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PMA@MIL-53: A novel composite of Fe (III) based MOF and phosphomolybdic acid as an efficient and reusable catalyst to produce biodiesel under ultrasonic condition

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The world is in great demand for energy, which is mainly fed by fossil fuels; there is a change in demand pattern that was similar in the past 50 years. In addition, for the past 3 years, the demand for energy from fossil fuels has been reduced as we are currently in the stage of the new energy world, called "The Grand Transition". At this stage, demand for energy by consumers will not be reduced, but energy generation from sectors will be unprecedented as the energy produced from fossil fuels is reduced and the energy from renewable energy increases significantly. Biodiesel fuel has shown great promise as an alternative to petro-diesel fuel. Biodiesel is being vigorously pursued as a secure and clean energy source in the transition from the fossil fuel-based energy system to renewable energy for our global future. Traditionally, biodiesel production was carried out under homogeneous conditions in the presence of bases or an acid catalyst such as sulfuric acid and sodium hydroxide. These homogeneous systems have numerous drawbacks such as corrosion of reactors, difficult recovery of catalyst and environmental pollution. In recent years, metal organic frameworks (MOFs) have become of growing interest due to their unique chemical and physical properties such as controllable composition, large surface area, thermal stability, flexibility and easy preparation. MOFs are a new class of nanoporous inorganic–organic hybrid materials that as well as extending potential applications such as catalysis, separation, gas storage, carbon dioxide capture. According to the inimitable advantages, MOFs can be used as a powerful heterogeneous catalyst or an appropriate catalyst carrier. In this work, esterification of oleic acid by methanol is achieved with high yields under ultrasonic irradiation. Factorial design evidenced a positive effect of reaction time amount of catalyst and molar ratio of oleic acid to methanol. This reaction performed with a novel heterogeneous catalyst that fabricated by 12-molybdophosphoric acid (PMA) and Fe (III) -based MOF, namely MIL-53 (Fe). Syntheses of MIL-53 and encapsulation process carry out by ultrasound irradiation at ambient temperature and atmospheric pressure. The prepared composite was characterized by various techniques such as XRD, FT-IR, SEM, BET and ICP that demonstrate excellent catalytic activities, while being highly convenient to synthesize. The obtained results were revealed that ultrasound irradiation could be used for the appropriate and rapid biodiesel production.

Biography

Ahmad Nikseresht is affiliated with Payame Noor University as a PhD student until May 2013. His thesis was conducted under the supervision of Prof M Bakavoli in the Ferdowsi University. He commenced research in the field of Organic Chemistry involving carbohydrates, as a Gust PhD-student at the laboratory of Organic Chemistry of Wageningen University. He was worked as a Gust PhD-student under the supervision of Prof. H Zuilh of and Tom Wennekes for a period of nine month. He is the Director of Department of Research and Entrepreneurship of Payame Noor University of Ilam, Iran. He has published more than 37 papers in reputed journals and international conferences in the field of organic chemistry.

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