Original Research Paper

Volume-9 | Issue-6 | June-2019 | PRINT ISSN No. 2249 - 555X

Chemistry

DEVELOPMENT OF A NEW GREEN PROTOCOL FOR THE BIGINELLI REACTION EMPLOYING READILY AVAILABLE CATALYSTS

S. R. Jagtap	Department Of Chemistry , Abeda Inamdar College, Affiliated to Savitribai Phule Pune University
Dr. B .B. Bahule*	Department Of Chemistry , Nowrosjee Wadia College, Affiliated to Savitribai Phule Pune University *Corresponding Author
R . P . Yadav	Department Of Chemistry , Nowrosjee Wadia College, Affiliated to Savitribai Phule Pune University
Khursheed Ahmad	Department Of Chemistry , Abeda Inamdar College, Affiliated to Savitribai Phule Pune University

ABSTRACT A new methodology is designed for the preparation of 1,2,3,4 tetra-hydro pyrimidine derivatives starting from the aromatic aldehyde in combination with ethyl acetoacetate , urea and catalyst like ammonium acetate, cetyl trimethyl ammonium bromide and tetra-decyl trimethyl ammonium bromide.

A three component condensation was carried out in ethanol . The reaction was completed in 1 hour at 80 °C . The products were isolated , purified by column chromatography and characterised by IR and PMR data. The catalysts used arecheaper , easily available and can be recovered, recycled .The pyrimidine derivatives thus obtained are expected to possess some biological activity by the virtue of pyrimidine moiety.

KEYWORDS : Biginelli reaction , Green protocol, dihydropyrimidin derivatives

Introduction

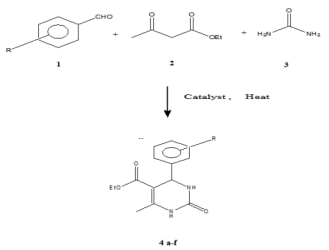
Biginelli reaction is a one pot , acid catalysed cyclocondensation of ethylacetoacetate , aromatic aldehyde and ureato produce 3,4-Dihydropyrimidin2(1H)-one [1]. The classical method has been modified inrecent past by employing various catalysts. The DHPMs possess a wide rangeof pharmacological activities. Many research groups have tried to improve the yield of this reaction by the application of different reagents such as Indium bromide [2] , boric acid [3], Ionic liquids [4] and potassium hydrogen sulphate [5] .Zeolite catalysed solvent free one pot synthesis of dihydropyrimidin 2(1H)-ones was reported [6]. Chloroacetic acid [7] was also used as a catalyst for the preparation of dihydropyrimidin derivatives. Titanium (IV) chloride [8]catalysed synthesis of dihydropyrimidones and thiones was also reported. Ruthenium (III) chloride [9] Yb (OTf) $_3$ [10] , silver salt of heteropolyacid (HPA) [11]were the catalysts employed.

In this connection, we would like to report the use of three catalysts for the Biginelli reaction. They are tetra-decyl trimethyl ammonium bromide, cetyl trimethyl ammonium bromide and ammonium acetate These catalyst are readily available and cheap and easy to handle. The yield of the dihydropyrimidin-2(1H)- ones is excellent .

Experimental

General Procedure : In a round bottomed flask benzaldehyde 1 gm (9.4 mmol) ,ethyl acetoacetate 1.22 gm (9.4 mmol) and urea 0.56 gm(9.4 mmol) were charged alongwith 20 ml ethyl alcohol.The reaction mixture was refluxed for 60 minutes and the course of the reaction was monitored by TLC. The Catalyst was removed by filtering the reaction mixture through the Whatmann filter paper. The removal of solvent furnished the crudedihydropyrimidin-2(1H)- one. The yield of the product was 2.62 gm , 80 % . The crude product was purified by column chromatography using Petroleum ether and ethyl acetate as eluent. Purified products were further characterised by spectral techniques like IR and PMR. .

Scheme 1



Results and Discussion

We herein report the one pot cyclo condensation reaction and the results are summarised in Table 1.

Table 1

Entry	R	Reaction Time Min.	% Yield	M.P. °C
4a	H	120	80	208
4b	3-NO_2	90	90	227-229
4c	4-OH	120	78	208-209
4d	4-NO_2	90	80	205-207
4e	4-Cl	120	72	210-211
4f	2-OCH_3	120	68	200

Catalyst used : tetra decyl trimethyl ammonium bromide, cetyl trimethyl ammonium bromide and ammonium acetate.

Spectral Data of compound - 4a

IR cm^{-1} : 3233, 3100,2940,1718,1697,1600,1200

^{1}H NMR (δ) $CDCl_3$ - 1.22 (t, J =7 Hz, 3H), 2.3 (s,3H) ,4.07(q, J=7 Hz,2H), 5.29 (s, 1H), 5.91 (s, 1H), 7.09 -7.21 (m,5 H), 8.28 (s, 2H)

Conclusion

The new methodology for the Biginelli reaction is developed using readily available catalysts like tetradecyl trimethyl ammonium bromide, cetyl trimethyl ammonium bromide and ammonium acetate . The reaction was carried out in ethanol solvent and the reaction is rapid , economical and efficient .The reaction is rapid , economical and efficient . The products are obtained in high yield and they can be readily purified and characterised.

Acknowledgements

The authors wish to thank the Principal of Nowrosjee Wadia College,Pune and Abeda Inamdar College,Pune for the infrastructural and administrative support. The help from Savitribai Phule Pune University for getting the spectral analysis of the samples is specially acknowledged. Finally we extend our thanks to the Head Department of Chemistry , Abeda Inamdar College for encouragement and help during the actual work of the scheme.

REFERENCES

1. Biginelli,P. Ber., (1893), 24, 1317
2 A. Debache, B. Boumoud, M. Amimour, A. Belfaitah, S. Rhouati, B. Carboni Tet. Lett. (2006),47 (32), 5697-5699.
3 Rammohan Pal , Arkivoc, (2018), Part I, 346-371.
4 Y.Zhang, B. Wang, , X. Zhang, J. Huang, C. Liu, Molecules, (2005),3, 20, 3811-3820.
5 S.Tu, F.Fang, S. Zhu, T.Li, X. Zhang, Q. Zhuang J. Het. Chem. (2009),41 (2).
6 Mukund G. Kulkarni, Sanjay W. Chavhan, Mahadev P. Shinde, Dnyaneshwar D.

Gaikwad, Ajit S. Borhade, Attrimuni P. Dhondge, Yunnus B.Shaikh, Vijay B. Ningdale, Mayur P.Desai and Deekshputra R.Birhade, Beilstein Journal of Organic chemistry , (2009), 5,4.
7 Yu, Y. , Liu, D. , Liu, C. , Luo, G.,Bioorg. & Medicinal Chem. Lett. (2007),17(12), 3508-3510.
8 Rahul R. Nagawade , S.A. Kotharkar, D.S. Shinde ., Mendeleev Communications , (2005), 15 (4), 150-151
9 Surya K. De , Richard A. Gibbs , Synthesis , (2005),11, 1231-1233.
10 Rui Kong, Shuai-Bo Han, Jing-Ying Wei, Xiao-Chong Peng, Zhen-Biao Xie, Shan-Shan Gong * and Qi Sun , Molecules , (2019), 24,2, 364.
11 Jhillu S. Yadav , Basi V. Subba Reddy , Pamu Sridhar Joolakanti S. S. Reddy , Kommu Nagaiah , Nakka Lingaiah , Potharaja S. Saiprasad, European Journal of Organic Chemistry , (2004), 3, 552-557.