eV. The photocatalyst was calcined at temperature range between 400 to 800 °C. Their crystallite sizes and crystallinity increased proportionally with the calcination temperature. Then, the photocatalyst was subjected into photodegradation study by using RB5 as the model pollutant. Different factors which may affect the rate of photodegradation were tested which are the effect of calcination temperature, catalyst loading, pH and initial concentration of RB5. From the findings, the optimum parameters are calcination temperature=600 °C, catalyst loading=3 g/L, pH=6 and initial concentration=5 mg/L. The optimum parameters were used again in optimization study and the apparent degradation rate of constant was 3.917×10^{-3} min^{-1}.

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