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SYNTHESIS AND CHARACTERIZATION OF INDIUM VANADATE LOADED ON SILVER CARBONATE FOR PHOTOCATALYTIC ACTIVITY RHODAMINE B

Name	:	MUHAMMAD AZFAR BIN MUHAMAD SABRI
Student ID	:	2022819094
Program	:	AS222
Course code	:	FSG671
Mobile Phone	:	011-24240769
E-mail	:	2022819094@student.uitm.edu.my

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MUHAMMAD AZFAR BIN MUHAMAD SABRI

BACHELOR OF SCIENCE (Hons.) CHEMISTRY WITH MANAGEMENT
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA

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This Final Year Project entitled "**Synthesis and Characterization of Indium Vanadate ($InVO_4$) loaded on Silver Carbonate (Ag_2CO_3) for Photocatalytic Activity Rhodamine B (RhB))"** was submitted by Muhammad Azfar Bin Muhamad Sabri in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Chemistry with Management in the Faculty of Applied Sciences, and was approved by

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Dr. Mohammad Saifulddin Bin Mohd Azami
Supervisor
B. Sc. (Hons.) Chemistry with Management
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau Perlis

Mdm Farhana Othman
Project Coordinator
B. Sc. (Hons.)
Chemistry with
Management
Faculty of Applied Science
Universiti Teknologi MARA
02600 Arau
Perlis

Dr. Nur Nasulhah binti
Kasim
Head Center of Studies
B. Sc.(Hons.) Chemistry with
Management
Faculty of Applied Science
Universiti Teknologi MARA
02600 Arau
Perlis

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ABSTRACT

SYNTHESIS AND CHARACTERIZATION OF INDIUM VANADATE LOADED ON SILVER CARBONATE FOR PHOTOCATALYTIC ACTIVITY RHODAMINE B

Synthetic dyes such as Rhodamine B (RhB) pose serious environmental and health risks due to their toxicity, carcinogenic nature, and resistance to conventional wastewater treatment methods. RhB induces oxidative stress through the generation of reactive oxygen species (ROS), leading to ecological imbalance and reproductive toxicity when discharged into aquatic systems. Traditional dye removal techniques, including adsorption, coagulation, and ultrafiltration, are often limited by high operational costs, low efficiency, and the generation of secondary pollutants. In this study, an $Ag_2CO_3/InVO_4$ composite photocatalyst was synthesized via a simple impregnation method and evaluated for the photocatalytic degradation of RhB under visible-light irradiation. The prepared photocatalyst were characterized using X-Ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), nitrogen adsorption-desorption, Fourier Transform Infrared (FTIR), and ultraviolet-visible diffuse reflectance spectroscopy (UV-Vis/DRS). Among the prepared photocatalysts, the composite containing 20 wt.% $InVO_4$ supported on Ag_2CO_3 (20% InAC) exhibited the highest photodegradation efficiency towards RhB compared with pristine $InVO_4$ and Ag_2CO_3. This enhancement of photoactivity was due to the homogeneous dispersion of $InVO_4$ on the Ag_2CO_3 surface that led to the strong interfacial interactions between $InVO_4$ and Ag_2CO_3 and 20% InAC also possessed the lowest bandgap energy (1.81 eV), enabling enhanced visible-light absorption. Scavenger experiments revealed that photogenerated holes (h^+) were the dominant reactive species, contributing approximately 68% to the photocatalytic degradation of RhB. Based on the experimental results, a Z-scheme charge transfer mechanism was proposed to explain the improved photocatalytic activity. Overall, the $Ag_2CO_3/InVO_4$ composite prepared by the impregnation method shows great potential as an efficient visible-light-driven photocatalyst for dye degradation in wastewater treatment applications.

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