ISGC 2019 May 13rd - 17th

N°525 / OC
TOPIC(s) : Homogenous, heterogenous and biocatalysis / Alternative technologies

Mesoporous Nano-sized CuO/MgAlOx Catalysts for Enantioselective Henry Reactions: Green Sustainable Perspectives

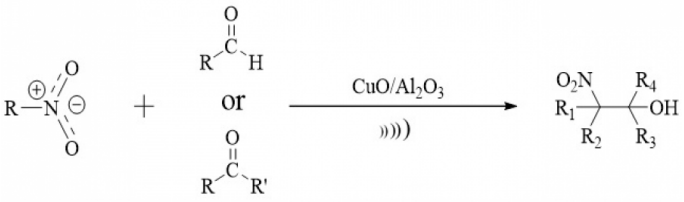
AUTHORS

Mohamed MOSTAFA / CHEMISTRY DEPARTMENT, FACULTY OF SCIENCE, KING ABDULAZIZ UNIVERSITY, KING ABDUL AZIZ UNIVERSITY, JEDDAH
Bodour ALHASHDI / CHEMISTRY DEPARTMENT, FACULTY OF SCIENCE, KING ABDULAZIZ UNIVERSITY, KING ABDULAZIZ UNIVERSITY, JEDDAH
Heba KASHMERY / CHEMISTRY DEPARTMENT, FACULTY OF SCIENCE, KING ABDULAZIZ UNIVERSITY, KING ABDULAZIZ UNIVERSITY, JEDDAH
Nesreen S. AHMED / DEPARTMENT OF THERAPEUTIC CHEMISTRY, PHARMACEUTICAL AND DRUG INDUSTRIES RESEARCH DIVISION, NATIONAL RESEARCH CENTER, EL BUHOUTH STREET, DOKKI, CAIR, 12622, EGYPT, EL BUHOUTH STREET, DOKKI, CAIR, EGYPT, CAIRO

PURPOSE OF THE ABSTRACT

Great progress has been made in mesoporous solid bases in the last decade [1]. They are extremely desirable in green catalytic processes, due to their advantages including accelerated mass transport, negligible corrosion, and easy separation. In addition to their wide applications in the catalytic synthesis of organics and fine chemicals, mesoporous solid bases have also been used in the field of energy and environmental catalysis [2]. Nano-sized metal oxides behave efficiently as they have unique features in their specific surface area, electric conductivity, and thermal stability. The utilization of such solid base mesoporous nano-sized catalysts is one of the alternative pathways to the classical environmentally unfavorable homogeneous catalysts. Henry reaction continues to fascinate attention in numerous areas of synthetic organic chemistry. The reaction has established to be a viable testing asymmetric synthesis and progress of chiral catalysts, mainly in the field of pharmaceuticals and experimental therapeutics where the activity of the compounds depends on their relative chirality. The development of environmentally favorable process and the robust environmentally benign catalyst to synthesize novel series of Henry products is the challenge between different research groups. Metal oxides synthesized via hydrotalcite-like structure route considered have specific features in their crystallite size, morphology, surface area, and catalytic efficiency towards various catalytic reactions [3,4]. In the present study a series of mesoporous nanosized CuO/MgAlOx catalysts synthesized form Cu-layered double hydroxide calcined at 500oC for 8h. All the synthesized catalysts were characterized by ICP-MS, XRF, FTIR, TGA, XRD, XPS, SEM, HRTEM and BET-surface area gas analyzer. A catalytic test of Henry reaction utilizing nitromethane and various aldehyde derivates was carried out under ultrasonic irradiation (scheme 1). The obtained results revealed that CuO/MgO/Al2O3 (ex-Cu1Mg1Al1LDH) catalyst was the superior active candidate that provides high %yield (in few minutes) of all the synthesized alcohols. The re-use of the catalysts over six periods of time showed a robust sustainable active catalyst that resist deactivation due to the large surface area of nanosized mesoporous nature of this catalyst (Fig. 2). The present scenario of ultrasonic assisted catalyzed organic synthesis could be a new trend for stereoselective Henry reactions.

FIGURES



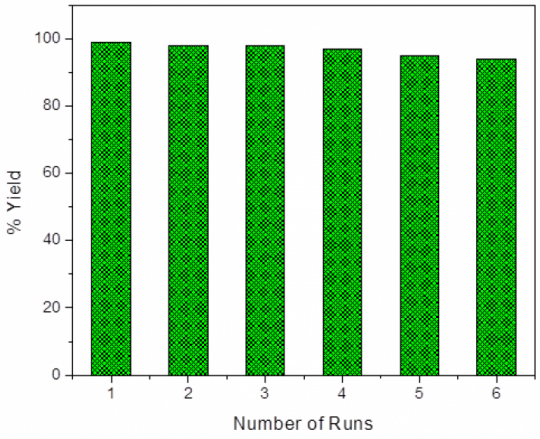


FIGURE 1

Scheme 1

Schematic diagram for Henry reaction

FIGURE 2

Figure 2

% Yield of Henry utilizing CuO/Al2O3 catalyst for six period cycles

KEYWORDS

Henry reaction | Enantioselective | Mesoporous nanosized CuO/Al2O3 | Green sustainable perspective

BIBLIOGRAPHY

[1] Sun, L.B; Liu, X.Q.; Zhou, H.C. Design and fabrication of mesoporous heterogeneous basic catalysts. Chem Soc Rev.2015, 44,5092-5147

[2] Ameen, S.; Nesreen, S. A.; Tamer, S. S.; Shaeel, A. A.; Sulaiman, N. B.;Wilhelm, S.; Mohamed, M. Solvent-free Biginelli reactions catalyzed by hierarchical zeolite utilizing a ball mill technique: A green sustainable process. Catalysts 2017, 7,84; doi:10.3390/catal7030084

[3] M. Mokhtar, S. N. Basahel, Y.O. Al-Angary; Nanosized spinel oxide catalysts for CO-oxidation prepared via CoMnMgAl quaternary hydrotalcite route", J. Alloy compd , 2010,493, 376–384

[4] M. Mokhtar, A. Inayat, J. Ofili, W. Schwieger, Thermal decomposition, gas phase hydration and liquid phase reconstruction in the system Mg/Al hydrotalcite/mixed oxide: A comparative study", Appl Clay Sci, 2010, 50,176-181