ISSN 2250-3153

Efficient Microwave-Assisted Synthesis and Antibacterial Activity of Some 1,2,4 trisubstituted Imidazolin-5-One

A. K. RATHOD

Department of Chemistry, Sevadal Mahila Mahavidyalaya, & Research Academy,
Nagpur – 440 009 (M.S.) INDIA

Abstract- A successful application of microwave irradiation has been studied in which series of different 2-aryl-4-arylidene-1-carboxymethyl-2-imidazolin-5-one (3a-f) were synthesized in high yield using a microwave method. More chemistry techniques have many advantages i.e. very rapid reactions, low energy, consumptions and safe operation, high yield, less time.

Index Terms- Synthesis of 1,2,4-trisubstituted imidazolin-5-one, microwave irradiations and antibacterial activity

I. INTRODUCTION

The nitrogen heterocycles have received considerable attention in recent years due to their biological and physiological activity. Their properties like central pervious system depressant [1] anticonvalsant [2] and monoamine inhibitors are of great significance. Amino acids are precursors of various macromolecules in biological systems [3] with a view to extend the scope and validity of these observations a new imidazolinones containing amino acids moiety is synthesized and screened for their antimicrobial activity.

In recent years, microwave irradiation using commercial domestic ovens has been rapidly increased for optimization and acceleration of organic synthesis under solvent free conditions [4-9]. It has been reported for the variety of reactions such synthesis of heterocycles[10] and more recently for synthesis of imidazolylpyrimidine[11], because of advantages such as reduction in reaction time, improved energy utilization, potential for lower processing temperature and improved product uniformity.

In conventional method, for the synthesis, several 1,2,4-trisubstituted imidazolynones and heated with the molar ration of saturated sodium carbonate solution was dissolved in (10ml) ethanol and rebluxed for 1 hr for effective condensation [12].

In microwave irradiation method, for the synthesis of 1,2,4-trisubstituted imidazolynones and heated with the saturated sodium carbonate solution was dissolved in (10ml) ethanol the reactions are completed within 3 min in equimolar proportions and almost in all the cases afford the product in high yields[12]. The products were characterized on the basis of their M.P., ^{1}HNMR, Elemental analysis and their Antimicrobial activity.

II. MATERIALS AND METHODS

All the synthesized heterocyclic compounds were purified by re-crystallization by using ethanol. The melting points were recorded on melting point apparatus in open capillaries and are uncorrected. All the purity of compounds was checked by TLC. All reaction were carried out in a commercially available IFB domestic microwave oven having a maximum power out put of 110 W operating at 2450 MHz. IR spectra were recorded in an a Perkin Elmer 1800 spectrophotometer using KBr discs, mass spectra were recorded on Finnigan MAT 8200 spectrophotometer, 'HNMR spectra were recorded using AC Bruker 300F. The nitrogen elements analyses were found to be within the permissible limits.

Method–A (Conventional)

Synthesis of 2-aryl-4-arylidene-1-carboxymethyl-2-imidazoline-5-one (3a-b)

2-aryl-4-aryldiene-4-carbethoxymethyl-2-imidazolin-5-one (2a-k) (0.01mole) (2.44g) was dissolved in ethanol (15ml) and heated with saturated sodium carbonate solution (10ml). The contents were refluxed on water bath for 1 hr. After refluxing it was cooled and acidified using dilute HCl. The product formed was filtered, washed with cold water, dried and followed by re-crystallization from ethanol.

Yield 48%, MP 250ºC

Method-B (Microwave Irradiations)

Synthesis of 2-aryl-4-arylidene-1-carboxymethyl-2-imidazoline-5-one (3a-b)

2-aryl-4-aryldiene-4-carbethoxymethyl-2-imidazolin-5-one(2a-k) (0.01mole), (2.44g) was dissolved ethanol (15ml) and heated with saturated sodium carbonate solution (10ml). The contents were thoroughly mixed. The reaction mixture was subjected to microwave irradiation in a commercially available IFB domestic microwave oven having a maximum power output of 110W. Operating at 2450 MHz intermittently at 30 sec. intervals for 3 min. After refluxing it was cooled and acidified using dilute HCl. The product formed was filtered washed with cold water, dried and followed by recrystallizatioin from ethanol (3a).

Yield 80%; wt. 1.95g; MP 250ºC

III. RESULTS AND DISCUSSION

The synthesis of 2-aryl-4-aryldiene-4-carboxymethyl-2-imidazolin-5-one (3a-f) were synthesized 2-aryl-4-aryldiene-4-carboxymethyl-2-imidazolin-5-one (2a-k) were dissolved in (10ml) ethanol and heated with sodium carbonate solution (10ml) was heated under reflux for 1 hr under conventional technique reflux for 3 min under microwave technique.

TABLE 1 : PHYSICAL DATA OF 1,2,4-TRISUBSTITUTED IMIDAZOLYNONES OF CONVENTIONAL METHOD 'A' (3a-f)

Compd	R^1	R^2	R^3	M.F.	M.P. ºC	Method-A yield/T %/h	N.Analysis F/(Calc.) (%)
3a	C_6H_5	CH_3	CH_2COOH	$C_{13}H_{12}N_2O_3$	250	48/1	11.3 (11.5)
3b	C_6H_5	C_6H_5	CH_2COOH	$C_{18}H_{14}N_2O_3$	198	46/1	9.2 (9.1)
3c	4-Cl- C_6H_4	C_6H_5	CH_2COOH	$C_{18}H_{13}N_2O_3Cl$	216	51/1	8.3 (8.1)
3d	4-OCH_3- C_6H_4	C_6H_5	CH_2COOH	$C_{19}H_{16}N_2O_4$	195	48/1	8.4 (8.1)
3e	2-Cl- C_6H_4	C_6H_5	CH_2COOH	$C_{18}H_{13}N_2O_3Cl$	198	47/1	8.3 (8.15)
3f	4-CH_3-C_6H_4	4-OCH_3- C_6H_4	CH_2COOH	$C_{19}H_{15}N_2O_3Cl$	190	48/1	7.8 (7.9)

TABLE 2: PHYSICAL DATA OF 1,2,4-TRISUBSTITUTED IMIDAZOLYNONES OF MICROWAVE IRRADIATION METHOD 'B' (3a-f)

Compd	R^1	R^2	R^3	M.F.	M.P. ºC	Method-B yield/T %/min	N.Analysis F/C (%)
3a	C_6H_5	CH_3	CH_2COOH	$C_{13}H_{12}N_2O_3$	250	80/2	11.3 (11.5)
3b	C_6H_5	C_6H_5	CH_2COOH	$C_{18}H_{14}N_2O_3$	198	82/2	9.2 (9.1)
3c	4-Cl- C_6H_4	C_6H_5	CH_2COOH	$C_{18}H_{13}N_2O_3Cl$	216	75/2	8.3 (8.1)
3d	4-OCH_3- C_6H_4	C_6H_5	CH_2COOH	$C_{19}H_{16}N_2O_4$	195	76/2	8.4 (8.1)
3e	2-Cl- C_6H_4	C_6H_5	CH_2COOH	$C_{18}H_{13}N_2O_3Cl$	198	76/2	8.3 (8.15)
3f	4-CH_3- C_6H_4	4-Cl_3- C_6H_4	CH_2COOH	$C_{19}H_{15}N_2O_3Cl$	190	79/2	7.8 (7.9)

^{1}HNMR for compound (3a) in (CDC/3/DMSO : δ ppm): 358 (S, 3H – OCH_3) 8 4.49 δ (S, 2H – CH_2), 9-8.2 δ (m, 9H, Δγ - H)
Mass for compound (3a); M/Z – 336 (M^+), 305, 291, 277, 162, 146, 134, 117, 105, 77

Antimicrobial activity

The compound (2a-3f) was tested for their antibacterial activity against E. Coli and S. typhimurium by Cup plate method at a concentration of 100 µg in acetone. Chloramphenicol was used as standard drug. The zone of inhibition was compared with the standard drug after 24 h of incubation at 37ºC for antimicrobial activity. Most of the compound showed good activity against the two bacterial strains. The activity of some of the compound is found to be very close to the standard drug.

IV. CONCLUSION

The proposed method is simple, precise, accurate, and rapid for the synthesis of medicinal compounds. It is now possible to carry out number of microwave organic synthesis. The use of MW technique can lead to substantial saving in time and high yield. Chloromphenol was used as a standard drug compared with the synthesized compound showed good activity against the too bacteria strains. The activity of the compound is found to be

close to the standard drug.

ACKNOWLEDGMENT

The authors are thankful to Dr. G. B. Kulkarni, Dr. Pradipkumar Dey (Registrar), Dr. Ramesh Bhandari (Dean) and Dr. Khatri Sir, Head, Dept. of Applied Science (Chem.), Jodhpur National University, Jodhpur for their guidance and providing the permission for research work.

I am equally thankful to Dr. Pravin Charde, Principal, Sevadal Mahila Mahavidyalaya and Research Academy, Nagpur, for his co-operation and providing the permission for research work.

REFERENCES

[1] S.S. Tiwari, R. Agarwal and R. K. Satsang, J. India Chem. Soc. 1980; 57, 10410.

[2] D. Mukherji, S. R. Nautiyi and C. R. Prasad, Indian Drugs, 1981; 18, 125.

[3] R. F. Borne, R. L. Peden, I. W. Watus, J. M. Weinem and M. Wall, J. Med. Chem. 15, 1925 (1972).

[4] (a) Ghiya B. J. and Lohiya S. B. Indian J. Chem. 1986;25B, 279.

(b) S. B. Lohiya Ph.D Thesis : Oxygen nitrogen containing heterocyclic compounds, their synthesis and mechanism of reaction, Nagpur University 1983.

[5] Ashok K. Rathod et al. Int. J. Pharm. Tech. Res. 2011;3(1), 197-200.

[6] Reimlinger H; Lingr W. R F and Vandewalle J J. M. Synthesis, 1970;2, 433 .

[7] Prabha V. s. and Sheshadri S; Indian Journal of Chemistry, 1985;24B, 137 .

[8] Rashed N, El Wassry A. M. El Ashry. El-Sayed H; Amer. A. and Zimmer H, Journal of Heterocyclic Chem. 1990;27, 691.

[9] Potls K. T., and Burter H. R, J. Org. Chem. 1996;31, 251.

[10] Moghilaiah K, Rama Sudhakar G. and Reddy N. V., Indian Journal of Chemistry, 1985;42B, 1753.

[11] R. S. Verma, Pure Appl. Chem. 2001;73, No.1, 193-198.

[12] Ashok K. Rathod et al. Ind. J. Pharm. Tech. Res. 2011; 3(1), 435-441 .

Author – A. K. RATHOD, Department of Chemistry, Sevadal Mahila Mahavidyalaya, & Research Academy, Nagpur – 440 009 (M.S.) INDIA, Email: ashokrathod1972@yahoo.in