VIETNAM NATIONAL UNIVERSITY - HCMC
HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY

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DISSERTATION INFORMATION

Title: ***Synthesis of reduced graphene oxide-based TiO_2 nanocomposites doped with ZnO, $MgFe_2O_4$ for photodegradation of methylene blue in water.***

Major: **Chemical Engineering** Major code: **9520301**

PhD candidate: **Thieu Quang Quoc Viet**

Advisors: **1: Assoc. Prof. Dr. Nguyen Huu Hieu**

2: Assoc. Prof. Dr. Mai Thanh Phong

University: **Ho Chi Minh City University of Technology, VNU - HCMC**

Major Contributions of This Dissertation:

The overall purpose of this dissertation is to successfully synthesize three types of reduced graphene oxide-based nanocomposites, including TiO_2/rGO, ZnO–TiO_2/rGO and MFO–TiO_2/rGO, with high photodegradation efficiency of methylene blue (MB).

Three types of nanocomposite materials were successfully synthesized with suitable synthesis process and precursor ratio. The band gap energies of all three kinds of synthetic nanocomposites were lower than that of P25; namely TiO_2/rGO (2.79 eV), ZnO–TiO_2/rGO (2.70 eV) and MFO–TiO_2/rGO (2.46 eV). These results demonstrate that the materials in this dissertation have higher light absorption ability, helping to improve the photodegradation efficiency of MB in the visible light.

The survey results of individual and simultaneous effects of factors provided set of appropriate parameters which corresponding to each type of material for the process of MB photodegradation in water. The survey results of TiO_2/rGO showed that, the suitable photodegradation parameters are pH 10, 23 mg/L of the initial MB concentration and 20 mg of material, corresponding to 99.92% of MB photodegradation efficiency. In the case with ZnO–TiO_2/rGO, 63.5 min of photodegradation time, 25.25 mg of material and 20 mg/L of initial MB concentration is the the suitable photodegradation parameters. MFO–TiO_2/rGO showed the best of MB photodegradation efficiency with the suitable conditions, including 20 mg/L of initial MB concentration, 16 mg of material and 200 μL of additional H_2O_2.

The MB photodegradation efficiency of materials slightly decreased (2-2.5%/time) after 5 cycles of recovery and reuse. These results showed the good recovery and reuse ability of the synthesized nanocomposites in this dissertation.

The mechanism of MB photodegradation of all three types of materials mainly occurred via indirect pathway with the formation of free radicals upon irradiation. In which, $\bullet O_2^-$ and •OH are the main radicals involved in the photodegradation of MB.

All three kinds of nanocomposites in this dissertation achieved over 99.71% of MB removal efficiency when irradiated with UV light. In particular, the MB photodegradation efficiency of MFO–TiO_2/rGO reached 99.89% and 97.46% when irradiated with UV light and solar light, respectively. Besides, the MFO–TiO_2/rGO material could be easily recovered by external magnetism due to its paramagnetic properties.

Therefore, MFO–TiO_2/rGO is the most suitable material for further research and practical application in organic dye contaminated wastewater treatment.

Advisors **Ph.D. candidate**

Assoc. Prof. Dr. Mai Thanh Phong Assoc. Prof. Dr. Nguyen Huu Hieu Thieu Quang Quoc Viet