Microwave Assisted Synthesis and Characterization of Substituted Pyrazoline Derivatives

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Abstract **- Substituted Pyrazolines are usually prepared from the cyclization of Chalcones with Thiosemicarbazide under the alcoholic conditions using microwave irradiation method. A considerable increase in the reaction rate has been observed, with better yield. The synthesized compounds have been characterized on the basis of molecular weight determination and spectral data like 1H-NMR, 13C-NMR and IR.**

Index Terms- **Chalcones, Microwave, Pyrazolines, Thiosemicarbazide.**

I.INTRODUCTION

Pyrazoline and their derivatives are well known and versatile, important nitrogen containing five membered, heterocyclic compounds. They possess a broad spectrum of biological activities viz. antibacterial, antifungal, antitubercular, antitumor, antidepressant, insecticidal, antidiabetic and anti-inflammatory[1]-[4]. They are extensively used as important synthons in organic synthesis. Nowadays pyrazoline derivatives are used in photographic films, dyes, lubricating oils, catalyst and in variety of drugs[5]-[8].

In the present investigation 1-Thiocarbamoyl-3,5-diphenyl-2-pyrazoline is prepared by the reaction of chalcone, thiosemicarbazide and NaOH in ethanolic medium by microwave irradiations. And different chalcones (1,3-diphenyl prop-2-ene-1-one) are synthesized via classical, base catalysed " Claisen Schmidt condensation reaction" through reported procedures[9-11].

Over the years various innovative methods have been devised to speed up the chemical reactions. In these environmentally conscious days the development of technology is directed towards environmentally sound and eco-friendly methods. Microwave assisted organic synthesis is a revolutionary technique in the discovery of drugs. Less reaction time, easy work up and cleaner products are the major advantages of microwave heating[12]-[13].

II. PROCEDURE

Domestic microwave oven modified for, reflux organic synthesis was used within 100–300-watt level, for MWI method. Microwave safe borosil glass apparatus was used for the synthesis in microwave oven. All the compounds were synthesized by using analytical grade chemicals. Melting points of the synthesized compounds are uncorrected and were determined in sealed capillary tubes in a BESTO melting point apparatus. All the synthesized compounds were characterized by melting point determination, elemental analysis, IR, ^{1}H-NMR and ^{13}C-NMR spectral studies.

2.1 Synthesis of Substituted Pyrazolines:-

Substituted pyrazoline was synthesized in the following two steps by the MWI method.

2.1.1 Step I: Synthesis of Substituted Chalcones:-

Substituted acetophenones(0.01m) and substituted aromatic aldehydes(0.01m) were thoroughly mixed with anhydrous K_2CO_3 to form a thick paste. The paste was air dried and the residual mass was subjected to microwave irradiation for 5-10 minutes. After completion of the reaction the contents were dissolved in ethanol. Inorganic material was filtered off and then filtrate, after concentration was left overnight to afford the desired chalcones in 80-90% yield [14]-[19].

2.1.2 Step II: Synthesis of Substituted Pyrazolines:-

Synthesized chalcones were treated with thiosemicarbazide, and various substituted pyrazolines were synthesized. All the reagents were

taken in equimolar ratio (0.01m) in ethanol and their mixture solution was microwave irradiated for 10-15 minutes cautiously at low temperature in modified microwave oven [20]-[25] and then poured over crushed ice. The solid product separated was filtered, washed with water and dried, recrystallized using ethanol, yellow crystals obtained.

The analytical and physical data of the synthesized compound (2a-d) is summarized in Table-1 and spectral data is summarized in Table -2.

Table 1: microwave assisted synthesis of 3,5-arylated 2-pyrazoline (2a-d)

Comp. no.	Molecular formula	M.W. Found (cal.)in g/mol	Colour	M.P. (°C)	Yield (%)
2a	$C_{16}H_{15}SN_3$	281.37 (280.3)	Pale yellow	165	55
2b	$C_{16}H_{14}SN_3ClO$	313.81 (312.6)	Yellow	226	89
2c	$C_{16}H_{13}SN_3Cl_2$	350.26 (349.2)	Yellow	142	68
2d	$C_{17}H_{17}SN_3O_2$	327.40 (326.6)	Creamy yellow	227	51

Table 2: IR and ^{1}H-NMR spectral data of the 2-pyrazoline products

S. no.	Compound	IR υ(cm^{-1})	^{1}H-NMR δ(ppm)
1	$C_{16}H_{15}SN_3$ (2a)	1582(C=N), 1071(C-N), 827(N-N),1564 & 3000-3042(Ar-nu), 1147(C=S)	3.3-3.1 (C_4-CH_2), 4.0(C_5-CH), 7.7-6.6 (Ar-H)
2	$C_{16}H_{14}SN_3ClO$ (2b)	1584(C=N),1073 (C-N), 825 (N-N), 1590 & 3000-3045(Ar-nu), 1170(C=S), 3080-2990 (Ar-OH)	3.3-2.9 (C_4-CH_2), 6.3 (C_5-CH), 7.4-6.3 (Ar-H), 7.4 (Ar-OH)
3	$C_{16}H_{13}SN_3Cl_2$ (2c)	1578(C=N), 1082(C-N), 814(N-N), 1599 &2995-3070(Ar-nu), 1183(C=S) ,773(C-Cl)	3.4-2.5 (C_4-CH_2), 6.1 (C_5-CH), 8.1-7.2 (Ar-H)
4	$C_{17}H_{17}SN_3O_2$ (2d)	1586(C=N), 1076(C-N), 813(N-N), 1603 & 3025-3074 (Ar-nu), 449(C=S), 3095-2990 (Ar-OH)	3.5-2.9 (C_4-CH_2), 5.9 (C_5-CH), 8.3-7.5 (Ar-H), 10.9-9.8 (Ar-OH)

III.RESULT AND DISCUSSION

As a result of our studies related to the development of synthetic protocols using microwave irradiation, we reported a novel and easy access to substituted 1-Thiocarbamoyl-3,5-diphenyl-2-pyrazoline. We reported in this paper some Claisen Schmidt condensation reaction between substituted acetophenone and substituted benzaldehyde in the presence of NaOH to give intermediate chalcones. Which undergo rapid cyclization with thiosemicarbazide under microwave irradiation to yield substituted 1-Thiocarbamoyl-3,5-diphenyl-2-pyrazoline(2a-d). The heterocyclic products were characterized on the basis of their IR, 1H-NMR and elemental analysis.

IV.CONCLUSION

In summary, this work demonstrates a rapid, efficient and environmentally friendly method of synthesis of substituted1-Thiocarbamoyl-3,5-diphenyl-2 pyrazoline under microwave heating, and the results obtained confirm that the use of microwave has shown the advantages like high yields, relatively short reaction times, low cost, simple experimental and isolation procedures, and finally, it is in agreement with the green chemistry protocols.

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