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RESEARCH ARTICLE
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COMPARATIVE STUDIES ON CONVENTIONAL AND MICROWAVE SYNTHESIS OF PARACETAMOL

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Abstract:-
Paracetamol (p-acetamidophen) has been synthesized using microwave irradiation and conventional heating method. Microwave technique can be used for more efficient synthesis of organic compounds as compared to conventional technique. Paracetamol has been synthesized in our laboratory by carringout a reaction between p-aminophenol and acetic anhydride inside a domestic microwave oven. Progress of the reaction monitored by TLC and product was characterized by its FTIR spectrum.

Keywords: *Microwave synthesis, conventional synthesis, p-amino phenol, acetic anhydride*

Introduction:-

Paracetamol is a derivative of p-aminophenol which also has analgesic and antipyretic action[1]. Paracetamol is used to relieve mild to moderate pain, including instances of intention headache, migraine headache, muscular aches, back pain, joint pain and general pain[2]. Paracetamol is used in the treatment and relief of serve pain such as post-operative pain [3] and proving palliative care in terminal stage of cancer patients[4].
The chemical structures of paracetamol is presented in figure 1.

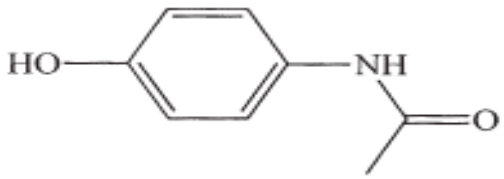

Fig.-1 Chemical Structure of paracetamol

In last few years, there has been increasing interest in the use of environment benign reagent and conditions[5-7] particularly in solvent free procedures[8]. Although microwave dielectric heating has been used in areas as divergent as meal preparation and industrial processing[9]. Microwave irradiation is well known technique to promote the synthesis of a variety of compounds, where chemical reactions are accelerated because of selective absorption of microwaves by polar molecules[10]. Now a day, microwave-assisted synthesis is widely used especially in the field of organic chemistry an in pharmaceutical industry for the oriented-synthesis of targeted compounds. Microwave irradiation is regarded as an alternative route for supplying energy the reagents instead of using conventional methods, such as heating[11]. Microwave assisted reactions are considerable fastly, cleaner economic and eco-friendly comparative to classical organic synthesis.

Experimental: -

All the chemicals for experiment were reagent grade and used as commercially obtained (Sigma-Aldrich) without further purification. The melting point was synthesized paracetamol of determined using melting point apparatus. The IR spectra were measured on Shimadzu 84,005 FTIR spectrophotometer using KBr matrix[12-16] from 4000cm-^{1} to 500cm^{-1}.

Here the synthesis of paracetamol from p-aminophenol and acetic anhydride was carried out by conventional method.

We have taken a cleaned and dry 100ml beaker, p-aminophenol, distilled water and acetic anhydride were added in that. After that reaction mixture was placed in a microwave oven for 5minute at 20% power. Then, the reaction mixture was removed from the microwave and the beaker was allowed to room temperature. After that the crystallization occurred on cooling. The reaction was monitored using thin layer chromatography (TLC) with stationary phase of chloroform: methanol(9:1v/v) . The formation of solids in the reaction mixture indicates the presence of the product.

For recrystallization, we used 10ml methanol in 10ml of water. After recrystallization solid product was isolated by filtration. Then it it dried, weight the yield and melting point was determined. And finally paracetamol crystals were characterized by FTIR.

Results and discussion:-

The experiment was deigned to study the effect of microwave irradiation in reaction to the reaction time, product purity and yield. Table 1 shows that under microwave irradiation, the results are different from the conventional synthesis in terms of reaction time and the yield.

The reaction using conventional heating was completed in 30 minute and 38% yield was obtained while compare to the microwave technique taken 5 minute and yield was 85 %[17-22].

The synthesis of paracetamol was carried out by the modification of synthesis mentioned in literature[23], according to figure 2.

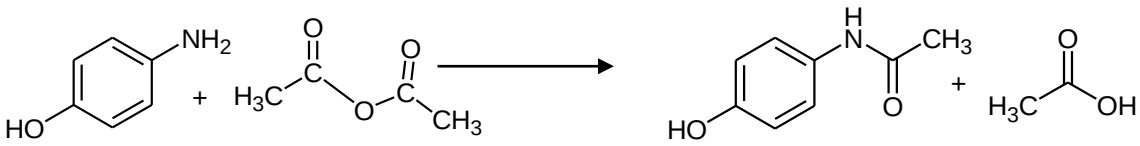

Fig. 2. Reaction scheme for synthesis of Paracetamol

Table 1:- Comparition of some physical data.

Synthesis Type	Reaction Time(minutes)	Yield %
Convetional	30	38
Microwave	5	85

Table 2:- IR frequencies (cm^{-1}) and their Assignment for synthesized Paracetamol

Assignment	Frequency (cm^{-1})
	1442

Aromatic vibrations	1506 1564
C=O stretch	1654
O-H stretch	3163
N-H stretch	3325

The spectral study did not show any difference. The spectra of parcetamol obtained by both the method were same.
According to the literature, compare to traditional methods, many organic reactions occur more efficiently in the solid state than in solution[24].

Conclusion:
Microwave-assisted synthesis is a convenient way toward the goal of green chemistry, microwaves irradiation can be used to in chemical synthesis as a heat source; it is very efficient and can be used to significantly reduce reaction times of numerous synthetically useful chemical transformations. Thus, microwave-assisted synthesis has advantages over the conventional technology: it is more energy efficient and it is an elegant method of synthesis in short time duration with good yield. The work up of the reaction mixture is also very simple.

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