Fakulti Sains Gunaan

SUBMISSION FOR EVALUATION
FINAL YEAR PROJECT 2 - RESEARCH PROJECT

SYNTHESIS OF ZnS LOADED WITH TRANSITION METAL USING IMPREGNATION METHOD FOR REDUCTION OF 4-NITROPHENOL

Name	:	Muhamad Iklil Hafiy Bin Ramli
Student ID	:	2023189349
Program	:	RAS2456D
Course code	:	FSG671
Mobile Phone	:	
E-mail	:	hafiy434@gmail.com

** Please attach the Turnitin summary report, with your name clearly stated, at the end of your report and submit it together.*

Approval by Main Supervisor :

I certify that the work conducted by the above student is completed and approve this report to be submitted for evaluation.

Supervisor's name	:	Dr. Mohammad Saifulddin Bin Mohd Azami
Date	:	31.7.2025
Turnitin Similarity %	:	11 %
Signature	:	

< Put this form as the front page of your report >

SYNTHESIS OF ZnS LOADED WITH TRANSITION METAL USING IMPREGNATION METHOD FOR REDUCTION OF 4-NITROPHENOL

MUHAMAD IKLIL HAFIY BIN RAMLI

BACHELOR OF SCIENCE (HONS.) APPLIED CHEMISTRY
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA

AUGUST 2025

ABSTRACT

SYNTHESIS OF ZnS LOADED WITH TRANSITION METAL USING IMPREGNATION METHOD FOR REDUCTION OF 4-NITROPHENOL

Organic pollutants such as 4-nitrophenol (4-NP) pose serious environmental challenges due to their chemical stability, thus requiring the development of efficient catalytic materials to facilitate their reduction into less harmful compounds like 4-aminophenol. In Advanced Oxidation Processes (AOPs), heterogeneous photocatalysts based on ZnS offer a prospective treatment method; nonetheless, ZnS has specific limitations, prompting modifications to the photocatalyst to enhance the breakdown of organic compounds. In this regard, the present work involves synthesizing ZnS loaded with transition metals, including Ag, Cu, Co, and Fe, by the impregnation method and then the prepared photocatalysts were evaluated for the efficiency of catalytic reduction of 4-NP to 4-aminophenol (4-AP). The physicochemical properties of the prepared catalysts were characterized by UV-Vis/DRS, FTIR, and FESEM to determine the optical, functional group, and morphology, respectively. From the result, Ag/ZnS showed the highest 4-NP reduction (71%) followed by Cu/ZnS (52%), Fe/ZnS (48%), Co/ZnS (23%) and ZnS (10%). The highest photocatalytic activity of Ag/ZnS is attributed to its well-dispersed Ag on the surface ZnS. This well dispersion contributes to the great interaction between Ag and ZnS, which led to the narrowed band gap energy from (3.32 eV to 2.11 eV) that induced the charge separation and better light harvesting in the visible region. Consequently, a scavenger experiment confirmed that bulk hydroxyl radicals ($\bullet OH_{bulk}$) and photogenerated electrons are the primary species responsible for 4-NP reduction. This study demonstrates the potential of transition metal-loaded ZnS as an affordable yet highly effective photocatalyst for water treatment. It is hoped that this research will aid in designing more sustainable and efficient photocatalysts that can be produced on a large scale for removing hazardous organic pollutants from wastewater.

TABLE OF CONTENTS