University of Zabol
Graduate school
Faculty of science
Department of Chemistry

Dissertation for Master's Degree in Organic Chemistry

Title:

Preparation and Application of Metal-Organic Framework/Porous Organic Polymer Nanocomposite for Photocatalytic Oxidation of Benzyl Alcohols

Supervisors:
Dr. Ali Reza Oveisi
Dr. Esmael Sanchooli

Advisor:
Dr. Saba Daliran
Dr. Mostafa Khajeh

By:
Safiye Heydariany Rigi

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Abstract

Porous organic polymer (POP) nanocomposites represent an innovative approach in catalytic materials science, offering unprecedented opportunities for controlled chemical transformations. This study presents a novel UiO-66(Ce)-NH_2/POP nanocomposite based on 5,10,15,20-tetrakis(3,4-dihydroxy phenyl)porphyrin, designed for efficient photocatalytic oxidation of benzyl alcohols under visible light conditions. The catalyst demonstrates exceptional characteristics, including high surface area, remarkable reusability, and stability across multiple reaction cycles. Comprehensive characterization using Fourier-transform infrared spectroscopy (FT-IR), powder X-ray diffraction (PXRD), scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM/EDX), thermal gravimetric analysis (TGA), photoluminescence (PL), and BET (Brunauer-Emmett-Teller) surface area analysis confirmed its structural integrity and catalytic potential. The nanocomposite successfully converted benzyl alcohols to valuable aldehydes with minimal catalyst quantity and optimized reaction conditions. Notably, the catalyst maintained its performance for at least four consecutive reaction cycles without significant efficiency degradation. This research contributes significantly to developing sustainable and efficient photocatalytic strategies with broad potential applications in organic synthesis and green chemistry.

Keywords: Porous Organic Polymer, Metal-organic Framework, Nanocomposite, Photocatalyst, Oxidation Reactions, Benzyl Alcohol