Organic Chemistry: An Indian Journal

Organic Chemistry
ISSN: 0974-7516

Commentray | Vol 16 Iss 3

Applications of Heterogeneous Solvent-Free Catalysis under Microwave Conditions in C-C and C-Hetero Bond Formations-Spectral Evaluation using Hammett Equation

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Received: December 02, 2021, Manuscript No. TSOC-21-48875; **Editor assigned:** December 06, 2021, PreQC No. TSOC-21-48875; **Reviewed:** December 20, 2021, QC No. TSOC-21-48875; **Revised:** February 02, 2022, Manuscript No. TSOC-21-48875 (R); **Published:** March 01, 2022

Introduction

The research work presented by Guna Sekar and co. on the topic entitled, 'SiO_2-H_3PO_4-catalyzed solvent free aldol condensation: Synthesis and spectral correlations of some antimicrobial potent arylE2-propen-1-ones', gives readers of interest mainly the following aspects:

- Firstly, heterogeneous catalyzed reactions, which can be recyclable and reusable-a key green chemistry protocol.
- Secondly, Neat/solvent-free catalyzed reactions offering green environment by avoiding harsh and toxic solvents.
- Thirdly, use of microwave in organic synthesis-One added application.
- Lastly, exploitation of Hammett equations, Swain-Lupton's, F and R parameters in spectroscopic evaluation which will pave way for knowing both the benefits as well as limitations.

All these very important green strategies were applied on the synthesis of biologically relevant aryl propenones using well known Aldol condensation.

Role of Heterogeneous Catalysis in Green Chemistry

Researchers need to focus more on eco-friendly synthetic organic transformations in synthesizing biologically relevant heterocyclic scaffolds. Catalysis is extremely important in industrial chemistry due to enhancement of rate of reaction without getting involved in the reaction [1]. Homogeneous catalysts are known for high activity and selectivity but have problem in loss of precious heavy metal, corrosion and plating out on the reactor wall. As there is no recovery of the catalyst, reusing it is out of consideration. Heterogeneous reactions are often more useful compared to homogeneous reactions both in laboratory and in industrial scale owing to faster reaction times, large scale operational viability, reusability and selectivity such as above solid acid catalyst- silica phosphoric acid (like in a homogeneous catalyst is anchored on to a solid. support, its activity and selectivity can be retained and it can be rendered suitable for recovery and reuse). In present days, around 90% of chemical production is being done by solid catalysts, especially by chemical and energy sectors [2]. Heterogeneous catalysts are choosier because of their robustness, low operational cost and easier ways of separation and recovery enabling its reuse. These solid catalysts possess large surface area thus provide more active catalytic active centers for speedy reaction outcome.

Citation: Narsimhaswamy D. Applications of Heterogeneous Solvent-Free Catalysis under Microwave Conditions in C-C and C-Hetero Bond Formations-Spectral Evaluation using Hammett Equation. Org Chem Ind J. 2022;16(3):67

Role of Solvent-Free Approach in Green Chemistry

A solvent free approach for organic synthesis is described which involve in general microwave exposure of neat reactants. A variety of cyclization and condensation are carried out including the efficient one pot assembly of heterocyclic molecules from in situ generated intermediates. Strict legal restrictions on pollution exposure have enforced the application of solvent-less conditions into practice. The reactions under solvent-free conditions are especially appealing as they provide the opportunity to work in an open vessel, thus circumventing the risk of generating high pressure in reaction vessels. In this endeavor, inorganic solid supports (alumina, bentonite, montmorillonite, etc.) have made a landmark, because reactions can be performed in a dry media or under solvent free conditions [3]. In addition, the use of solid supports in conjunction with microwave leads to a higher yield, remarkable reactions rate enhancement, and high catalytic activity with the optimum utilization of energy. In this expeditious and solvent free approach the reactants were adsorbed over inorganic support/clays and exposed to microwave irradiation. This solvent-less approach provides an opportunity to conduct selective organic functional group transformations more efficiently and expeditiously, thereby increasing the potential of such reactions to be up scaled.

The toxicity and volatile nature of many organic solvents, particularly chlorinated hydrocarbons that are widely used in huge amounts for organic reactions have posed a serious threat to the environment. Thus, design of solvent-less catalytic reaction has received tremendous attention in recent times in the area of green synthesis. A solvent-free or solid state reaction may be carried out using the reactants alone or incorporating them in clays, zeolites, silica, alumina or other matrices to achieve high degree of stereo selectivity in the products, to reduce byproducts, to maximize rate of reaction like in SiO_2-H_3PO_4-catalysis.

Role of Microwave Technology in Green Chemistry

Microwave (MW) irradiation has gained popularity in the past decade as a powerful tool for rapid and efficient synthesis of a variety of compounds because of selective absorption of microwave energy by polar molecules [4]. The application of MV irradiation to provide enhanced reaction rate and improved product field in chemical synthesis has been extending to modern drug discovery in complex multi-step synthesis and it is proving quite successful in the formation of a variety of carbon-heteroatom bonds. Solvent-free methods are especially adapted to organic synthesis under green chemistry conditions. When coupled to Microwave (MW) irradiation, it results in very efficient and clean procedures with noticeable improvements over classical methods. To take advantage of MW specific effects, the most suitable cases involve reactions with polar mechanisms with increase of the polarity during the progress of the reaction and late transition states along the reaction coordinates.

Role of Aldol Condensation in Medicinal Field

The aldol condensation reaction is recognized as one of the most fundamental tools for the construction of new carbon-carbon bonds in both the biochemical and purely chemical domains [5]. It is a wide spread reaction. Utilization of Aldol Condensation in biological and medicinal area has attracted considerable interest over the years as the aldol reaction is one of the most fundamental tools for the construction of new carbon-carbon bonds. So in this review we provide a discussion of recent developments of Aldol Condensation in the area of bioorganic and medicinal Chemistry.

Role of Hammett Equation in Spectral Evaluation

Efforts for the synthesis of heterocycles to study the quantitative structure activity relationships by spectral correlation through Hammett equation with their Infra-Red and NMR spectral data.

All these very important aspects are covered in OCAIJ, which will definitely enable young researchers to explore more for the development of scientific innovations.

REFERENCES

1. Bhaskaruni SV, Maddila S, Gangu KK, et al. A review on multi-component green synthesis of N-containing heterocycles using mixed oxides as heterogeneous catalysts. Arab J Chem. 2020;13(1):1142-78.
2. Rai VK, Verma F, Mahata S, et al. Metal Doped-C_3N_4/Fe_2O_4: Efficient and versatile heterogenous catalysts for Organic Transformations. Curr Organ Chem. 2019;23(12):1284-306.
3. Kantevari S, Vuppalapati SV, Biradar DO, et al. Highly efficient, one-pot, solvent-free synthesis of tetrasubstituted imidazoles using $HClO_4$-SiO_2 as novel heterogeneous catalyst. J Mol Catal. 2007;266(1-2):109-13.
4. Firouzabadi H, Iranpoor N, Nowrouzi F, et al. Aluminum dodecatungstophosphate (AlPW12O40) as an efficient heterogeneous inorganic catalyst for the chemoselective synthesis of geminal diacetates (acylals) under solvent-free conditions. Tetrahedron Letters. 2003;44(20):3951-4.
5. Cui X, Xu MC, Zhang LJ, et al. Solvent-free heterogeneous catalysis for cyanosilylation in a dynamic cobalt-MOF. Dalton Transact. 2015;44(28):12711-6.