PREPARATION OF $FePO_4$/CdS BASED PHOTOCATALYST USING IMPREGNATION METHOD FOR PHOTODEGRADATION OF METHYL ORANGE

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This Final Year Project entitled "**Preparation of $FePO_4$/CdS Based Photocatalyst Using Impregnation Method for Photodegradation of Methyl Orange"** was submitted by Wan Muhammad Haikal Bin Wan Mohd Shuimy @ Suhaimi 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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ABSTRACT

PREPARATION OF $FePO_4$/CdS BASED PHOTOCATALYST USING IMPREGNATION METHOD FOR PHOTODEGRADATION OF METHYL ORANGE

Water contamination from industrial activities, particularly due to dye pollutants, poses serious threats to both the environment and public health. Among these pollutants, Methyl Orange (MO), a widely used synthetic azo dye, stands out because of its strong resistance to traditional treatment methods. In response to this challenge, this study focuses on creating an effective photocatalyst to break down MO by utilizing a $FePO_4$/CdS composite, which is synthesized through the impregnation technique. The combination of iron (III) phosphate ($FePO_4$) and cadmium sulfide (CdS) is anticipated to boost the catalyst's efficiency under visible light by enhancing charge separation and minimizing electron-hole recombination. To gain deeper insights into the composite's properties, various analytical methods, including field-emission scanning electron microscopy (FESEM), ultraviolet-visible diffuse reflectance spectroscopy (UV-Vis DRS), and Fourier-transform infrared spectroscopy (FTIR), were employed. The study further examined the photocatalytic performance under different conditions such as catalyst loading, dye concentration, and pH levels to identify the most effective parameters for degradation. Findings revealed that the 15 wt.% $FePO_4$/CdS composite achieved the best degradation efficiency, mainly due to its enhanced ability to absorb light and better surface interaction. In addition, scavenger studies were conducted to determine the key reactive species responsible for degradation, revealing that hydroxyl radicals on surface ($\bullet OH_{ads}$) were the the main species in the reaction. The photodegradation process followed the Z-Scheme mechanism, which facilitates efficient charge separation and maintains strong redox potential. This research offers valuable insights into the development of affordable and efficient photocatalytic materials for wastewater treatment, providing a sustainable approach to tackling dye pollution in water bodies. The outcomes of this work emphasize the potential of $FePO_4$/CdS composites as viable solutions for environmental cleanup efforts, fostering future advancements in photocatalytic applications.