COMMISSIONERATE OF COLLEGIATE EDUCATION

TELANGANA::HYDERABAD

CHECK LIST

(Details of Ph.D. Degree claimed to be obtained by Contract Faculty)

1	Name of the Faculty	Dr. B. PRAVEEN KUMAR
2	Name of the GDC & District	GOVT. DEGREE COLLEGE, BELLAMPALLY, DIST. MANCHERIAL.
3	Subject of Teaching	CHEMISTRY
4	Date of Award of Ph.D. Degree	19-11-2022 (Copy Enclosed)
5	Subject in which Ph.D obtained	CHEMISTRY
6	Whether Ph.D in Part time or Full time	PART TIME
7	Whether the faculty obtained NOC from CCETS to pursue Ph.D. Degree or not	NOC is not issued by CCE for that period (CCE Issued NOC from 2022) (G.O. Copy Enclosed)
8	Title of Ph.D Thesis	SYNTHESIS OF MEDICINALLY VALUE ADDED DRUG LIKE MOLECULES; 3,4-DIHYDROPYRIMIDINONES, BENZIMIDAZOLES, β-AMINOKETONES AND HOMOALLYLIC AMINES (Copies Enclosed)
9	Name and Address of the University from which Ph.D. Degree obtained	KAKATIYA UNIVERSITY, WARANGAL.
10	Ph.D Registration Number.	110001638(Registration Number vide Transfer Certificate Dated.12-01-2023)
11	Date of Notification of Ph.D. Admission	15-06-2010 (Notification copy enclosed)
12	Mode of Selection (Entrance Exam or NET/SET)	Entrance Exam
13	Date of Entrance Exam and Hall Ticket /Interview Call Letter	11-08-2010(as per notification dated 15-06-2010) Hall Ticket number 1179, call letter not enclosed
14	Date of Ph.D. Registration and Registration Certificate	18-01-2012 (orders copy enclosed)
15	Name of the Supervisor with Phone Number. and Designation, Department, Address	Dr J Madhukar-9346472838, Associate Professor of Chemistry, Dept. of Chemistry , Kakatiya University.
16	Supervisor Allotment Letter from the University	Orders dated 17-04-2012 (Copy Enclosed)
17	Research Paper Publications as part of your Ph.D. work	1.Zn acetate catalyzed synthesis of 3,4-dihydropyriminin-(1H)-ones 2. Facile and efficient synthesis of Benzimidazoles using zinc acetate. (Copies enclosed)
18	Date of Pre-Ph.D. Exam Marks Memo	Marks Memo of Pre-Ph.D enclosed 22-02-2013
19	Date of Viva Voce (of Ph.D.) & Intimation Letter	Viva Voce and intimation letter not issued (Press note enclosed)
20	Date of Ph.D. Award & Press note or published on website	19-11-2022 (Press Note Enclosed) Shodhganga Certificate enclosed
21	Any other related to Ph.D. Degree	1.Ph.D viva voce photo enclosed 2.Publication evidence Enclosed

*Note: Please submit the self-attested copies of all the related documents along with original Ph.D. Thesis bound copy.

Signature of the Faculty

12/11/2024

Principal

(with College Seal)

PRINCIPAL
Govt. Degree College
Bellampally, Dist: Mancherial.

EXAMINATION BRANCH
KAKATIYA UNIVERSITY
WARANGAL – 506 009 (TS) INDIA

No. 1032 /Ph.D./E1/KU/2022 Date: 19-11-2022

PRESS NOTE

Mr/Ms. **Praveen Kumar B**, Research Scholar in **Chemistry,** Kakatiya University, Warangal, who has presented the thesis entitled **"SYNTHESIS OF MEDICINALLY VALUE ADDED DRUG LIKE MOLECULES: 3,4-DIHYDROPYRIMIDINONES, BENZIMIDAZOLES, β-AMINOKETONES AND HOMOALLYLIC AMINES CATALYZED BY ZN ACETATE"** has been declared qualified for the Degree of **Doctor of Philosophy** (Ph.D.) in **Chemistry** of Kakatiya University.

"By Order"

CONTROLLER OF EXAMINATIONS

Copy forwarded for information to:

1. The Registrar, Kakatiya University, Warangal.
2. The Secretary, University Grants Commission, New Delhi-110 002.
3. The Editor, University News, A.I.U., 16 Kotla Marg, New Delhi-110 002.
4. The Dean, Faculty of Sciences, KU, Warangal.
5. The Coordinating Officer, U.G.C. Unit, Kakatiya University, Warangal.
6. The Principal, University College, Kakatiya University.
7. The Chairperson, Board of Studies in Chemistry, K.U., Wgl.
8. The Head, Department of Chemistry, KU, Wgl.
9. The E X A M I N E R.
10. **Dr. J. Madhukar** (Supervisor), Department of Chemistry, Kakatiya University, Warangal.
11. The Nodal Officer, Kakatiya University, Warangal.
12. The Member-in-Charge, University Library, Kakatiya University, Warangal.
13. The Deputy Registrar (Admn.), Kakatiya University, Warangal.
14. The Public Relations Officer, Kakatiya University, Warangal.
15. The Secretary to Vice-Chancellor, Kakatiya University, Warangal.
16. The Documentation Section (E5), Examination Branch, KU, Warangal.
17. The Person concerned (**Praveen Kumar B** S/D/o. **Mallaiah**).

(4255)

(B. Praveen Kumar)

Bl No - 37

OFFICE OF THE DEAN
Faculty of Science
Kakatiya University : : Warangal – 506 009 (A.P.), India

Prof. T. Bhaskar Rao
Dean

No. 429 /DFS/KU/2012

17th April, 2012

ORDERS

Sub: Faculty of Science - Ph. D. Admissions for the Year 2010-11 - Department of Chemistry - Orders – Issued
Ref: No. 403/DFS/KU/2011, dated 29-12-2011

* * *

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3.	Sudhakar Lavudya S/o Vaachya Lavudya	Dr. N. Vasudeva Reddy Synthesis of 1,2,3 – triazoles by using Cu(0) nano particles	Regular	19-01-2012
4.	K. Thirupathaiah S/o K. Brahmaiah	Prof. E. Raja Narender Synthesis, characterization of new heterocyclic substituted isoxazoles and development of synthetic methodologies	Part-time	18-01-2012
5.	Rajesh Kumar Gaddam S/o Sudhakar	Prof. Ch. Sanjeeva Reddy Synthesis and Pharmacological evaluation of linked and fused heterocyclic compounds	Regular	18-01-2012
6.	Rama Krishna Saini S/o Rayamallu Saini	Prof. E. Raja Narender Design, Synthesis and characterization of new isoxazole substituted heterocycles and their biological evaluation	Regular	18-01-2012
7.	Edulla Ravi Krishna S/o Jalaiah	Prof. V. Ravinder New applications of organo and organometallic catalysts in organic synthesis	Regular	18-01-2012

8.	Vani Devi Macherla D/o Sathyanarayana M	Prof. Ch. Sanjeeva Reddy Synthesis of novel linked and fused heterocycles as biologically potential molecules	Regular	11-01-2012
9.	Rajender Orsu S/o Ramulu	Dr. N. Vasudeva Reddy Synthesis and Evaluation of Biological activity of some Heterocyclic Compounds containing 1,2,3 – Triazole rings	Regular	12-01-2012
10.	Sreenivas Vasam S/o Veera Swamy Vasam	Prof. V. Ravinder Synthesis of new Schiff base Macrocyclic Transition Metal Complexes and their Catalytic Applications	Part-time	18-01-201
11.	L. Sanjeeva Rao S/o L. Rajeshwar Rao	Prof. Ch. Sanjeeva Reddy Design and synthesis of pharmacologically potential mono and bis heterocycles	Regular	11-01-201
12.	Parathasaradhi Y. S/o Vittal	Dr. T. Savitha Jyothsna Synthesis of 1,4-disubstiituted 1,2,3-Triazoles and evaluation of their biological activity	Regular	18-01-201
13.	Vinutha Kumari Chakilam D/o Satyanarayana	Prof. V. Ravinder Development of new chiral Schiff base metal complexes & their selective organic transformations	Part-time	18-01-201
14.	Gopi Iloni S/o Saraiah Iloni	Prof. V. Ravinder Designing of new organo and organometallic catalysts and their catalytic and biological applications	Regular	18-01-201
15.	Praveena D D/o Agama Rao	Prof. K. Mogilaiah Studies towards the synthesis of some new 1,8-Naphthyridines under non-traditional conditions	Regular	18-01-201
16.	Anjum Aara D/o Md. Abdul Rasheed	Prof. K. Mogilaiah Synthesis and bioactive nature of some new 1,8-naphthyridinyl heterocycles	Part-time	18-01-201
17.	Anjali Reddy S/o Laxmikanth Reddy	Prof. S. Jagannatha Swamy Designing, synthesis and characterization of new ligands for selective binding of some cations and anions and investigation of supramolecular interactions	Regular	19-01-201
18.	Shabana Sultana D/o Miraza Mahashik Baig	Prof. Ch. Sanjeeva Reddy Biological activities of metal complexes of bis-Schiffs bases	Regular	20-01-20

31.	Suresh Budde S/o Sambaiah	Dr. G. Brahmeshwari Organic transformations catalyzed by N-heterocyclic carbenes	Regular	21-01-2012
32.	Bhaskar Pittala S/o Somaiah	Dr. G. Brahmeshwari Synthesis of biologically active heterocyclic compounds	Regular	10-01-2012
33.	Venkateshwarlu Paka S/o Somaiah	Prof. E. Raja Narender Synthesis, characterization of some new isoxazolyl heterocycles and development of new methodologies	Regular	18-01-2012
34.	K. Shylaja D/o K. Anjaiah	Prof. V. Ravinder Synthesis and characterization of some transition metal complexes with biologically active Schiff bases	Regular	18-01-2012
35.	Nagashyam Velupula S/o Komuraiah Velupula	Dr. J. Madhukar Preparation and characterization of some transition metal complexes with new amide ligands	Regular	19-01-2012
36.	Chandra Mouleshwara Rao J S/o Rattaiah	Dr. J. Madhukar Synthesis and biological activity of heterocyclic compounds	Regular	18-01-2012
37.	Praveen Kumar B S/o Mallaiah	Dr. J. Madhukar Synthesis and biological studies of homo allylic alcohols, alkenes and quinolines	Part-time	18-01-2012
38.	Boche Srinivas S/o Yakaiah	Dr. G. Brahmeshwari Synthesis and evaluation of new heterocyclic moieties for possible biological activities	Regular	18-01-2012
39.	E. Jayanath Rani D/o Ganapathi	Dr. T. Savitha Jyostna Excess thermodynamic properties of liquid mixtures	Regular	19-01-2012
40.	Sri Sudha K D/o Saraiah	Heterocyclic compounds and development of new synthetic methodologies	Regular	19-01-2012
41.	Dharavath Nagaraju S/o Venkateshwarlu	Prof. E. Raja Narender Synthesis, characterization and biological screening of new isoxazole substituted heterocycles	Regular	18-01-2012
42.	Bhasker J S/o Mallaiah	Prof. V. Ravinder Designing of new synthetic organic methodologies using N-heterocyclic carbenes and their medicinal applications	Regular	18-01-2012
43.	Kusuma Banoth D/o Devalal	Prof. G. Dayakar Synthesis and antimicrobial evaluation of some imidazopyridine derivatives	Part-time	12-01-2012

19.	Dara Hari Prasad S/o Sambasiva Rao	Prof. K. Mogilaiah Synthesis and biological screening of some new 1,8 – naphthyridinyl heterocycles	Regular	18-01-2012
20.	Gampa Raghava Chary S/o Gampa Laxmanachary	Prof. G. Venkateshwara Rao Electro organic synthesis and photochemistry of synthetic organic compound drugs & natural products	Regular	12-01-2012
21.	Kumaraswamy Battula S/o Sailu	Prof. N. Vasudeva Reddy Click Chemistry : Synthesis of thiomorpholine linked 1,2,3-Triazoles – Investigation of pharmacological activity and synergetic effects	Regular	19-01-2012
22.	Kumaraswamy Gullapelli S/o Sambaiah Gullapelli	Dr. G. Brahmeshwari Synthesis and characterization of some new heterocyclic compounds	Regular	10-01-2012
23.	Kalyani Bandi D/o Agaiah	Prof. Ch. Sanjeeva Reddy Synthesis and biological evaluation of novel bis-heterocylic compounds	Regular	19-01-2012
24.	Sunitha B D/o Eeda Reddy	Prof. Ch. Sanjeeva Reddy Synthesis, biological and pharmacological evaluation of novel sulphur heterocycles	Regular	11-01-2012
25.	Thatipamula Ranjith Kumar S/o T. Gopala Krishna	Dr. N. Vasudeva Reddy Click Chemistry – Synthesis of N-hetero cyclic linked 1,2,3-triazoles and investigation of pharmacological activity	Regular	19-01-2012
26.	Venkanna Chinthala S/o Ramulu	Prof. K. Mogilaiah Synthesis of some new 1,8-naphthyridinyl heterocycles as potential biodynamic agents	Regular	18-01-201
27.	Sumalatha A D/o A. Sarangapani	Dr. N. Vasudeva Reddy Copper catalyzed synthesis of 1,2,3-Triazoles : Study of their applications on biological system	Regular	17-01-201
28.	Godishala Ramesh S/o Ailaiah	Dr. T. Savitha Jyotsna Excess thermodynamic properties of liquid mixtures	Part-time	20-01-20
29.	Seeka Suresh S/o Venugopala Rao	Dr. T. Savitha Jyotsna Synthesis of 1,2,3-Triazoles and evaluations of their antimicrobial activity	Regular	18-01-20
30.	Sowjanya G D/o G. Prabhakar	Dr. T. Savitha Jyotsna Excess thermodynamic properties of liquid mixtures	Regular	19-01-20

44.	Seelam Venkata Reddy S/o Kota Reddy	Dr. B. Vijay Kumar Synthesis of new phenoxazone derivatives as potent anti-hyperglycemic and hypolipidemic agents	Regular	19-01-2012
45.	Srinivas Bandari S/o Mallaiah B	Dr. M. Ravinder Studies on synthesis and anti-microbial activity of novel fused heterocycles containing quinoxalines	Regular	19-01-2012

DEAN

(B. Praveen Kumar)

GOVERNMENT OF TELANGANA
HIGHER EDUCATION (CE) DEPARTMENT

Memo.No.1117 /CE/A1/2022

Dated:19.09.2022

Sub: Collegiate Education – Contract Lecturers working in Government Degree Colleges - Fulfilment of required eligibility qualification - Issue of no objection certificate to them for joining Ph.D. course in any UGC recognised university – Regarding.

Ref: From the President, TS Govt., College Contract Lecturers Association, Representation Dt.15.07.2022.

* * *

A copy of the reference cited is sent herewith to the Commissioner of Collegiate Education, Telangana State, Hyderabad and he is requested issue NOC for registering of PHD.

KARUNA VAKATI
SECRETARY TO GOVERNMENT

To
The Commissioner of Collegiate Education,
Telangana State, Hyderabad.[w.e.]

//FORWARDED::BY ORDER//

Kakatiya University

4255

No. 0990

PROVISIONAL CERTIFICATE
Ph.D.

This is to certify that Praveen Kumar B

Son/Daughter of Mallaiah has been declared qualified for the award of the Ph.D. Degree in Chemistry of this University in November, 2022.

Topic of Thesis:

"SYNTHESIS OF MEDICINALLY VALUE ADDED DRUG LIKE MOLECULES: 3,4-DIHYDROPYRIMIDINONES, BENZIMIDAZOLES, β-AMINOKETONES AND HOMOALLYLIC AMINES CATALYZED BY ZN ACETATE"

Warangal T.S. - 506 009
Date: 02-12-2022

for Registrar

(B Praveen Kumar)

UNIVERSITY COLLEGE

KAKATIYA UNIVERSITY
Vidyaranyapuri, WARANGAL - 506 009.
TELANGANA STATE

BONAFIDE CERTIFICATE

No. 5321 Date : 12-Jan-23

This is to certify that PRAVEEN KUMAR B

Son/Daughter of Sri MALLAIAH

Hall Ticket No. 110001638 is/was a student of this College

Studying in Ph. D. IN CHEMISTRY during the academic

Year 2012-2022

Principal
University College
Kakatiya University
Warangal-506 009 T.S.

UNIVERSITY COLLEGE

KAKATIYA UNIVERSITY
Vidyaranyapuri, WARANGAL - 506 009.
TELANGANA STATE

TRANSFER CERTIFICATE

TC No. 233 Date : 12-Jan-23

Registration No. 110001638

Name of the Student PRAVEEN KUMAR B

Father's Name MALLAIAH

Date of Birth 01.04.1979
FIRST APRIL NINTEEN SEVENTY NINE

Place of Birth KARIMNAGAR

Date of Admission 18.01.2012

Date of Leaving 19.11.2022

Subject Ph. D. IN CHEMISTRY

Social Status SC

Conduct SATISFACTORY

General Remarks ----NIL----

Principal
University College
Kakatiya University
Warangal-506 009 T.S.

B Praveen Kumar

KAKATIYA UNIVERSITY, WARANGAL (A.P.)

Notification for Ph. D. Eligibility Test – 2010-11

Applications are invited for registration to Ph.D. Eligibility Test 2010-11 in the faculties of Arts, Commerce & Business Management, Education, Engineering & Technology, Law, Pharmaceutical Sciences, Science and Social Sciences. The candidates must have passed the Master's Degree in the concerned subject with a minimum of 55% marks (50% in the case of SC/ST/PH Candidates). Application Form and Information Brochure can be obtained from the Director, Directorate of Admissions, Kakatiya University, KU Campus, Warangal (A.P.) by paying Rs.50/- in cash. The filled in application along with necessary enclosures and a demand draft towards registration fee Rs.500/- for each Subject (for SC/ST/PH Candidates Rs.300/-) should reach **the Director, Directorate of Admissions, Kakatiya University, Warangal (A.P.)–506 009 on or before 17-7-2010 without Late Fee.**

Important Dates:

1. Sale of Application Forms commences from : 18-6-2010 (11.00 a.m. to 5.00 p.m.)
2. Last date for Receiving of Application Forms...
   - i. Without Late Fee : 17-7-2010
   - ii. With late fee of Rs.100/- : 24-7-2010
3. Date of Eligibility Test : 11-8-2010

(Time & Test Center will be informed through Hall – Ticket)

For further details visit the Website: www.kakatiya.ac.in

Note: 1. Candidates with M. Phil. in concerned or in an allied subject from Kaktiya University and those admitted to M. Phil. in regular stream through entrance test and completed from other Universities in A.P. OR those who have qualified in UGC-NET / CSIR-UGC NET / AP-SLET / Candidates with valid GATE Score need not go through this Eligibility Test. They can apply directly to Ph.D. Admission for which Notification will be issued later. **2.** Combined Test will be conducted for Commerce & Business Management Subjects.

Dt. 15-6-2010

Sd/-
REGISTRAR

KAKATIYA UNIVERSITY

Warangal - 506 009. (A.P.)

ORIGINAL

Hall - Ticket for Ph.D. Eligibility Test - 2010-11

SUBJECT : Chemistry

HALL TICKET NO. : 1179

1. Name of the Candidate : B. PRAVEEN KUMAR
2. Father's Name : MALLAIAH
3. Identification Marks : A mole on the neck

Signature of the Candidate

Director

B Praveen kumar

OFFICE OF THE DEAN

Faculty of Science

Kakatiya University : : Warangal – 506 009 (A.P.), India

Prof. T. Bhaskar Rao
Dean

No. 429 /DFS/KU/2012

17th April, 2012

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20.	Gampa Raghava Chary S/o Gampa Laxmanachary	Prof. G. Venkateshwara Rao Electro organic synthesis and photochemistry of synthetic organic compound drugs & natural products	Regular	1
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27.	Sumalatha A D/o A. Sarangapani	Dr. N. Vasudeva Reddy Copper catalyzed synthesis of 1,2,3-Triazoles : Study of their applications on biological system	Regular	17-
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29.	Seeka Suresh S/o Venugopala Rao	Dr. T. Savitha Jyotsna Synthesis of 1,2,3-Triazoles and evaluations of their antimicrobial activity	Regular	18-0
30.	Sowjanya G D/o G. Prabhakar	Dr. T. Savitha Jyotsna Excess thermodynamic properties of liquid mixtures	Regular	19-0

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32.	Bhaskar Pittala S/o Somaiah	Dr. G. Brahmeshwari Synthesis of biologically active heterocyclic compounds	Regular	[illegible]
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34.	K. Shylaja D/o K. Anjaiah	Prof. V. Ravinder Synthesis and characterization of some transition metal complexes with biologically active Schiff bases	Regular	[illegible]
35.	Nagashyam Velupula S/o Komuraiah Velupula	Dr. J. Madhukar Preparation and characterization of some transition metal complexes with new amide ligands	Regular	[illegible]
36.	Chandra Mouleshwara Rao J S/o Rattaiah	Dr. J. Madhukar Synthesis and biological activity of heterocyclic compounds	Regular	[illegible]
37.	Praveen Kumar B S/o Mallaiah	Dr. J. Madhukar Synthesis and biological studies of homo allylic alcohols, alkenes and quinolines	Part-time	[illegible]
38.	Boche Srinivas S/o Yakaiah	Dr. G. Brahmeshwari Synthesis and evaluation of new heterocyclic moieties for possible biological activities	Regular	18-01-2012
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45.	Srinivas Bandari S/o Mallaiah B	Dr. M. Ravinder Studies on synthesis and anti-microbial activity of novel fused heterocycles containing quinoxalines	Regular	19-01-

D

(B. Praveen Kumar)

Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2018, 10(5): 132-13

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPR

Zinc (II) Acetate Catalyzed Synthesis Of 3,4-Dihydropyrimidin-2(1H)-On

Praveen Kumar Bonkuri and Madhukar Jeripothula*

Department of Chemistry, Kakatiya University, Warangal-506001(T.S), India

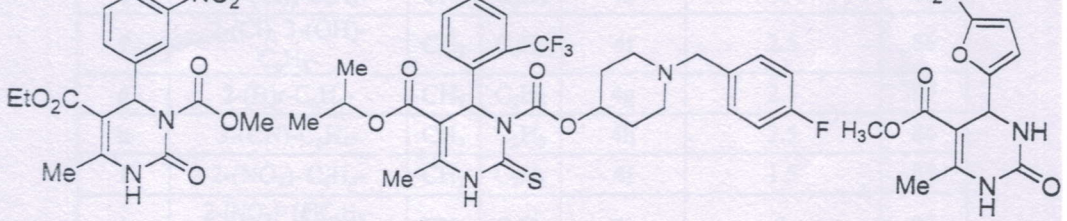
ABSTRACT

An efficient and new protocol for the synthesis of 3,4-dihydropyrimidin-2(1H)-ones (DHPMs) 4(a-m) has developed by using Zn(OAc)2 as a catalyst. This is one of the useful new catalyst that can be easily separated are not contaminated by products. This method offers several advantages including high yields, short reaction ti simple work up procedure and easy isolation.

Keywords: Aromatic aldehyde; Ethyl acetoacetate; Urea; Dihydropyrimidinones; Zinc acetate

INTRODUCTION

The Biginelli reaction is a well-known, simple and straightforward procedure for the synthesis dihydropyrimidinones (DHPMs) by the three component condensation of aliphatic or aromatic aldehydes, ketoesters and urea. The original reaction was first reported by Pietro Biginelli in 1983 and was catalyzed by min acids[1,2]. These DHPMs are very interesting due to their wide spectra of biological activities and are used a starting point to prepare complex heterocyclic scaffolds with pharmacological properties such as calcium chan blockers, mitotic kinesin inhibitors, antiviral, antibacterial, antifungal and anticancer activities [3-8] (Figure 1).



Ca^{+2} channel blocker **antihypertensive agent** **Antiviral**

Figure 1: Examples of biologically active DHPMs

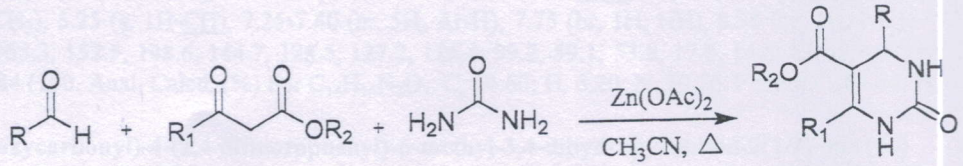
In order to improve the reaction yields or the scope of reaction numerous catalysts have been employed. Some which could be mentioned here such as acid catalysts $InBr_3$, $InCl_3$, LiBr, $LiClO_4$, $CaCl_2$, $Ca(OTf)_3$, $LaCl_3$, La(OT $BiCl_3$, $FeCl_3.6H_2O$, $BF_3.OEt_2$, $KHSO_4$, $ZnCl_2$ etc., [9-14] and by means of green chemistry processes like solve free conditions microwave irradiation ultrasound irradiation and ionic liquids[15-18]. However, some metho suffered from drawbacks like low yield, longer reaction time, toxic reagents, expensive and involve difficult produ

isolation procedures. Moreover, some of the methods are only practical for aromatic aldehydes. As pa research program in developing various synthetic methodologies, herein we report, the Biginelli condensat Zinc (II) Acetate $Zn(OAc)_2$ as an efficient catalyst. The catalyst $Zn(OAc)_2$ is known as an efficient catal literature for various organic transformations [19-22]. In this article we wish to report a simplified synthetic procedure with high atom economy for the Biginelli reaction.

EXPERIMENTAL SECTION

General Methods

All commercial reagents were used without purification and all solvents were reagent grade. All the mixtures were stirred magnetically and were monitored by TLC using 0.25 mm E-Merck silica gel $60F_{254}$ glass plates, which were visualized with UV light. Melting points were recorded on Buchi R-535 appa spectra are recorded in KBr pellets on Nexus-670 spectrophotometer. ^{1}H NMR spectra are recorded on B MHz spectrophotometer using TMS as an internal standard [13]. CNMR spectra are recorded on Bruker spectrophotometer and ESI-Mass spectra are obtained on shimadzu mass spectrophotometer.



1(a-m) 2 3 4(a-m)

R=Aromatic, heteroaromatic R_1=CH_3 R_2=C_2H_5 **Scheme 1**

Table 1: Zinc (II) acetate catalyzed synthesis of DHPMs 4(a-m)

Entry	R	R^1	R^2	Product[a]	Reaction Time (h)	Yield (%)[b]
a	C_6H_5	CH_3	C_2H_5	4a	1	90
b	2,4-$(F)_2$-C_6H_3-	CH_3	C_2H_5	4b	1.5	88
c	2,4,5-$(F)_3$-C_6H_2-	CH_3	C_2H_5	4c	1.5	87
d	*O*-$(F)_3$-C_6H_2-	CH_3	C_2H_5	4d	2	86
e	2,4-$(Cl)_2$-C_6H_3-	CH_3	C_2H_5	4e	2	87
f	2-(Cl), 3-(OH)-C_6H_3-	CH_3	C_2H_5	4f	2.5	86
g	2-(B)r-C_6H_4-	CH_3	C_2H_5	4g	2.5	85
h	3-(CN)-C_6H_4-	CH_3	C_2H_5	4h	2.5	84
i	2-(NO_2)-C_6H_4-	CH_3	C_2H_5	4i	1.5	85
j	2-(NO_2)-(*E*)C_6H_5-CH=CH-	CH_3	C_2H_5	4j	3	87
k	4-(MeO)-C_6H_4-	CH_3	C_2H_5	4k	1	90
l	4-$(H_3C)_2C$-C_6H_4-	CH_3	C_2H_5	4l	1	89
m	2-Thienyl-	CH_3	C_2H_5	4m	1.5	86

[a]All the products were characterized by ^{1}H NMR, IR and Mass spectra data
[b]Isolated and unoptimized yields

General procedure for the synthesis of 3,4-dihydropyrimidin-2(1*H*)-ones 4(a-m)

To a stirred mixture of aromatic aldehyde (2 mmol) and ethyl acetoacetate (2.2 mmol) in acetonitrile (5 m added Urea (3 mmol) and zinc acetate (0.3 mmol). The resulting reaction mixture was refluxed for a specifie as mentioned in the Table 1 After complete conversion of the starting material (aldehyde) as indicated by thi chromatography, the reaction mixture was cooled to room temperature, poured into water and extracted with three times (3 × 20 ml). The combined organic layers were washed with brine dried over anhydrous Na_2SO_4 organic layer was concentrated to obtain the crude product. The crude product was purified by recrystall (Ethyl acetate) to give pure products 4(a-m). Formation of 4(a-m) was confirmed by their elemental and s data analysis (**Scheme 1**).

Spectral Data for all the Compounds

5-Ethoxycarbonyl-4-(4-phenyl)-6-methyl-3,4-dihydropyrimidin-2-(1*H*)-one (4a)

Solid, mp, 201-203°C. IR (KBr): υ_{max} cm^{-1}: 3416, 3231, 3108, 2936, 2867, 1701, 1648, 1592, 1241, 1129, 103 834. ^{1}H NMR (DMSO-d_6): δ 1.15 (t, 3H, *J*=7.0 Hz, $OCH_2\underline{CH_3}$), 2.32 (s, 3H, $\underline{CH_3}$), 4.05 (q, 2H, *J*=7 $O\underline{CH_2}CH_3$), 5.25 (s, 1H-$\underline{CH}$), 7.25-7.40 (m, 5H, Ar-H), 7.75 (br, 1H, NH), 8.98 (br, 1H, NH).; ^{13}C NMR (D d_6): δ 165.3, 152.5, 148.6, 144.7, 128.5, 127.2, 126,4, 99.2, 59.1, 53.8, 17.6, 14.3. EIMS *m/z* (%): 260 (m^+1 (42), 184 (100. Anal. Calcd. (%) For $C_{14}H_{16}N_2O_3$: C, 64.60; H, 6.20; N, 10.76. Found: C, 64.64; H, 6.25; N, 1

5-(Ethoxycarbonyl)-4-(2,4-difluorophenyl)-6-methyl-3,4-dihydropyrimidin-2(1*H*)-one (4b)

Solid, mp 182-184°C. IR (KBr) υ_{max} cm^{-1}: 3255, 1740, 1650. ^{1}H NMR (200 MHz, $CDCl_3$) δ: 1.18 (t, 3H, OCH 2.39 (s, 3H, $\underline{CH_3}$), 4.10 (q, 2H, $O\underline{CH_2}CH_3$), 5.7 (s, 1H,-$\underline{CH}$), 6.1 (s, 1H, NH), 6.75-6.90 (m, 2H, Ar-H), 7.4 (Ar-H), 8.6 (s, 1H, NH). ^{13}C NMR (200 MHz, $CDCl_3$) δ: 14.63, 18.98, 56.44, 61.35, 101.89, 122.78, 135.66, 155.37, 158.67, 159.65, 165.90. ESI-MS, m/z 297 $[M+H]^{+1}$, 255. Anal. Calcd for $C_{14}H_{14}F_2N_2O_3$; C, 56.76; H N, 9.46. Found C, 56.72; H, 4.78; N, 9.43.

5-(Ethoxycarbonyl)-4-(2,4,5-trifluorophenyl)-6-methyl-3,4-dihydropyrimidin-2(1*H*)-one (4c)

Solid, mp. 217-220°C. IR (KBr) υ_{max} cm^{-1}: 3253, 1741, 1652. ^{1}H NMR (200 MHz, $CDCl_3$) δ: 1.19 $OCH_2\underline{CH_3}$), 2.40 (s, 3H, $\underline{CH_3}$), 4.10 (q, 2H, $O\underline{CH_2}CH_3$), 5.6 (s, 1H,-$\underline{CH}$), 6.7 (s, 1H, NH), 6.8-6.9 (m, 1H, 7.08-7.10 (m, 1H, Ar-H), 8.9 (s, 1H, NH). ^{13}C NMR (200 MHz, $CDCl_3$) δ: 13.22, 17.45, 28.72, 47.95, 58.90, 104.35, 104.73, 105.01, 115.51, 115.84, 148.59, 151.54, 164.48. ESI-MS, m/z 315 $[M+H]^{+1}$. Anal. Ca $C_{14}H_{13}F_3N_2O_3$; C, 53.51; H, 4.71; N, 8.91. Found C, 53.48; H, 4.69; N, 8.94.

5-(Ethoxycarbonyl)-4-(α, α, α-trifluorophenyl)-6-methyl-3,4-dihydropyrimidin-2(1*H*)-one (4d)

Solid, mp. 182-184°C. IR (KBr) υ_{max} cm^{-1}: 3255, 1740, 1650. ^{1}H NMR (200 MHz, $CDCl_3$) δ: 3H, $OCH_2\underline{CH_3}$), 2.25 (s, 3H, $\underline{CH_3}$), 4.0 (q, 2H, $O\underline{CH_2}CH_3$), 5.25 (s, 1H,-$\underline{CH}$), 5.4 (s, 1H, NH), 7.60 (s, 4H, 9.2(s, 1H, NH). ^{13}C NMR (200 MHz, $CDCl_3$) δ: 12.25, 16.22, 52.28, 57.54, 97.10, 120.82, 121.42, 121.47, 122.11, 122.15, 124.16, 127.08, 127.53, 128.43, 131.17, 144.47, 147.18, 150.44, 156.28, 163.46. ESI-MS, $[M+H]^{-1}$. Anal. Calcd for $C_{15}H_{15}F_3N_2O_3$; C, 54.88; H, 4.61; N, 8.53. Found C, 54.90; H, 4.64; N, 8.49.

5-(Ethoxycarbonyl)-4-(2,4-dichlorophenyl)-6-methyl-3,4-dihydropyrimidin-2(1*H*)-one (4e)

Solid, mp. 218-220°C. IR (KBr) υ_{max} cm^{-1}: 3430, 3340, 1710, 1668, 1358, 1276. ^{1}H NMR (200 MHz, $CDCl_3$) (t, 3H, $OCH_2\underline{CH_3}$), 2.25 (s, 3H, $\underline{CH_3}$), 3.90 (q, 2H, $O\underline{CH_2}CH_3$), 5.60 (s, 1H, $\underline{CH}$), 7.22-7.40 (m, 2H, Ar-H), 1H, Ar-H), 7.65 (s, 1H, NH), 9.30 (s, 1H, NH). ^{13}C NMR (200 MHz, $CDCl_3$) δ: 14.52, 57.66, 61.05, 103.27, 127.34, 128.62, 131.44, 132.53, 144.22, 160.11, 163.26, 177.43. ESI-MS, m/z 329 $[M+H]^{+1}$. Anal. Ca $C_{14}H_{14}Cl_2N_2O_3$; C, 51.08; H, 4.29; N, 8.51. Found C, 51.11; H, 4.31; N, 8.60.

5-(Ethoxycarbonyl)-4-(2-chloro-3-hydroxyphenyl)-6-methyl-3,4-dihydropyrimidin-2(1*H*) one (4f)

Solid, mp. 248-250°C. IR (KBr) υ_{max} cm^{-1}: 3429, 3341, 1711, 1667, ^{1}H NMR (200 MHz, $CDCl_3$) δ: 1.05 $OCH_2\underline{CH_3}$), 2.41 (s, 3H, $\underline{CH_3}$), 4.0 (q, 2H, $O\underline{CH_2}CH_3$), 5.81 (s, 1H, $\underline{CH}$), 6.25 (s, 1H, NH), 6.8 (d, 1H, Ar-H (d, 1H, Ar-H), 7.15 (t, 1H, Ar-H), 8.85 (s, 1H, NH), 9.4 (s, 1H, OH). ESI-MS, m/z 311 $[M+H]^{+1}$. Anal. C $C_{14}H_{15}ClN_2O_4$; C, 54.11; H, 4.87; N, 9.02. Found C, 54.04; H, 4.90; N, 9.09.

5-Ethoxycarbonyl-6-methyl-4-(2-bromophenyl)-3,4-dihydropyrimidin-2(1*H*)-one (4g)
Solid, mp 240-242°C. IR (KBr) υ_{max} cm^{-1}: 3430, 3340, 3220, 1690, 1636, ^{1}H NMR (200 MHz, DMSO-d_6) δ: 1 3H, $OCH_2\underline{CH_3}$), 2.40 (s, 3H, CH_3), 4.0 (q, 2H, $O\underline{CH_2}CH_3$), 5.80 (s, 1H, CH), 6.20 (s, 1H, NH), 7.15 (m, 1H, 7.3.(d, 2H), 7.55 (d,1H) , 8.9 (s, 1H, NH). ^{13}C NMR (200 MHz, DMSO-d_6) 17.7, 50.6, 53.9, 98.1, 122.1, 128.6, 129.3, 132.6, 143.2, 149.3, 151.2, 165.4. ESI-MS m/z 339 $[M+H]^+$. Anal. Calcd for $C_{14}H_{15}BrN_2O_3$; C, H, 4.46; N, 8.26. Found C, 49.61; H, 4.42; N, 8.30.

5-Ethoxycarbonyl-6-methyl-4-(3-cyanophenyl)-3,4-dihydropyrimidin-2-(1*H*)-one (4h)
Solid. mp 228-230°C; IR (KBr) υ_{max} cm^{-1}: 3219, 2975, 2227, 1697, 1634, 1454, 1385, 1363, 1251, 1200, 1019, 935, 825, 756. ^{1}H NMR (200 MHz, DMSO-d_6) δ: 1.07 (t,3H, $OCH_2\underline{CH_3}$), 2.25 (s, 3H, CH_3), 3.97 ($O\underline{CH_2}CH_3$), 5.21 (s,1H, CH), 7.42 (d, 2H), 7.80 (d, 2H), 7.88 (s, 1H, NH), 9.33 (s, 1H, NH). ^{13}C NMR (200 DMSO-d_6) δ: 14.5, 18.3, 54.3, 59.8, 98.7, 110.5, 119.2, 127.8, 133.0, 149.8, 150.5, 152.3, 165.6. ESI-MS m/ $[M+H]^+$. Anal. Calcd for $C_{15}H_{15}N_3O_3$; C, 63.15; H, 5.30; N, 14.73. Found C, 63.09; H, 5.35; N, 14.68.

5-(Ethoxycarbonyl)-4-(2–nitrophenyl)-6-methyl-3,4-dihydropyrimidin-2(1*H*)-one (4i)
Solid, mp. 238-240°C. IR (KBr) υ_{max} cm^{-1}: 3338, 3289, 2996, 1685, 1572, 1355, 1310. ^{1}H NMR (200 MHz, C δ: 1.14 (t, 3H, CH_3), 1.98 (s, 3H, CH_3), 4.15 (q, 2H, $CH_3\underline{CH_2}O$), 5.15 (s, 1H, CH), 6.8–7.38 (m, 4H, Ar–H), 7. 1H, NH), 9.35 (s, 1H, NH). ^{13}C NMR (200 MHz, $CDCl_3$) δ: 18.37, 56.36, 60.44, 101.48, 123.21, 125.72, 1 130.26, 130.83, 142.77, 159.61, 161.12, 175.87. ESI-MS m/z 306 $[M+H]^+$. Anal. Calcd for $C_{14}H_{15}N_3O_5$; C, H, 4.95; N, 13.76. Found C, 55.11; H, 4.89; N, 13.80.

5-Ethoxycarbonyl-4-((E)$_2$-Phenylethyl-4-nitro)-6-methyl-3,4-dihydropyrimidine-2(1*H*)-one (4j)
Solid, mp. 216-218°C. IR (KBr) υ_{max} cm^{-1}: 3354, 3262, 2983, 2854, 1695, 1656, 1495, 1372, 1224, 1163, 785 ^{1}H NMR (200 MHz, $CDCl_3$) δ: 1.30 (t, 3H, CH_3), 2.30 (s, 3H), 4.25 (q, 2H), 5.0 (s, 1H), 6.40 (d, 1H), 6.6 (s 7.10(s, 1H, NH), 7.50 (s, 1H), 7.65 (t, 3H), 8.15 (s, 2H), 8.9 (s, NH), 18.96 (s, 1H, NH). ESI-MS, m/z 332 [M+ 286 (M+17). Anal. Calcd for $C_{16}H_{17}N_3O_5$; C, 58.00; H, 5.17; N, 12.68. Found C, 57.98; H, 5.20; N, 12.70.

5-(Ethoxycarbonyl)-6-methyl-4-(4-methylphenyl)-3,4-dihydropyrimidin-2(1*H*)-one (4k)
Solid, mp.198-200°C. IR (KBr) υ_{max} cm^{-1}: 3246, 3115, 2955, 1704, 1647, 1513, 1461, 1422, 1386, 1328, 1222, 1172, 1087, 952, 865, 779, 699, 67 cm^{-1}.; ^{1}H NMR (200 MHz, $CDCl_3$) δ: 1.20 (t, 3H CH_3), 2.32 (s, 6H 4.08 (q, 2H CH_2), 5.30 (s, 1H CH), 6.95 (s, 1H, NH) 7.10-7.24 (m, 4H ArH), 8.85 (s, 1H NH), ESI-MS, m/ $[M+H]^{+1}$. 274.37 (M+). Anal. Calcd. for $C_{15}H_{18}N_2O_3$: C, 65.68; H, 6.61; N, 10.21. Found: C, 65.61; H, 6.6 10.17.

5-(Ethoxycarbonyl)-4-(iso-propyl)-6-methyl-3,4-dihydropyrimidin-2(1*H*)-one(4l)
Solid, mp. 160-162°C. IR (KBr) υ_{max} cm^{-1}: 3240, 3117, 2961, 2608, 2522, 1771, 1740, 1703, 1644, 927, 759 ^{1}H NMR (200 MHz, $CDCl_3$): δ 0.76-0.81 (m, 6H, CH_3), 1.07 (t, 3H, CH_3), 1.69 (m, 1H), 2.19 (s, 3H, CH_3), 4.0 2H, CH_2CH_3), 4.89 (s, 1H, NH), 7.54 (s ,1H), 9.00 (s, 1H, NH). ESI-MS, m/z 303 226.21 $[M+H]^{+1}$. Anal. Calc $C_{17}H_{22}N_2O_3$: C, 67.53; H, 7.33; N, 9.26. Found C, 67.49; H, 7.30; N, 9.31.

5-Ethoxycarbonyl-4-(2-thienyl)-6-methyl-3,4-dihydropyrimidine-2(1*H*)-one (4m)
Solid, mp. 225-227°C. IR (KBr) υ_{max} cm^{-1}: 3245, 3234, 3164, 3120, 3043, 2979, 2946, 1718, 1689, 1632, 1462, 1251, 1065, 851, 745. ^{1}H NMR (200 MHz, $CDCl_3$) δ: 1.25 (t, 3H-OCH_2CH_3), 2.30 (s, 3H, CH_3), 4.15 (CH_2CH_3), 5.6 (s, 1H, NH), 6.9-7.3 (m, 4H-Ar-H), 8.9 (s, 1H, NH), ESI-MS, m/z 287 $[M+H]^{+1}$. 266 (M+ 80). Calcd. for $C_{12}H_{14}N_2O_3S$: C, 54.12; H, 5.30; N, 10.52. Found: C, 54.18; H, 5.28; N, 10.54.

RESULTS AND DISCUSSION

In this article we have used a new protocol to Biginelli reaction and synthesized 3,4-di hydropyrimidin-2(1*H*) 4(a-m) in good yields by using new catalyst $Zn(OAc)_2$. All the reactions were carried out in acetonitrile. Synthe DHPMs 4(a-m) involves one-pot three component condensation reaction between aromatic aldehydes 1(a-m), acetoacetate 2 and urea 3. To confirm the catalyst role, a blank experiment was carried out with ethyl acetoac benzaldehyde and urea in acetonitrile at reflux temperature, without using the catalyst. There was no pr formation even after 20 hours. In another experiment, the catalyst was used in equivalent and stirred at

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Research Article

Facile and Efficient Synthesis of Benzimidazoles Using Zinc Acetate

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Keywords: Benzimidazoles, aldehydes, orthophenylenediamine, Zinc Acetate.

ABSTRACT

Benzimidazoles have been efficiently synthesized in high yields by treatmen 1,2-phenylenediamine with aldehydes using Zinc acetate in acetonitrile. absolute testing was carried out with ortho-phenylenediamine and 3, trimethoxy benzaldehyde in the absence of the catalyst zinc acetate and essential 3,4,5-trimethoxy benzimidazole product was not establish even a stirring for 15 hours.Aromatic aldehydes responded very well to afford consistent products of benzimidazole derivatives in very good to outstand yields. In overall, the aromatic aldehydes having electron donating groups electron withdrawing groups are reacting very healthy.

1. Introduction

The Benzimidazole moiety is found in various bioactive compounds having antiviral, antiulcer, antihypertension and anti-cancer properties. Benzimidazoles are precise impotent intermediates in synthetic ways and helps as ligands for irregular catalysts [1-8]. The great contour of biological presentations of the benzimidazole compounds has provoked widespread studies of their synthesis. Therefore, various efforts have remained completed to synthesize benzimidazole derivatives. The most common methods for the preparation of benzimidazole derivatives contains the reduction of an ortho-phenylenediamines and carbonyl compounds. The reduction of ortho-phenylenediamine with carboxylic acid often needs strong acidic settings and high temperatures. [9,10] The other method includes the oxidative cyclo-dehydrogenation of Schiff bases, which is generated from ortho-phenylenediamine and aldehyde in occurrence of numerous catalysts.

This is the most prevalent methods in common for the synthesis of benzimidazole derivatives. The catalysts compounds are cericammonium nitrate, K_3PO_4, oxone, sulfamic acid, DDQ, PhI $(OAc)_2$, Iodine and $KHSO_4$, [11-17] In addition, numerous catalysts such as metal halides &metaloxy chlorides, [18-22] metal oxides, PTSA, metal triflates, Air, [23-30] ionic liquid, hetero polyacid, BDSB, [31-33] proline, solid supported, polymer supported catalysts, [34 & 35] microwave promoted, [36-39] and clay zic [40] reactions have been described in the literature. Unfortunately, several of these approaches suffer from disadvantages such as extreme reaction conditions, low yields, tedious workup measures and co-occurrence of several side reactions. As a consequence, the overview of a competent and mild scheme is still required to overcome these restrictions.

As part of our research program in developing var synthetic practices we report, the synthesis of benzimidaz using zinc acetate as a competent catalyst. The catalys identified as an efficient catalyst in the literature for nume organic transformations [41].

2. Material and Methods

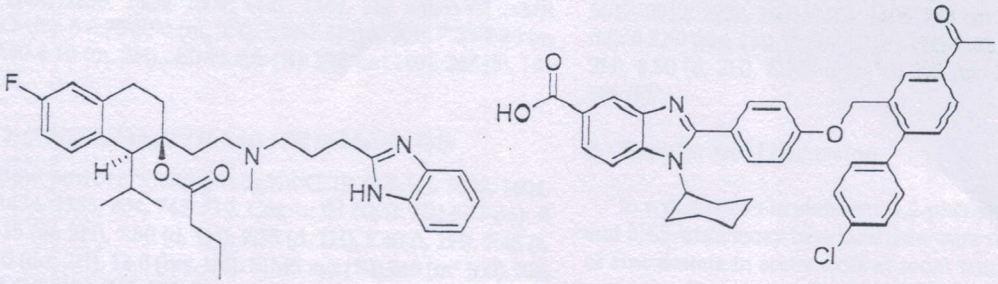
2.1 Experimental Section

Melting points were noted on Buchi R-535 apparatus and uncorrected. IR spectra were verified on a Perkin-Elmer F 240-c spectrophotometer using KBr discs. ^{1}H NMR spectra v noted on Gemini-200 spectrometer in $CDCl_3$ using TMS internal standard. Mass spectra were documented o FinniganMAT 1020 mass spectrometer operating at 70 eV.

2.2 General Procedure:

A combination ofortho-phenylenediamine (1.0 mmol) aldehyde (1.2 mmol) in presence of zinc acetate (10 mol %) stirred in acetonitrile (5 ml) at room temperature. improvement of the reaction was observed by thin la chromatography (TLC). After completion of the reaction indicated by TLC, the solvent was detached under redu pressure. The residue was liquified in ethyl acetate and was with water and brine. The organic layer was dehydrated o Na_2SO_4 and concentrated under reduced pressure. The cr yields were purified by column chromato graphy.

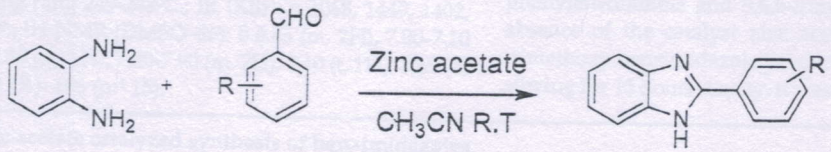
Figure-1. Example of benzimidazole based drugs



Mibefradil hypertension

NS5B RNA Polymerese inhibitor

Figure-2. Yield of 2-(3,4,5-trimethoxyphenyl)-1H-benzo[d]imidazole (3) from the Reaction between 1,2-phenylenediamine (1) and 3,4,5-trimethoxybenzaldehyde (2)



1 2 3

R=H, Aryl

All the yields were recognized by their ^{1}H NMR, IR and mass spectroscopy data.

2.3 Spectral data for selected compounds:

2.3.1. 2-(3,4,5-Trimethoxyphenyl)-1H-benzo[d]imidazole (3a):

White solid. Melting rang. 259°C; IR (KBr): υ 2924, 2851, 1601, 1495, 1463, 1416, 1282, 1096, 1020, 899, 801, 749, 693 cm.$^{-1}$; ^{1}H NMR (DMSO-d_6): δ 3.90 (s, 3H), 4.00 (s, 6H), 7.43-7.60 (m, 2H), 7.65 (s, 2H), 7.85-7.95 (m, 2H); EIMS *m/z* (%): 285 (m^{+1}100), 269 (10), 255 (10), 224 (5).

2.3.2 4-(1H-Benzo[d]imidazol-2-yl)-N,N-dimethyl benzenamine (3b):

White solid. Melting rang. 288-290°C; .IR (KBr): υ 2853, 2800, 1740, 1611, 1561, 15276, 1446, 1389, 1362, 1324, 1278, 1230, 1200, 1167, 1106, 1064, 948, 819, 800, 744, 769, 583 cm.$^{-1}$; ^{1}H NMR (DMSO-d_6): δ 2.90 (s, 6H), 6.70 (dd, 2H), 6.95 (d, 2H), 7.10-7.25 (m, 2H), 7.60 (dd, 2H); EIMS *m/z* (%): 238 (m^{+1}100), 157 (30), 134 (80), 109 (10).

2.3.4 2-(Furan-2-yl)-1H-benzo[d]imidazole (3c):

Solid. Melting rang 296°C; IR (KBr): υ 2927, 2857, 1741, 1609, 1545, 1462, 1379, 1189, 1069, 751, 597 cm.$^{-1}$; ^{1}H NMR (DMSO-d_6): δ 6.30 (d, 2H), 7.15-7.35 (m, 2H), 7.40 (d, 1H), 7.65 (d, 2H).; EIMS *m/z* (%): 184 (m^{+1}100),158 (20), 137 (5), 133 (5).

2.3.5. (E)-2-Styryl-1H-benzo[d]imidazole (3d):

Solid. Melting rang 201-203°C; IR (KBr): υ 3377, 3027, 2924, 2853, 1948, 1805, 1633, 1598, 1495, 1449, 1402, 1355, 1326, 1284, 1194, 1153, 1070, 1018, 963, 918, 841, 737, 691, 558 cm.$^{-1}$; ^{1}H NMR (DMSO-d_6): δ 6.40 (dd, 1H), 6.55 (d, 1H), 7.15-7.55 (m, 7H), 7.70 (d, 2H); EIMS *m/z* (%): 220 (m^{+1}15), 195 (5), 174 (5), 155 (5), 144 (5), 134 (5).

2.3.6 2-(4-Fluorophenyl)-1H-benzo[d]diazole (3e):

White solid. Melting rang 248°C; IR (KBr): υ 3053, 2930, 1663, 1624, 1545, 1486, 1440, 1315, 1277, 1229, 1094, 1034, 1004, 972, 833, 795, 746, 690, 618, 568 cm.$^{-1}$; ^{1}H NMR (DMSO-d_6): δ 7.15-7.20 (m, 2H), 7.20-7.40 (m, 2H), 7.45-7.52 (m, 2H), 7.60-7.70 (m, 2H), 8.00 (brs, 1H).; EIMS *m/z* (%): 212 (m$^+$100), 193 (5), 215 (15), 168 (5), 155 (5), 136 (5), 129 (5), 95 (5).

2.3.7 2-p-Tolyl-1H-benzo[d]imidazole (3f):

White solid. Melting rang 275°C; IR (KBr): υ 3397, 3027, 2922, 2858, 1813, 1514, 1481, 1452, 1412, 1383, 1348, 1282, 1250, 1183, 1157, 1114, 1021, 987, 823, 746, 612.cm.$^{-1}$; ^{1}H NMR (DMSO-d_6): δ 2.35 (s, 3H), 4.42 (brs, 1 NH), 6.95 (d, 2H), 7.10 (d, 2H), 7.28 (d, 2H), 7.55 (d, 2H); EIMS *m/z* (%): 208 (m$^+$100), 195 (15), 179 (20), 161 (10), 153 (10), 149 (5), 140 (20), 136 (5), 126 (10), 122 (5).

2.3.8 2-Phenyl-1H-benzo[d]imidazole (3g):

White power. Melting rang295°C; IR (KBr): υ 3406, 3047, 1589, 1540, 1443, 1409, 1483, 1275, 1118, 736, 704.cm.$^{-1}$; ^{1}H NMR (DMSO-d_6): δ 4.50 (brs, 1H), 7.20-7.40 (m, 2H), 7.50-7.75 (m, 5H), 7.70 (d, 2H), 8.25 (d, 2H).; EIMS *m/z* (%): 195 (m$^+$10), 175 (5), 160 (5).

2.3.9. 4-(1H-Benzo[d]imidazole-2yl) phenol (3h):

White power. Melting range229-230°C; IR (KBr): υ 3376, 3290, 3027, 2807, 1697, 1611, 1591, 1515, 1443, 1394, 1268, 1246, 839, 745 cm.$^{-1}$.; ^{1}H NMR (DMSO-d_6): δ 6.90 (d, 1H), 7.05-7.15 (m, 4H), 7.75 (d, 2H), EIMS *m/z* (%): 210 (m$^+$100), 193 (5), 191 (20), 183 (10), 181 (5), 169 (40), 154 (5), 137 (5).

2.3.10 2-(3-Chlorophenyl)-1H-benzo[d]imidazole (3i):

White powder. Melting rang 232–234°C; IR (KBr): υ 3059, 1619, 1593, 1440, 1421, 1269, 836, 750. cm.$^{-1}$; ^{1}H NMR (DMSO-d6 MHz): δ 7.45-7.60 (m, 4H), 7.62-7.72 (m, 2H), 8.30-8.45 (m, 2H); EIMS *m/z* (%): 229 (m$^+$100).

2.3.11 2-(Naphthalene-2yl)-1H-benzo [d] imidazole (3j):

White powder. Melting rang 218-219°C. IR (KBr): υ 3425, 3047, 2924, 2853, 1624, 1605, 1447, 1385, 748 cm.$^{-1}$: ^{1}H NMR (DMSO-d6): δ 6.70-6.90 (m, 2H), 7.20-7.35 (m, 2H), 7.55-7.80 (m 4H), 7.90-8.10 (m, 2H).; EIMS *m/z* (%): 245 (m^+100), 243 (5), 141 (10).

2.3.12 2-(4-Nitrophenyl)-1H-benzo [d] imidazole (3l):

Yellow powder. Melting rang314°C. IR (KBr): υ 3042, 1604, 1515, 1434, 1353, 854, 745, 710. Cm.$^{-1}$.: ^{1}H NMR (DMSO-d6): δ 7.10-7.15 (m, 2H), 7.30 (d, 1H), 7.35 (d, 1H), 7.40 (t, 1H), 7.45 (t, 1H), 8.0 (dd, 2H), 13.0 (brs, 1H); EIMS *m/z* (%): 240 (m^+100), 226 (5), 211 (10), 194 (20), 182 (5).

2.3.13 2-(Pyridine-2-yl)-1H-benzo[d]imidazole (3l):

Solid.Melting rang 245-248°C.; IR (KBr): υ 3068, 1449, 1402, 1280, 746, cm.$^{-1}$.: ^{1}H NMR (DMSO-d6): δ 6.85 (m, 2H), 7.00-7.10 (m, 1H), 7.45-7.55 (m, 1H), 7.80-7.90 (m, 2H), 8.10 (t, 1H), 8.65 (d, 1H);. EIMS *m/z* (%): 196 (m^+15).

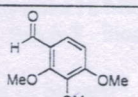
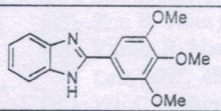
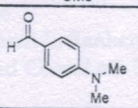
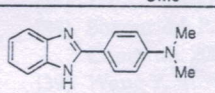
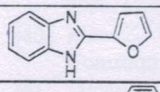
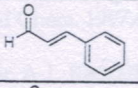
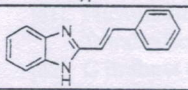
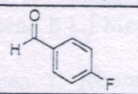
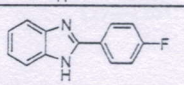
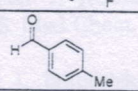
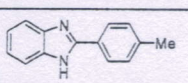
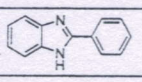
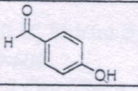
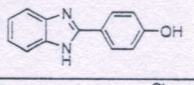
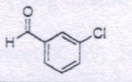
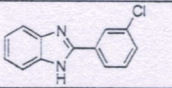
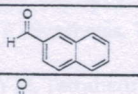
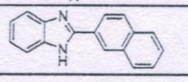
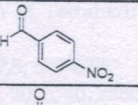
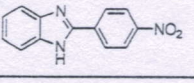
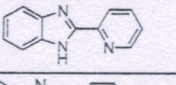
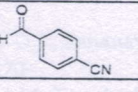
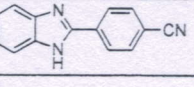
White crystalsolid.Melting rang 262°C. IR (KBr) 3047, 2912, 2222, 1605, 1454, 1408, 748 cm.$^{-1}$.: ^{1}H NMR d6): δ 5.50 (brs, 1H), 7.45-7.60 (m, 2H), 7.82-7.90 (m, 2H 2H), 8.50 (d, 2H), EIMS *m/z* (%): 220 (m^+100), 211(10 186 (5).

3. Results and Discussion

In a distinctive experiment, 1,2-phenylenediamine and 3,4,5-trimethoxy benzaldehyde were reacted in at of zinc acetate in acetonitrile at room temperature to corresponding product, (3,4,5-trimethoxyphe benzo[d]imidazole (3) in outstanding yield. The reac finished within 2 hours.

An absolute testing was carried out with phenylenediamine and 3,4,5-trimethoxy benzaldehyc absence of the catalyst zinc acetate and the essent trimethoxy benzimidazole product was not establish e stirring for 15 hours. Lastly, it was decided that the app

Table 1. Zinc acetate catalyzed synthesis of benzimidazoles

Entry	Diamine	Aldehyde	Product (3a-3m)	Time (h)	Yields (%)
a				2.0	94
b				2.5	87
c				2.0	89
d				3.0	85
e				2.0	84
f				2.5	91
g				3.0	87
h				2.5	85
i				2.5	90
j				3.0	86
k				3.0	87
l				2.5	85
m				2.5	88

2.3.14 4-(1H-Benzo[d]imidazole-2yl) benzonitrile (3m):

conditions for the reduction is in a solvent and in the atte

of an activator or promoter. Aromatic aldehydes responded very well to afford the consistent products of benzimidazole derivatives in very good to outstanding yields. In overall, the aromatic aldehydes having electron donating groups and electron withdrawing groups are reacting very healthy. All the reactions were completed within 2.0 to 4.0 hours of reaction period and the gained produces also 84 to 94%.

4. Conclusions

In conclusion, the zinc acetate has been working as a novel and effectual catalyst for the synthesis of benzimidazoles in noble yields from ortho-phenylenediamine and a wide diversity of aldehydes. All the reactions were approved at room temperature, though using the catalyst zinc acetate in 10 mol%. The reaction situations were precise mild and the isolation of yields also very informal.

Competing Interests

The authors have declared that no competing interests exist.

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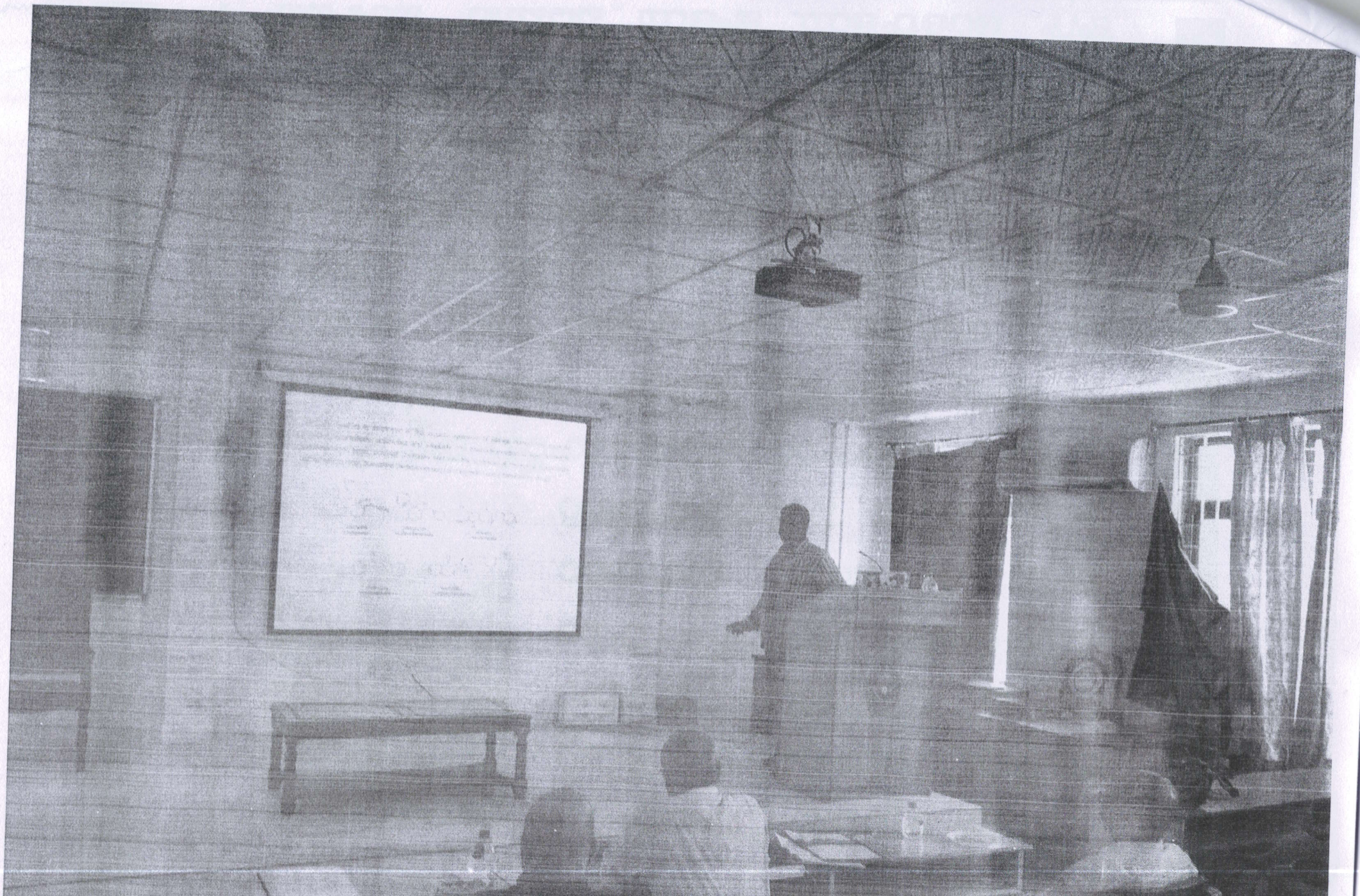

కెమిస్ట్రీలో ప్రవీణ్‌కుమార్‌కు డాక్టరేట్

కేయూ క్యాంపస్, డిసెంబరు 1 : కాకతీయ యూనివర్సిటీ కెమిస్ట్రీ విభాగం పరిశోధకుడు బొంకూరి ప్రవీణ్‌కుమార్ డాక్టరేట్ సాధించారు. ఈ మేరకు గురువారం కేయూ పరీక్షల నియంత్రణాధికారి ప్రొఫెసర్ పి.మల్లారెడ్డి ప్రవీణ్‌కుమార్‌కు డాక్టరేట్ ప్రకటించినట్లు తెలిపారు. 'ఔషదాల తయారీలో మూలమైన అణువులను సంశ్లేషించుట' అనే అంశంపై కెమిస్ట్రీ ప్రొఫెసర్ జె మధుకర్ పర్యవేక్షణలో ప్రవీణ్‌కుమార్ పరిశోధన పూర్తి చేశారు. ప్రవీణ్‌కుమార్ ప్రస్తుతం బెల్లంపల్లి ప్రభుత్వ డిగ్రీ కళాశాలలో కెమిస్ట్రీ విభాగం కాంట్రాక్టు అధ్యాపకులుగా పనిచేస్తున్నారు. కాగా. అంతరాతీయ. జాతీయ సదస్సులో పరిశోదన