VIETNAM NATIONAL UNIVERSITY-HCMC
BACH KHOA UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence – Freedom - Happiness

THESIS INFORMATION

- Title: $CuFe_2O_4$ and Fe_2O_3 superparamagnetic nanoparticles as catalysts for some C-N cross-coupling reactions
- Major: Chemical Engineering
- Major code: 9520301
- PhD candidate: NGUYEN THI KIM OANH
- Scientific advisors: Prof. Dr. PHAN THANH SON NAM
- University: Bach Khoa University-Vietnam National University - Ho Chi Minh City

CONTENT

❖ ***The objectives of thesis:***

The overall objective of the thesis is to use the superparamagnetic nanoparticles as catalysts for C–N cross-coupling reactions to directly synthesize triphenylamines, 3-phenylquinoxalin-2(1*H*)-one, and phenyl(2-phenylimidazo[1,2-a]pyrimidin-3-yl)methanone compounds. These compounds serve as important intermediates in the synthesis of many bioactive nitrogen-containing compounds, including anticancer, antimicrobial, antithrombotic, protein kinase inhibitor, and benzodiazepine receptor agonist activity.

❖ ***Contribution of this thesis:***

- This is the first time these superparamagnetic nanoparticle materials have been used as heterogeneous catalysts for the following reactions: i) $CuFe_2O_4$ nanomaterial catalyzed for synthetic reaction of triphenylamine from benzoxazole and iodobenzene; ii) The nano Fe_2O_3 material catalyzed for the cyclization reaction between 2-oxo-2-phenylacetic acid and benzene-1,2-diamine to form 3-phenylquinoxalin-2(1*H*)-one; iii) The oxidative cyclization reaction between *trans*-chalcone and 2-aminopyrimidine to form phenyl(2-phenylimidazo[1,2-a]pyrimidin-3-yl)methanone with $CuFe_2O_4$ material as the catalyst.
- $CuFe_2O_4$ and Fe_2O_3 materials exhibit high catalytic activity for C–N cross-coupling reactions mentioned above and the suitable condition of the reaction was also found.

- These superparamagnetic nanoparticle materials can be recovered and reused many times without losing catalytic activity. The structure of them before and after use as catalysts did not change much after the determination by XRD and TEM.
- All major products of reactions were determined by ^{1}H NMR and ^{13}C NMR spectra. Besides, the refined performance of the products is also calculated.

❖ ***The most remarkable points:***

Triphenylamines, 3-phenylquinoxalin-2(1*H*)-one, and phenyl(2-phenylimidazo[1,2-a]pyrimidin-3-yl)methanone substances act as important intermediate compounds in the synthesis of biologically active compounds containing nitrogen and functional organic materials. Many transition metal catalysts, homogeneous and heterogeneous, have been applied as catalysts for C–N cross-coupling reactions. However, these processes have some limitations as difficult reaction conditions, low product performance, complex refining processes, and the use of toxic metal salts as a catalyst. Therefore, the research that finds more effective processes for the synthesis of organic products is great of interest worldwide. Therefore, the first of the thesis is the use of these $CuFe_2O_4$ and Fe_2O_3 nanomaterials as catalysts for the C–N cross-coupling reactions to synthesize triphenylamines, 3-phenylquinoxalin-2(1*H*)-one, and phenyl(2-phenylimidazo[1,2-a]pyrimidin-3-yl)methanone compounds. The thesis is also to study the recovery and reusability of materials in suitable conditions without significant decrease in catalytic activity.

Scientific advisors	PhD candidate
Prof. Dr. Phan Thanh Son Nam	Nguyen Thi Kim Oanh