International Journal of Knowledge Engineering
ISSN: 0976-5816 & E-ISSN: 0976-5824, Volume 3, Issue 1, 2012, pp.-98-99.
Available online at http://www.bioinfo.in/contents.php?id=40

SHORT COMMUNICATION

APPLICATION OF NANOMATERIALS AS A CATALYST IN ORGANIC SYNTHESIS

SURAMWAR N.V.[1], THAKARE S.R.[2]* AND KHATY N.T.[1]

[1]Department of Applied Chemistry, Priyadarshani College of Engg.& Tech., Hingna, Nagpur, MS, India.
[2]Nanotechnology lab, Department of Chemistry, Science College, Congress Nagar, Nagpur, MS, India
*Corresponding Author: Email- sanjaythakare@yahoo.co.uk

Received: February 28, 2012; Accepted: March 06, 2012

Citation: Suramwar N.V., Thakare S.R. and Khaty N.T. (2012) Application of Nanomaterials as a Catalyst in Organic Synthesis. International Journal of Knowledge Engineering, ISSN: 0976-5816 & E-ISSN: 0976-5824, Volume 3, Issue 1, pp.-98-99.

Nanomaterials containing high surface area and reactive morphologies have been studied as effective catalysts for organic synthesis.[1-3] Furthermore, the nanomaterial catalyzed reactions provide the advantages of high atom efficiency, simplified isolation of product, and easy recovery and recyclability of the catalysts. Several groups have intensively investigated the effect of shape of the nanocrystals on their catalytic activity and stability.[4-7]Ullman reaction in which the condensation of Iodobenzene into biphenyl takes place in presence of copper metal as catalyst is an industrially important reaction due to its significant role in organic synthesis as drug intermediate. The reactions which give 43% conversion of Iodobenzene to biphenyl in normal size copper particle as a catalyst and the conversion is up to 95% when copper nanoparticle used as catalyst. Which shows the higher catalytic activity towards the condensation of Iodobenzene could be due to higher catalytic surface area of small nanoparticle.[8] There is another example in which CuO nanoparticle prepared in the presence of cyclodextrin act as catalyst for liquid phase alcohol oxidation in air. The catalytic activity of the CuO nanocomposites and its green chemistry exhibit good reusability, simple workup procedure and a straight forward approach to aldehyde formation with improved reaction condition which results in greater yield and improved purity.[9] There are various organic synthesis which catalyzed by the nanomaterial which cause the improved results in term of the yield and the purity of the product. Nanoscale catalysts have been investigated in a number of reactions. Nanometal colloids have been of particular interest. In the precursor concept, pre-prepared nanometal colloids can be tailored for special applications independently of the support by modifying them with lipophilic or hydrophilic protective coatings. Adsorption onto the support is achieved by dipping the material into a solution of the particles. Surfactant stabilized nanometal colloid catalysts have been found to surpass conventional catalysts for hydrogenation and oxidation reactions.[10] The first intramolecular Pauson-Khand reaction in water was successfully carried out by using aqueous colloidal cobalt nanoparticles as the catalyst.[11] Metal nanoclusters have also been found to be good catalysts. Nanoparticles supported on polymers have been found to catalyze hydrogenations and carbon -carbon coupling reactions.[12] Colloids of bi- and tri-metallic nanoclusters have been shown to be active and selective catalysts in the Suzuki cross-coupling, Phauson-Khand, and hydrogenation reactions. Metal clusters retain their activity for extended periods of time and over a range of substrates. Gold nanoclusters have also exhibited catalytic activity for the low temperature oxidation of carbon monoxide,[13] even though bulk gold is inactive. Metal nanoparticles on a variety of supports have also been investigated as catalysts. Zinc and platinum nanoparticles supported on a zeolite matrix exhibited high aromatizing activity in the conversion of lower alkanes.[14] Other types of nanocatalysts have been studied as well. Nanopowder catalysts composed of silica and platinum nanoparticles exhibited very strong catalytic activity for hydrolyzation reactions.[15] Intra-dendrimer hydrogenation and carbon-carbon coupling reactions took place in a variety of solvents (water, organics, biphasics, supercritical CO2) using dendrimer-encapsulated metal nanoparticles. In the same way ZnO nanoparticles which are effective nanocatalyst for the synthesis of β- acemido ketone with improved results.[16]

A burst of research activity is witnessed in recent years in the area of synthesis and fabrication of different size and shape of metal nanoparticles due to the application of these nanoparticles

in organic synthesis described above. Amongst many metals like Au, Ag, Pd, Pt, towards which research is directed, copper, nickel and copper based compounds are the most important material. They play a significant role in the organic synthesis. Very little work has been carried out on the cold synthesis of nanomaterial in view of the above limitations there are various aspects by which we can prepare size controlled nanoparticles And their application as a catalyst in organic synthesis. In view of this we prepare nanomaterials by soft chemical method in a greener way and study of its catalytic activity in the organic synthesis. The prepared nanomaterials were characterized by SEM, TEM, UV-Visible spectrophotometer, XRD, IR we studied their size distribution by nanodistribution and a zeta potential analyzer. We apply these nanomaterials as a catalyst in organic syntheses of various molecules and characterize them with IR, LCMS, ^{1}HNMR, ^{13}CNMR.

References

[1] Rao H., Jin Y., Fu H., Jiang Y., Zhao Y. (2006) *Chem. Eur. J*. 12 (2006), 3636.
[2] Kwong F.Y., Klapars A., Buchwald S.L. (2002) *Org. Lett*. 4, 581.
[3] Kwong F.Y., Buchwald S.L.(2003) *Org. Lett*. 5, 793.
[4] Narayanan R., El-Sayed M.A. (2004) *J. Am. Chem. Soc.* 126, 7194.
[5] Narayanan R., El-Sayed M.A. (2004) *J. Phys. Chem*. B, 108, 5726.
[6] Narayanan R., El-Sayed M.A. (2005) *Langmuir*, 21, 2027.
[7] Somorjai G.A., Zaera F. (1982) *J.Phys.Chem*. 86, 3070.
[8] Samim M., et al. (2007) *Bull. Mate. Sci*. 30, 535.
[9] Marshall J.A., Chobanian H.R., Yanik M.M. (2001) *Org. Lett*. 3, 4107.
[10] Ying M. (2005) *J. Am.Chem.Soc*.127, 9506.
[11] Ozin G.A., Arsenault A., Cademartiri L. (2009) *Nanochemistry. A Chemical Approach to Nanomaterials*.
[12] Ranu B.C., et al. (2009) *Pure Appl. Chem*. 81, 2337.
[13] Astruc D. (2008) *Nanopart. Catal*. 1, 22.
[14] Djakovitch L., Koehler K., de Vries J.G. (2008) Nanopart. Catal., 303,145.
[15] Nagase K., Zheng Y., Kodama Y. and Kakuta J. (1999) *J. Catal*. 187, 123.
[16] Hambrock J., Becker R., Birkner A., Weiss J. and Fischer R.A. (2002) *Chem. Commun*., 12, 68.