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MICROWAVE: A NEW GREEN SYNTHESIS TECHNIQUE

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ABSTRACT

Chemistry brought about medical revolution till about the middle of 20th century in which drugs and antibiotics were discovered. These advances resulted in the average life expectancy rising from 47 years in 1900 to 75 years in 1990's. The quality of life on earth became much better due to discovery of dyes, plastics, cosmetics and other material. Soon, the ill effects of chemistry also became pronounced, main among them being the pollution of land, water and atmosphere. This is caused because of the effects of by-products of chemical industries, hazardous waste released, and used of harmful solvents. With this view in mind, synthetic method should be designed in such a way that the the reaction should carry out in aqueous phase or by solid phase reaction. Here in this we have highlighted use of microwave to avoid the use of solvent or atleast to minimize it.

Key words: Green synthesis, Microwave.

INTRODUCTION

Most of the common solvents generally used cause serves hazards. One of the most commonly used solvent, benzene is now known to cause or promote cancer in humans and other animals. Some of the other aromatic hydrocarbons, for example toluene could cause liver and kidney problems. All these solvents are widely used because of their excellent solvency properties. These benefits nevertheless, are coupled with health risks.

Commonly used halogenated solvents, like methylene chloride, chloroform, perchlorethylene and carbon tetrachloride have long been identified as suspected human carcinogens. All these obviate the need of microwave assisted reaction to avoid the use of solvent.

RESULTS AND DISCUSSION

Application of microwave irradiation in organic reactions has added a new dimension to solid phase synthesis. By the use of this technique, it is now possible to carry out reaction without the use of toxic or other solvents, which is one of the main problems associated with green synthesis. In these, the reactants are dissolved in a suitable solvent like water, alcohol, methylene chloride etc. and the solution stirred with a suitable adsorbent or solid support like silica gel, alumina or phyllosilicate. After stirring the solvent is

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removed in vacuo and the dried solid support on which the reactants have been adsorbed are used for carrying out the reaction under microwave irradiation[1,2].

Normally microwave has wavelengths between 1 cm to 1 m (frequencies of 30 GHz to 300 Hz). These are similar to frequencies of radar and telecommunications. In order to avoid any interference with these systems, the frequency of radiation that can be emitted by household and industrial microwave oven is regulated, most of the appliances operate at a fixed frequency of 2.45 GHz.

Since the first report in 1986 on the application of microwave for chemical synthesis in polar solvents, the technique has become popular for a variety of organic synthesis and functional group transformations. MWs have wavelengths range from 1 mm to 1 m corresponding to frequiencies between 0.3 ann 300 GHz. As MWs are used in telecommunication and radar equipments, only the wavelength of 12.2 cm is permitted to be used by industrial and domestic MW appliences. It is from India most of the papers appear based on this technique employing domestic MW oven[3,4].

The usual method of heat transfer in organic reactions include oil baths, sand baths and heating jackets. These methods are rather slow and temperature gradient develop within the sample in addition to local overheating resulting in product, substrate and reagent decomposition. On the other hand, in this method MW energy is introduced into the chemical reactor remotely and the MW radiation passes through the walls of the vessel and heats only the reactants and solvents, not the reaction vessel itself[5].

CONCLUSION

From the above it is concluded that used of MW for organic synthesis is the best technique. Because of its used reactions are rapid and completed within a few minutes. The purity of the product is very high as the residence time of high temperature is short with no overheating. The reactions are carried out without solvent or with the use of small amount of solvent. Yield is high.

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