



University of zabol
Graduate school
Faculty of science
Department of Chemistry

Dissertation for Master's Degree in Organic Chemistry

Title:

Synthesis of Metal-Organic Frameworks and Covalent-Organic Frameworks and Their Applications as New Heterogeneous Catalysts for Multicomponent and Oxidation Reactions

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February 2021

Abstract

A novel MIL-101(Cr) (MIL, Matériel Institut Lavoisier) supported propyl carboxylic acid, denoted here as MIL-101(Cr)-NH-CO-Pr-COOH, has been fabricated by post synthetic modifications of nitro-functionalized MIL-101(Cr), MIL-101(Cr)-NO₂. The resulting MOF was successfully characterized by using FT-IR, XRD, N₂ adsorption-desorption, ¹HNMR, SEM, ICP-OES, elemental analysis and TGA. Then, the prepared solid was used as an extremely highly effective multifunctional catalyst for the one-pot three-component synthesis of quinazolin-4(1*H*)-one derivatives as biologically active nitrogen heterocyclic compounds under solvent free conditions.

In The second work, direct synthesis of a chromium-porphyrinic MOF under thermal conditions has been reported. The resulting Cr-MOF exhibited a large surface area, permanent porosity, and a wide range of wavelengths of light absorption. Interestingly, this Cr-MOF is a highly effective heterogeneous photocatalyst for the selective aerobic oxidation of benzyl alcohol to benzaldehyde under visible light irradiation without any additives. Importantly, the Cr-MOF showed good recyclability maintaining its activity that runs three times.

Covalent organic structures are a unique class of porous crystalline polymers composed of light elements connected by strong covalent bonds Here, in the third work, we report the synthesis of a porous COF, in which the building units are meso-tetrakis-(3,4-dihydroxyphenyl)porphyrin and 1,4 phenyl diboronic acid linked together *via* boronate ester bonds. Then, the COF was used as an efficient multifunctional catalyst for selective tandem alcohol photooxidation/Knoevenagel condensation reaction under visible LED lamp irradiation.

Keywords: Metal-Organic Frameworks, Oxidation Reactions, Multicomponent Reactions, Heterogeneous Catalysts, Chromium-based Metal-Organic Framework, Covalent-Organic Framework, Tandem Reactions.