Print ISSN : 2395-1990
Online ISSN : 2394-4099
www.ijsrset.com

Techno Science Academy
The International Open Access Publisher

IJSRSET

BCUD, SPPU Sponsored National Conference on

New Horizons in Material Science

Organised by
Department of Chemistry,
New Arts, Commerce and Science College, Shevgaon,
Dist. Ahmednagar - 414 502, Maharashtra, India

VOLUME 4, ISSUE 3, JANUARY-FEBRUARY-2018

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Email : editor@ijsrst.com Website : http://ijsrst.com

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Shevgaon

National conference on

New Horizons in Material Science

On

Mon. & Tues. 22nd – 23rd January, 2018

In Association With

International Journal of Scientific Research in Science, Engineering and Technology

Print ISSN : 2395-1990 Online ISSN : 2394-4099

UGC Approved Journal [Journal No : 47147]

Volume 4, Issue 3, January-February-2018

Organized by

Department of Chemistry,

New Arts, Commerce and Science College, Shevgaon,

Dist. Ahmednagar - 414 502,

Maharashtra, India

Email- newartsshevgaonl@yahoo.co.in

Website: www.newartscollegeshevgaon.com

Tl.:(02429)221267. 222593 Fax: 02429-221267

Sponsored By

BCUD, SPPU

Published By

Technoscience Academy

(The International Open Access Publisher)

[www.technoscienceacademy.com]

Our Inspiration

Hon. Shri. Madhavrao Mulay
President, AJMVPS, Ahmednagar
Hon. Shri. Nandkurnar Zaware Patil
Vice-President, AJMVPS, Ahmednagar
Hon. Shri. G. D. Khandeshe
Secretary, AJMVPS, Ahmednagar
Hon. Smt. Adv. Deeplaxmi Mhase
Joint-Secretary, AJMVPS, Ahmednagar
Hon. Shri. Ramchandra Dare
Treasurer, AJMVPS, Ahmednagar

Honorable Trustees

Shri. Dr. Mohanrao Hapse
Shri. Adv. Ramnathji Wagh
Shri. Adv. Vishwasrao Athare Patil
Shri . Dr. Vivek Bhapkar
Shri. Sitaram Khilari
Shri. Dr. Chandrakant More

Organizing Committee

Dr. L. S. Matkar
Principal
New Arts, Commerce and Science College, Shevgaon, Dist. Ahmednagar-414 502, Maharashtra, India

Dr. R. K. Kasar
(Vice Principal)
Dr. N. G Kolhe (HOD)
Mr. C'.N. Potangale
Mr. A. R. Aare
Mrs. S. N. Supare
Mrs. R. S.Tupe
Mrs. M.V. Korde
Mr. A. K. Shidore

Prof. V. B. Lande
(Vice Principal)
Mr. S. R. Kande
Mr. R. U. Valvi
Dr. J. K. Khedkar
Mrs. S. B. Kapre
Miss. N. G Wavare
Miss. D. G. Ghanwat

Speakers of Conference

Hon. Dr. Nitin Karmalkar

(Vice Chancellor, Savitribai Phule Pune University)

Dr. P. V. Narkhede

(Joint Director-Higher Education, Pune

Prof. Dr. S. P. Gejji

(Savitribai Phule Pune University)

Prof. Dr. S. K. Pardeshi

(Savitribai Phule Pune University)

Dr. Bhaskar Kale

(Director, C-MET, Pune)

Dr. Parag Adhyapak

(Scientist, C-MET,Pune)

Dr. S. S. Jadhav

(Principal – Takali Dhokeshwar College)

Prof. Dr. Vrushali Joshi

(Goa University)

Prof. Dr. M. K. Lande

(BAMU, Aurangabad)

Dr. A. B. Gambhire

(Shri Anand College, Pathardi)

Prof. Dr. Bhaskar Sathe

(BAMU, Aurangabad)

Dr. Shankar Pawar

(Fergusson College, Pune)

About Us

It gives us a great pleasure to invite you to BCUD, SPPU sponsored National Conference entitled New Horizons in Material Science organized by Department of Chemistry. New Arts, Commerce & Science College Shevgaon.

Our Institution

Ahmednagar Jilha Maratha Vidya Prasarak Samaj Ahmednagar was established in 1918 in memory of Hutatma Karveer Chauthe Chhatrapati Shivaji Maharaj, The main object of the institute is to impart education to society irrespective of caste, creed, sex and religion. The growth of the institution during last 99 years is noteworthy with its moto "Tejo Si Tejo Me Dehi". Our institute is one of the pioneer educational institution in Maharashtra, providing quality education form KG to PG level in various streams i.e. Arts Commerce, Science, Environmental Science, Biotechnology, Education, Management, Hotel Management, Computer Science & Engineering etc.

About College

New Arts, Commerce & Science College, Shevgaon was established in 1978 and is affiliated to the Savitribai Phule Pune University, Pune. The college was reaccredited by NACC with grade 'A' in February 2017, The College is also received 'Best Rural College Award' in 2012 by the Savitribai Phule Pune University, Pune. The college is imparting quality education in UG & PG programmes. It is committed to intellectual, moral social and aesthetical development of its students.

Department of Chemistry

- Establishment- 1982
- PG Courses in Analytical, Organic Chemistry
- Research Area :
  Heterogeneous Catalysis
  Drug Synthesis
  Extraction Chromatography
  Method development and Validation

Deliberation

The conference will have plenary sessions, oral and poster presentation sessions.

About the Conference

It is well known that Chemistry is important branch in science, which plays crucial role in socio-economic development of country, Therefore the theme "New Horizons in Material Science" is chosen to fully capture the importance of innovation & developments in chemistry in the changing modern world.

The conference is aimed at providing strong foundation for future Endeavour in promoting new & innovative area of science, not only in area of research & development but also professional & practices without compromising its core values & scientific rigor.

The main purpose of the conference (NHMS-2018) is to enhance the concept on New Horizons in Material Science & to cover all aspects of material i.e. synthesis, characterization & application related to material. It will provide opportunity & platform for Eminent Scientist, Professors, Research Scholars, Chemist's & Student's to interact, exchange their basic idea & discuss the contemporary research on various topics in chemistry.

Sub Themes:-

* Metallurgy
* Advanced Composites
* Superconductivity
* Heterogeneous Catalysis
* Material Science
* Advanced Material Analysis
* Spectroscopic Analysis
* Solid State Physics

Advisory/Editorial Board

- Dr. BalramPanigrahi, Soil & Water Conservation Engineering, College of Agricultural Engg. &Techn. Orissa University Of Agriculture & Technology, Bhubanmeswar, Odisha, India
- Dr. AnantLalchandChaudhari, Department of Electronics, Arts, Science & Commerce College, Chopda, Jalgaon, Maharashtra India
- Dr. N. Pughazendi, Computer Science and Engineering, Panimalar Engineering College Chennai, Tamilnadu, India
- Dr. V. Ananthaswamy, Department of Mathematics, The Madura College, Madurai, Tamil Nadu, India
- Rakesh K. Bumataria, Mechanical Engineering, Marwadi Education Foundation's Group of Institutions Rajkot, Gujarat, India
- Dr. ArvindBijalwan, Indian Institute of Forest Management (IIFM) (Ministry of Environment & Forests, Govt. of India) Bhopal, Madhya Pradesh, India
- Sharvil D. Shah, Mechanical Engineering Department, ITM Universe, Vadodara, Gujarat, India
- Dr. Aditya Kishore Dash, Department of Environmental Engineering, Institute of Technical Education and Research (ITER), S'O'A University, Bhubaneswar, Odisha, India
- Dr. SubhaGanguly, Department of Veterinary Microbiology Arawali Veterinary College, Bajor, Rajasthan, India
- Dr. Shivakumar Singh, MVS Govt UG & PG College, Palamuru University, Mahabubnagr, Telangana, India
- MdIrfan Ahmed, Power System, Sityog Institute Of Technology Aurangabad, Bihar , India
- Dinesh Kumar, Mathematics, DhanalakshmiSrinivasan Engineering College, Perambalur, Tamilnadu, India
- ShyamLal Sharma, Mechanical Engineering, Department, AFSET, Al Falah University, Dhauj, Faridabad, India
- Prof (Dr.) Hardeep Singh, Electronics & Communication Engineering Department, Indo Global College of Engineering, Abhipur, District Mohali, Punjab, India
- Dr. S. R. BoselinPrabhu, Electronics and Communication Engineering, V. S. B. College of Engineering–Technical Campus, Coimbatore, Tamilnadu, India

- N.R.Shingala, Department of Mechanical Engineering, VVP Engineering College, Rajkot, Gujarat, India
- R. G. Vaghela, Mechanical Engineering, Atmiya Institute of Technology & Science, Rajkot, Gujarat, India
- S. Mayakannan, VidyaaVikas College of Engineering & Technology, Tiruchengode, Tamil Nadu, India
- R. Girimurugan, Nandha College of Technology, Erode, Tamil Nadu, India
- AchalGarg, Structural Section, Keppel Offshore and Marine Engineering, Mumbai, India
- VelladuraiChinnappillai, Department of Animal Repoduction, Gynaecology and Obstetrics, Veterinary College And Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Namakkal, Tamil Nadu, India
- SachinNarendraPardeshi, Department of Computer Engineering, R.C.Patel Institute of Technology, Shirpur, Maharashtra, India
- Hari Krishna, Department of Chemistry, Jagans College of Engineering & Technology, Choutapalem, VikramaSimhapuri University, Nellore, Andhra Pradesh, India
- Rajnish Kumar, Amity Institute of Biotechnology, Amity University, Uttar Pradesh, Lucknow Campus, Uttar Pradesh, India
- Dr. Meenakshi Sharma, Medical Biotechnology, Dr B.R. Ambedkar Centre for Biomedical Research, University of Delhi, Delhi, India
- Dr. P. Vijayarengan, Department of Botany, Annamalai University, Annamalainagar, Tamil Nadu, India
- Dr. BangoleNarendra Kumar, Department of Computer Science and Systems Engineering, SreeVidyanikethan Engineering College, Tirupati, Andhra Pradesh, India
- Dr. Deepmala, SQC & OR Unit, Indian Statistical Institute, 203 Barrackpore Trunk Road, Kolkata(West Bengal), India
- Dr. Mahendra Singh Khidiya, Department of Mechanical Engineering, College of Engineering And Technology, MaharanaPratap University of Agriculture and Technology, Udaipur, Rajasthan, India
- AbhishekVarshney, Power Electronics & Drives Engineering, Hardayal Technical Campus, Farah, Mathura, Uttar Pradesh, India
- MallavoluMalleswaraRao, Department of Electrical and Electronics Engineering, RISE Prakasam Group of institutions, Ongole, Andhra Pradesh, India

- Dr. SrijitBiswas, Department, Civil Engineering, ManavRachna International University, Faridabad, India
- Dr. Gunvant A. Birajdar, School of Rural Development, Tata Institute of Social Sciences, Tuljapur, Osmanabad, Maharashtra, India
- Prof. Kuldip B. Patel, Civil Engineering Department, Government Engineering College, Valsad, Gujarat, India
- Jaimin N. Undavia, Smt. ChandabenMohanbhai Patel Institute of Computer Applications, Charotar University of Science and Technology, Charusat Campus, Changa, Petlad, Gujarat, India
- IniyaPratheepa M, Department of Physics, St. Joseph's College, Trichy, Tamil Nadu, India
- K. Lenin, SreeSastha Institute of Engineering and Technology, Power System, Chennai, Tamil Nadu, India
- Dr. Christo Ananth, Department of ECE, Francis Xavier Engineering College, Tirunelveli, Tamilnadu, India
- P. M. K. Prasad, Department of Electronics and Communication Engineering (ECE), GMR Institute of Technology, RAJAM, Srikakulam(Dt), Andhra Pradesh, India
- Dr. Dhananjaya Reddy, M.Sc.(Maths),M.Sc.(Stat), M.Phil.(Maths), M.Phil. (Statistics), BEd, PhD Department of Mathematics,Government Degree College, Puttur, Chittoor, Andhra Pradesh, India
- Syed EashanAdil, Structural Engineering, Aurora Engineering College, Bhongiri, Nalgonda, Andhra Pradesh, India
- Prof. Manoj Kumar, School of Mechanical Engineering, Galgotias University, Uttar Pradesh, India
- Vigithra. R., Department of Mechanical Engineering, Panimalar Institute of Technology, Poonammalle,Chennai, Tamil Nadu, India
- Prof. Manoj Kumar, School of Mechanical Engineering, Galgotias University, Uttar Pradesh, India
- Prof. DivyaTadepalli, Civil/Structural Engineering, Aurora Engineering College, Bhongiri, Nalgonda, Andhra Pradesh, India
- Bala Subramanian, Power Electronics and Drives, Arasu Engineering College, Kumbakonam, Tamil Nadu

- YogeshNagnath Joshi, Department of Bioinformatics, Walchand Centre for Biotechnology, Walchand College of Arts and Science, Solapur, Maharashtra, India
- Dr. Praveen Kumar Sharma, Department of Chemistry, Lovely Professional University,Punjab, India
- Dr. R. Sridhar, Civil Engineering, CMJ University, Modrina Mansion, Laitumkhrah, Shillong, Meghalaya, India
- Prof. SaritaDhawale, Ashoka Center for Business & Computer Studies, AshokaMarg, Ashoka Nagar, Nashik, Maharashtra, India
- Dr. Ajitesh Singh Baghel, Department of Computer Science, AwadheshPratap Singh University, Rewa, Madhya Pradesh, India
- Prof. Vinod P. S., Department of Bioinformatics, Walchand Centre for Biotechnology, Walchand College of Arts and Science, Solapur, Maharashtra, India
- Dr. Syed Umar, Professor & R & D Head, Department of Computer Science and Engineering, MLR Institute of Technology, Hyderabad, Telangana, India
- Prof. C. K. Raina, HOD, Computer Science and Engineering Department, Adesh Institution of Technology Chandigarh, Gharuan, Chandigarh, India
- Dr. R. Reka, Professor & Head, Department of Computer Science & Engineering, AnnaiMathammalSheela Engineering College, Tamil Nadu, India
- Dr. Nilamadhab Mishra, Post Graduate Teaching & Research Department, School of Computing, DebreBerhan University, Ethiopia, India
- Dr. S. Ramkumar, Department of Computer Applications, Kalasalingam University, Krishnankoil, Sirivilliputhur, Palani, Dindugal, Tamil Nadu, India
- G. Naveen Balaji, Department of ECE, SNS College of Technology, SNS Kalvi Nagar, VazhiyampalyamPirivu, Coimbatore
- Dr. G. Rajkumar, Department of Computer Applications, N. M. S. S.VellaichamyNadar College, Madurai, Tamilnadu, India
- Prof. SagarBhilajiShinde, E & TC Engineering Department, JSPM, Narhe Technical Campus, Pune, Maharashtra, India
- Prof SaritaDhawale, HOD, Computer Science Department, Ashoka Education Foundation's, Ashoka Center for Business and Computer Studies, ACBCS, Nashik, India
- Prof. UmeshSehgal, Associate Professor, GNA University, Phagwara, Punjab, India
- Antomon T. K, Mould Designer, Triton Tech, Bangalore, Karnataka, India

- Deepak Dhounchak, University Institute of Engineering and Technology, Rohtak, Haryana, India
- Dr. KshitijShinghal, Associate Professor & Dean Academics, Department of Electronics & Communication, MIT, Moradabad, Uttar Pradesh , India
- Udit Narayan Bera, Department of Electronics and Communication Engineering, St. Aloysius Institute of Technology, Jabalpur, Madhya Pradesh, India
- Dr. M. Ramesh Kumar, Associate Professor/Project Coordinator, Department of Computer Science and Engineering, VSB College of Engineering Technical Campus, Coimbatore, Tamilnadu, India
- Dr. Sumit Kumar Gupta, Department of Physics, Parishkar College of Global Excellence , University of Rajasthan, Jaipur, Rajasthan, India
- V. Tamizhazhagan, Department of Zoology, Annamalai University Annamalai Nagar, Tamil Nadu, India
- Abilash, D.E & F.O Engineering Department, BTTI, Pilani, Rajasthan, India [https://publons.com/a/1224910]
- BhatGulzar, Department of Zoology DAV (PG) College Dehradun Uttarakhand India
- BramhaSwaroopTripathi, Senior Projectionist & Research Associate, SardaarVallabhbhai National Police Academy, Hyderabad, Andhra Pradesh, India
- P. K. MeenakshiRajan, PG and Research Department of Mathematics, Hindusthan College of Arts and Science, Behind Nava India, Coimbatore, Tamilnadu, India
- Diwakaran S, ECE Department, Kalasalingam University, Srivilliputhur, Tamilnadu, India
- Dr. Alka Singh, Department of Pure and Applied Physics, Guru Ghasi Das Central University, Bilaspur, Chhattisgarh, India
- Dr. Ashish Kumar, Associate Professor & HOD, Chemistry Department, Lovely Professional University, Punjab, India
- Dr. Ganesh Prasad, Department of Science & Technology, Govt. Polytechnic, Gaya, Bihar, Patna, Bihar, India
- Dr. J. R. Shukla, Associate Professor, Chemistry Department, Shri C.N.P.F Arts &D.N.Science College, Dabhoi, Gujarat, India
- Dr. Navin Kumar, Center Co-Ordinator, IGNOU Center of Engineering, Directorate of Distance Education, B.R.A Bihar University, Muzaffarpur, Bihar, India

- Dr. R. Vijayaragavan, Associate Professor, Department of Physics, Arasu Engineering College, Kumbakonam, Tamilnadu, India
- Dr. Vaijanath L. Chinchane, Assistant Professor, Department of Mathematics, Deogiri Institute of Engineering and Management Studies, Aurangabad, Maharashtra, India
- Dr. Vishal R.Panse, Assistant Professor, Department of Physics, Late. B.S. Arts, Prof. N. G. Science & A.G. Commerce College, Sakharkherda, Sindkhed Raja, Buldhana, Maharashtra, India
- G Chandra Sekhar, Department of Mechanical Engineering, Sri Krishnadevaraya Engineering College, Gooty, Anantapur, Andhra Pradesh, India
- Dr. Ganesh Prasad, Department of Science & Technology, Govt. Polytechnic, Gaya, Bihar, India
- Dr. Ikvinderpal Singh, Department of Computer Science & Applications, TraiShatabdi GGS Khalsa College, Amritsar, Punjab, India
- Kondru V. N. MallikharjunaRao, Department of Civil Engineering, RISE Group of Engineering College, Andhra Pradesh, India
- Prof. Prashant Ramesh Bamane, Assistant Professor, Civil Engineering Department, Adarsh Institute of Technology and Research Center, VITA,Maharashtra, India
- Vishwa J. S., Civil and Transportation Engineering Department, PES University, Bangalore, Karnataka, India
- S. Balakrishnan, Department of Advanced Zoology and Biotechnology, Loyola College, Chennai, Tamil Nadu, India
- Dr. SharadGangele, Professor and Head, Department of Computer Science & Application, RKDF University, Bhopal, Madhya Pradesh, India
- Sheshang D. Degadwala, Head of Computer Department, Sigma Institute of Engineering, Vadodara, Gujarat, India

International Advisory/Editorial Board

CONTENTS

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Synthesis, Characterization and Antimicrobial Analysis Of Various Substituted 6-(3-(5-Bromothiophen-2-Yl)-1-Phenyl-1H-Pyrazol-4-Yl)-4-(2-Hydroxyphenyl) Pyrimidine-2(1H)-Thiones

Sunil S. Bhagat[1*], Balaji D. Rupnar[1], Amol J. Shirsat[1], Charansingh H. Gill[2]
[1]Department of Chemistry, R. B. Attal Arts, Science and Commerce College, Georai,Beed, Maharashtra, India
[2]Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra, India

ABSTRACT

The title compounds thiopyrimidines 3(a-h) have been synthesized from chromones 1(a-h) by refluxing thiourea 2 with potassium hydroxide. The structures of all newly synthesized compounds have been confirmed by IR, ^{1}H NMR and Mass spectral data. The synthesized compounds have been screened for their antimicrobial activity. Some of the compounds show moderate antimicrobial activity as compared to the reference drugs Ciprofloxacin and Fluconazole.

Keywords: Chromones, Pyrazolopyrimidines, Antimicrobial Activity

I. INTRODUCTION

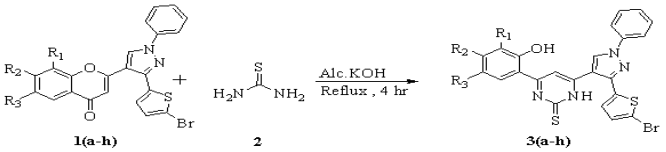
Pyrimidine derivatives are important among different heterocyclic compounds, due anti- antiviral, anti-inflammatory, neoplastic and antibiotic in addition to other microbial activities[1]. In nucleic acids, uric acid, purines, several vitamins, few marine microorganisms and coenzymes the pyrimidine ring system is present. Many synthetic members of pyrimidine are important as synthetic drugs and chemotherapeutic agents. Their remarkable biological activities attracted consideration to the chemistry of nitrogen heterocycles[2,3] Many novel drugs are planned using the small 5-acetyl pyrimidine-2, 4, 6-(1*H*, 3*H*, 5*H*)-trione moiety as a preliminary building block in the synthesis. Directly 5-acylbarbiturates are applied in pharmaceutical and other industry[4].Synthetic heterocyclic compounds, like furan, pyrrole, thiophene, pyrrolidine, piperidine, thiazole and pyridine having significant application and many are important intermediates in preparation[5]. Fused pyrimidines attracted much attention due to biological activities. This is obvious from publications where the pyrimidine ring is fused to various heterocycles such as purines, pteridines, pyridopyrimidines, quinazolines, triazolo pyrimidines, pyrazolopyrimidines, pyrimidoazepines and furopyrimidines. Work of well-known chemists like Riedel, Bischler, Gabriel, Niementowski and Bogert recognized for major progress in this field[6]. Many simple fused pyrimidines such as purines and pteridines are biologically active by themselves[7, 8] or are necessary constituents of very essential naturally occurring substances. Some pteridine derivatives are as anti-leukemic drugs[9], or potassium-conserving diuretics[10]. Moreover, several quinazoline alkaloids exhibit hypnotic[11, 12], bronchodilatory[13], and antimalarial activity [14, 15].

Many cardio circulatory syndromes such as deep vein thrombosis (DVT), myocardial infarction (MI) or unstable angina (UA) is one of the utmost significant causes of death worldwide. The importance of fused pyrimidines as antithrombotic and antiplatelet drugs has been definitely recognized by medical trials. Thus, extra investigation of pyrimidine chemistry seems to be worthwhile[16]. Pyrimidine derivatives show antibacterial[17, 18], antihyperlipidemic[19] anti-cancer[20] antihypertensive[21] and anti-HIV activities[22].

II. MATERIALS AND METHODS

All the chemicals required for the synthesis of the compounds were obtained from Sigma Aldrich and SD Fine chemicals. Melting points were recorded in open capillaries and are uncorrected. ^{1}H NMR spectra were recorded on Varian 400 MHz spectrophotometer in $CDCl_3$, DMSO-d_6 and TMS as an internal standard. The infra-red spectra were recorded as potassium bromide disk using Schimadzu-FT-IR Spectrophotometer. Mass spectra were recorded on Micromass mass spectrophotometer. The purity of the synthesized compounds was checked by TLC silica gel coated plates obtained from Merck as stationary phase and solvent mixture of ethyl acetate/hexane (20:80) as mobile phase. General procedure for the synthesis of 4-(5-bromo-2-hydroxyphenyl)-6-(3-(5-bromothiophen-2-yl)-1-phenyl-1*H*-pyrazol-4-yl) pyrimidine-2(1*H*)-thione (3g): To a mixture of Comp. 1 (0.00078 mmole) and KOH (0.05 mmole) in ethanol (10 ml), thiourea 2 (0.0025 mmole) was added and reaction mixture was refluxed for four hr. After completion of the reaction (monitored by TLC), reaction mass was cooled to the room temperature and poured on crushed ice, and acidified with conc. HCl to get yellow solid. The solid was filtered off and recrystallized from ethanol to afford 3(a-h) pure solid. The physical data of the compounds 3(a-h) were recorded in Table I. Their structures have been confirmed by ^{1}H NMR, Mass and IR spectra.

IR (3g) (cm^{-1}): 1258 (C-Br), 1478(C=C), 1559 (C=S), 3371(N-H), 3827(O-H);^{1}H NMR (3g) (DMSO) δ ppm: 6.905 (s, 1H, N-H), 7.157-7.602 (m, 10H, Ar-H), 7.801(s, 1H, Ar-H), 8.713(s, 1H, Pyrazole-H), 12.953 (s, 1H, Ar-OH); ES-MS (3g) (m/z): 585.1(M+1), 587(M+3), 589.1(M+5).



1(a-h) 2 3(a-h)

Scheme 1

Table 1. Physical data of compounds 3(a-h)

Comp.	R_1	R_2	R_3	M.P. (°C)	Yield (%)
3a	H	H	H	130-132	62
3b	H	H	CH_3	180-182	72
3c	H	H	Cl	136-138	64
3d	Cl	H	Cl	176-178	70
3e	H	H	F	190-192	70
3f	H	CH_3	Cl	188-190	68
3g	H	H	Br	140-142	68
3h	CH_3	H	CH_3	184-186	64

III. RESULTS AND DISCUSSION

The thiopyrimidine derivatives were synthesized successfully in moderate to good yields. The newly synthesized compounds were identified on the basis of melting point range, IR, ^{1}H NMR, Mass spectral analysis. All the newly synthesized derivatives were screened for antimicrobial activity using disc diffusion method.

Antimicrobial activity: Compounds 3(a-h) were screened for their in vitro antimicrobial activity against Escherichia coli (ATCC 25922), Pseudomonas aeruginosa (ATCC 27853), Staphylococcus aureus (ATCC 25923), Staphylococcus albus, Klebsiella pnuemoniae using Ciprofloxacin as a reference standard drug by paper disc diffusion method. Antifungal activity was evaluated against Candida sp. using Fluconazole as standard drug. All the tests were evaluated at 100 µg/ml concentration. The culture media was Muller Hinton agar. The zone of inhibition was measured in mm after 24 hr of incubation at 37°C. DMSO is used as control. Microbial data for corresponding compounds is summarized in Table 2.

Table 2. Antimicrobial Analysis Data

Sr. No.	Compound No.	Inhibition Zone Diameter (mm)					
		Candida sp.	S. aureus	S.albus	Klebsiella pnuemoniae	E. coli	Pseudomonas sp.
1.	3a	2	-	5	7	8	3
2.	3b	4	8	8	4	10	8
3.	3c	5	9	5	6	7	4
4.	3d	3	7	8	6	7	2

5.	3e	5	10	5	6	6	3
6.	3f	2	8	4	5	8	5
7.	3g	7	6	7	10	7	-
8.	3h	4	8	4	5	7	-
9.	Control	8	3	3	4	6	10
10.	Ciprofloxacin	---	20	22	22	21	23
11.	Fluconazole	23	---	---	---	---	---

IV. ACKNOWLEDGEMENTS

The authors are thankful to The Head, Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad for providing laboratory facilities and Uday Khedkar, Director, BAC-TEST Laboratory, Nashik for antimicrobial analysis. One of the authors (SSB) is thankful to Principal Dr. R. V. Shikhare for constant encouragement.

V. REFERENCES

[1]. (a) Basavaraja, H.S.; Jayadevaiah, K.V.; Hussain, M.M.; VijayKumar, M.M.J.J.Pharm.Sci.& Res.2010, 2 (1), 5; (b) Segal, H.; Hedgcoth, C.; Skinner, C.G.J.Med.Pharmaceut.Chem.1962, 5, 871; (c) Cumming, J.G.; Mckenzie, C.L.; Bowden, S.G.; Campbell, D.; Masters, D.J.; Breed, J.; Jewsbury, P.J.Bio-org.Med.Chem.Lett.2004, 14, 5389.

[2]. Omar, A.E.F.; Eman M.H.A.; Neama, A.M.; Sherien, I.A.E.Australian J.Basic and Applied Sciences, 2010, 4 (1), 27.

[3]. Branko, S.J.; Donna, M.N.Tetrahedron Lett.2001, 42, 8435.

[4]. Patil C.B.; Mahajan S.K.; Katti S.A.J.Pharm.Sci.Res.2009, 1, 11.

[5]. Devprakash; Udaykumar A.B.J.Pharm.Res., 2011, 4(7), 2436.

[6]. Adrien A, Advances in Heterocyclic Chemistry, United Kingdom Ed., 32, Academic Press, London, 1982, 30.

[7]. Rodney F.L.; Charle G.; Skinner; William S.Canadian J.Chem.1967, 45, 2213.

[8]. Litvinov, V .P.Advances in Heterocyclic Chemistry, vol.92, Zelinsky Institute of Organic Chemistry, Russian Academy of Sciences, 119991 Moscow, Russia, 2006, 83.

[9]. Hausen, A.; Fuchs, D.; Reibnegger, G.; Wachter, H.Cancer, 1984, 53(7), 1634.

[10]. Netzer, T.; Ullrich, F.; Priewer, H.; Majewski, M.; Mutschler, E .Brit.J.Pharmac.1992,106(1), 222.

[11]. Zheng, Y.; Sun, M.; Liu, Y.; Li, M.; Ji, M .Med.Chem.2011, 7(4), 295.

[12]. Sushil, K.; Kashaw, Vivek, G.; Varsha, K.; Mishra, P.Stables, J.P.; Jain, N.K.Med.Chem.Res.2010, 19, 250.

[13]. Combs, D.W.; Rampulla, M.S.; Russell, R.K.; Rampulla, R.A.; Klaubert, D.H.; Ritchie,D.; Meeks, A .S.; Kirchner, T.Drug Design Delivery, 1990, 6(4), 241.

[14]. (a) Katritzky, A.R.; Rees, C.W.; Scriven, E.F.V.Comprehensive Heterocyclic Chemistry II, Boulton, A.J., Ed., 6, Pergamon Press: Oxford – New York – Tokyo, 1996, 195; (b)Agarwal, A.; Srivastava, K.; Purib, S.K.; Chauhan, P.M.S.Bioorg.Med.Chem.2005, 13,4645.

[15]. Jian, G.; Quan, Z.; Michael, O.N.; Nicanor, O.; Arba, A.; Lucia, G.; Lin, A.J.Antimicrobial Agents and Chemotherapy, 2005, 49, 4928.

[16]. Raghunath, B.T.; Bhahusaheb, K.G.; Muddassar, A.K.; Dhananjay, B.K.; Madhukar, B.K.Tetrahedron, 2007, 63, 8157.

[17]. (a) El-Hossini, M.S.; Fadda, A.A.; Khodeir, M.N.Chem.Inform, 1991, 22(12), 25 ; (b) Hegab, M.I.; Hassan, N.A.; Rashad, A.E.; Fahmy, A.A.; Abdel Megeid, F.M.E.Phosphorus, Sulfur, Silicon and Related Elements, 2007, 182, 1535.

[18]. Ayoob, B.; Maryam, M.K.; Ramin, G.; G.Ali, G.Comptes Rendus Chimie, 2009, 12(12),1287.

[19]. Shishoo, C .J.; Pathak, U.S.; Jain, K.S.; Devani, I.T.; Chhabria, M.T.chem.Inform.1994, 25(38), 436.

[20]. Frederick, C.; Philippe, B .; Elizabeth, B.; Krista, K.B.; Huifen, C.; Antonia, G.D.;Jennifer, A.E.; Michael, F.T.K.; Kevin, L.; Cristina, L.; Lichuan, L.; Cuong, Q.L.;Shiva, M.; Jim, N.; Daniel, F.O.; Zhonghua, P.; Kirk, D.R.; Steve, S.; Lan, T.; Tom, T.;Jiansheng, W.; Xianrui, Z.; Joseph, P.L.J.Med.Chem.2011, 54(9), 3426.

[21]. Nofal, Z.M.; Fahmy, H.H.; Madkour, H.M.; Zareaa, E.S.; Hassan, S.A.Egypt.Pharm.J.2006, 5, 45.

[22]. Olaf, D.K.; Richard, G.B.; Monica, D.; Courtney, K.M.; Ester, M.; Silvia, P.; Michael,R.; Vincenzo, Tetrahedron Lett.2008, 49(46), 6556.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Lanthanum Nitrate Catalyzed an Efficient Synthesis of 2,3-Dihydroquinazolin-4(1H)-Ones

U. N. Chaudhar[*1], J. R. Deshmukh[2], S. R. Kande[3], V. B.Ningdale[1]
[1]Department of Chemistry, Kalikadevi Art's, Science & Commerce College, Shirur (Ka.), Beed, Maharashtra, India
[2]K.G. Kataria College, Daund, Pune, Maharashtra, India
[3]New Arts, Commerce and Science College, Shevgaon, Ahmednagar, Maharashtra, India

ABSTRACT
A simple, efficient and convenient one-pot synthesis of 2,3-dihydroquinazolin-4(1H)-one derivatives using Lanthanum nitrate and mild reaction conditions by the reaction of aromatic aldehydes and 2- aminobenzamide was reported. The advantages of this protocol include short reaction time, mild reaction conditions, easy work-up, high yields, and environmental friendliness.
Keywords: 2,3-dihydroquinazolin-4(1H)-ones, Aldehydes, Lanthanum nitrate, 2-aminobenzamide.

I. INTRODUCTION

Multi-component Reactions (MCRs) are powerful tools for build the products in organic chemistry. In which more than two starting materials react to form a product for their high degree of atom economy, save time, minimize cost, environmental friendliness and application in the diversity-oriented of convergent synthesis of complex organic molecules from simple and readily available substrates in a single synthetic operation [1-2]. 2,3-Dihydroquinazolin-4(1H)-ones are an important class of fused heterocyclic compounds that have drawn much attention because of their variety of biological and pharmaceutical activities [3-6]. Recently, number of organic reactions is reported in the literature by employing various catalysts like clay [7-9], phosphates [10-12] etc.

However, many of these methods suffer from one or more of the drawbacks such as requirement of strong acidic conditions, long reaction times, low yields, tedious work-up procedures, requirement of excess amounts of reagent and use of toxic reagents, catalysts or solvents. Therefore, there is a strong demand for a highly efficient and environmentally benign method.

Lanthanum (III) nitrate have recently attracted much attention in organic transformations due to its high acidity, thermal stability, low toxicity, low cost and good stability, Furthermore, current literature reveals that Lanthanum (III) nitrate has been utilized as an effective catalyst in the synthesis of 4-(3*H*)-quinazolinones under solvent-free conditions, chiral tetrahydroquinolino pyranose derivatives, chemoselective deprotection of acetonides, chemoselective protection of amines as *N*-benzyloxycarbonyl derivatives, acetylation of alcohols, phenols and amines with acetic anhydride and synthesis of α-amino nitriles [13-18]. In continuation of our ongoing research to develop novel methodologies in synthetic organic chemistry, [19-21] we report herein an efficient, low cost and environmentally benign protocol for the synthesis of 2,3-dihydroquinazolin-4(*1H*)-ones using Lanthanum (III) nitrate hexahydrate catalyst under mild reaction condition.

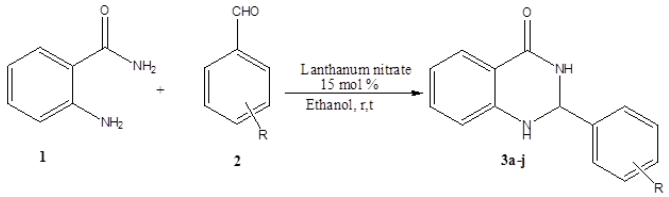
II. EXPERIMENTAL

All commercially available reagents used without further purification and the reactions were monitored by thin layer chromatography (TLC) Merck 60 F_{250} silica-gel plates. All yields refer to isolated products after purification. Melting points were recorded by open tube capillary method and are uncorrected.

General procedure for the synthesis of 2, 3-dihydroquinazolin-4(1H)-ones 3a-j:
To a mixture of 2- aminobenzamide 1 (1 mmol) and aldehyde 2 (1 mmol) taken in round bottam flask was

added Lanthanum nitrate (15 mol %) and the reaction mixture was stirred at room tempreture for the time indicated in Table1. The progress of the reaction was checked by TLC (ethyl acetate: n-hexane, 1:9). After completion of reaction, the solid residue was washed with ethanol. The obtained solid was collected by filtration and purified by recrystallization from ethanol.

All products are known compounds; their physical and spectroscopic data (IR and ^{1}HNMR) were compared with those reported in the literature and found to be identical.



Scheme 1. Synthesis of 2,3-dihydroquinazolin-4(1H)-one

III. RESULT AND DISCUSSION

To explore the use of Lanthanum nitrate as catalysts, a reaction of 2- aminobenzamide 1 and aldehyde 2 was conducted as a standard model reaction for the preparation of 2-arylbenzothiazoles (3a-3j) (Scheme 1). In general, all the reactions were very clean and the 2,3-dihydroquinazolin-4(1H)-ones derivatives were obtained in high yields under mild reaction conditions.

Encouraged by this result, we examined the scope and limitations of this approach by applying the optimal reaction conditions to a number of aromatic aldehydes bearing electron-withdrawing and electron-donating substituents. We found that the property of substituent groups of the aromatic aldehydes did not affect these reactions. The results of the reaction are listed in Table 1.

Table 1. Multicomponent reaction of aromatic aldehyde 2 and 2-aminobenzamide 1 for the synthesis of 3a-j[a]

Entry	Aldehyde	Product	Time (min)	Yield[b] (%)
1	C_6H_5	**3a**	45	91
2	4-$CH_3OC_6H_4$	**3b**	50	88
3	4-BrC_6H_4	**3c**	47	89
4	4-OHC_6H_4	**3d**	60	82
5	4-$NO_2C_6H_4$	**3e**	51	90
6	4-$CH_3C_6H_4$	**3f**	45	91
7	2-ClC_6H_4	**3g**	52	88
8	2-OHC_6H_4	**3h**	60	84
9	3-$NO_2C_6H_4$	**3i**	52	88
10	4-Cl-C_6H_4	**3j**	45	90

[a]Reaction conditions: Aromatic aldehyde (1 mmol), 2-aminobenzamide(1 mmol), Lanthanum nitrate (15 mol %) at room temperature. [b]Isolated yield.

IV. CONCLUSION

We have developed a new protocol for the synthesis of 2,3-dihydroquinazolin-4(1H)-one derivatives via the one-pot multi-components reaction under mild reaction conditions. High efficiency, easy availability, low cost, operational simplicity, mild reaction conditions, and improved yields within short reaction times are the advantages of this new method.

V. ACKNOWLEDGEMENT

Authors thank to Principal, Kalikadevi (ACS) College, Shirur (Ka.) Dist. Beed for providing necessary Laboratory facilities to carry out this work.

VI. REFERENCES

[1]. A. Domling, I. Ugi, Multicomponent reaction with isocyanides, Angew. Chem.Intl. Ed. 2000, 39, 3168-3210.

[2]. J. Zhu, H. Bienayme, Chapter-9 Catalytic Asymmetric Multicomponent Reactions, Wily-VCH, France, 2005

[3]. R. J. Alaimo, Antibacterial 2,3-dihydro-2-(5-nitro-2-thienyl)-quinazolin-4(1H)-ones, J Med Chem 15 (1972) 335-6

[4]. H. A. Jr. Parish, R. D. Gilliom, Syntheses and diuretic activity of 1,2-dihydro-2-(3-pyridyl)-3H-

pyrido[2,3-d]pyrimidin-4-one and related compounds, J Med Chem., 25 (1982) 98-102.

[5]. E. Hamel, C. M. Lin, J. Plowman, H. Wang, K.Lee, K. D. Paull, Biochem Pharmacol, 51 (1996) 53

[6]. M. Hour, L. Huang, S. Kuo, Y. Xia, K. Bastow, Y. Nakanishi, E. Hamel, K. Lee, 6-Alkylamino- and 2,3-dihydro-3'-methoxy-2-phenyl-4-quinazolinones and related compounds: their synthesis, cytotoxicity, and inhibition of tubulin polymerization, J Med Chem., 43 (2000) 4479-4487.

[7]. E. Ramesh, R. Raghunathan, Microwave-Assisted K-10 Montmorillonite Clay–Mediated Knoevenagel Hetero-Diels–Alder Reactions: A Novel Protocol for the Synthesis of Polycyclic Pyrano[2,3,4-kl]xanthene Derivatives, Syn. Comm., 39 (2009) 613-625.

[8]. D. Habibi, O. Marvi, Montmorillonite KSF and montmorillonite K-10 clays as efficient catalysts for the solventless synthesis of bismaleimides and bisphthalimides using microwave irradiation, Arkivok, xiii (2006) 8-15.

[9]. B. A. Dar; A. K. Sahu; P. Patidar; J. Patial; P. Sharma; M. Sharma; B. Singh Am. Jour. of Chem. 2 (2012) 284.

[10]. D. J. Macquarrie, R. Nazih, S. Sebti, KF/natural phosphate as an efficient catalyst for synthesis of 2′-hydroxychalcones and flavanones, Green Chem., 4 (2002) 56-59.

[11]. M. Zahouily, B. Mounir, H. Charki, A. Mezdar, B. Bahlaouan, M. Ouammou, Investigation of the basic catalytic activity of natural phosphates in the Michael condensation, Arkivok, xiii (2006) 178-186.

[12]. M. Zahouily, B. Bahlaouan, A. Rayadh, S. Sebti, Natural phosphate and potassium fluoride doped natural phosphate: efficient catalysts for the construction of a carbon–nitrogen bond, Tetrhedron. Lett., 45 (2004) 4135.

[13]. M. Narasimhulu, K. C. Mahesh, T. S. Reddy, K. Rajesh, Y. Venkateswarlu, Lanthanum(III) nitrate hexahydrate or p-toluenesulfonic acid catalyzed one-pot synthesis of 4(3H)-quinazolinones under solvent-free conditions. Tetrahedron Lett. 47 (2006) 4381-4383.

[14]. M. Narasimhulu, S. M. Reddy, K. Rajesh, N. Suryakiran, D. Ramesh, Y. Venkateswarlu, A mild and efficient synthesis of chiral tetrahydroquinolino pyranose derivatives catalyzed by lanthanum (III) nitrate hexahydrate. Heteroatom Chem. 19 (2008) 429-433.

[15]. S. M. Reddy, Y. V. Reddy, Y. Venkateswarlu, A mild and efficient method for the chemoselective deprotection of acetonides with lanthanum (III) nitrate hexahydrate. Tetrahedron Lett. 46 (2005) 7439-7441.

[16]. K. C. Mahesh, T. S. Reddy, M. Narasimhulu, N. Suryakiran, K. Ashalatha, Y. Venkateswarlu, A mild and efficient chemoselective protection of amines as N-benzyloxycarbonyl derivatives in the presence of La(NO3)3•6H2O under solvent-free conditions. Tetrahedron Lett. 48 (2007) 55-59.

[17]. T. S. Reddy, M. Narasimhulu, N. Suryakiran, K. C. Mahesh, K. Ashalatha, Y. Venkateswarlu, A mild and efficient acetylation of alcohols, phenols and amines with acetic anhydride using La(NO3)3•6H2O as a catalyst under solvent-free conditions. Tetrahedron Lett. 47 (2006) 6825-6829.

[18]. M. Narasimhulu, T. S. Reddy, K. C. Mahesh, S. M. Reddy, A. V. Reddy, Y. Venkateswarlu, Lanthanum (III) nitrate hexahydrate or gadolinium (III) chloride hexahydrate catalyzed one-pot synthesis of α-amino nitriles. J. Mol. Catalysis A: Chemical. 264 (2007) 288-292.

[19]. K. A. Shaikh, V.A. Patil, P.Arshia, An efficient and convenient synthesis of imidazolines and benzimidazoles via oxidation of carbon-nitrogen bond in water media. Chin. J. Chem. 30 (2012) 924-928.

[20]. K. A. Shaikh, V.A. Patil, An efficient solvent-free synthesis of imidazolines and benzimidazoles using K4 [Fe (CN)6] catalysis. Org. Commun. 5 (2012) 12-17.

[21]. K. A. Shaikh, U. N. Chaudhar, V. B. Ningdale, A facile and rapid access towards the synthesis of 2-aryl benzothiazoles using succinimide-N-sulphonic acid: A Reusable catalyst. Can. Chem. Trans. 4 (2016) 133-142.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Synthesis of Some Novel Tetrazole Derivatives & Evaluation of Their Biological Activity

Dhas A. K.[1], Shirsat A. J.[2],Rupnar B. D.[2], Bhagat S. S.[2], Kakade G. K.[3]
[1]Department of chemistry, Deogiri College, Aurangabad, Maharashtra, India
[2]Department of chemistry, R. B. Attal Arts, Commerce & Science College, Georai, Beed, Maharashtra, India
[3]Department of chemistry, Arts, Commerce & Science College, Kille- Dharur, Beed, Maharashtra, India

ABSTRACT

High efficient process for the preparation of novel tetrazole derivatives has been developed from aryl nitrile and sodium azide through [3+2] cycloaddition reaction. This method has the advantage of high yield and easy work up process.

Keywords: Tetrazole, Azide, Antimicrobial Activity.

I. INTRODUCTION

Recently compounds containing tetrazole moiety have gained considerable attention because they have a wide range of applications in material science and medicinal chemistry. Various biological activities of these compounds are reported such as antihypertensive, antifungal, antibacterial, anticancer, antidiabetic, anticonvulsant, anti-inflammatory etc[1-3]. They also play a very important role as a ligand in coordination chemistry.

Tetrazole derivatives can be prepared by different methods. Generally, the most convenient and versatile procedure for the preparation of tetrazole is the cycloaddition between nitriles and azide[4]. Several methods have been reported for the synthesis of 1/5-substituted tetrazole, unfortunately these methods have some drawbacks such as long reaction times, use of expensive and toxic reagents and harsh reaction conditions, low yield, tedious work-up, and even the need for excess amounts of highly toxic and explosive hydrazoic acid[5-6]. Therefore, in order to overcome these drawbacks, it is necessary to develop a simple, convenient and more efficient method for the synthesis of tetrazole derivatives also it is necessary to synthesis novel tetrazole derivatives & checks them for biological activity[7-8].

II. MATERIALS AND METHODS

All chemicals used for the synthesis of the compounds were obtained from Sigma Aldrich and SD fine chemicals. Proton magnetic resonance (^{1}HNMR) spectra were recorded in 400 MHZ NMR spectrophotometer by using Deuterated Dimethyl Sulfoxide (DMSO-d_6) as solvent and Tetramethylsilane (TMS) as an internal standard. The Infra-Red (IR) spectra were recorded using Fourier Transform Infrared (FT-IR) spectrophotometer Model RZX (Perkin Elmer). Using Thin Layer Chromatography (TLC) purity of the synthesized compounds was checked. TLC silica gel coated plates obtained from Merck as stationary phase and mobile phase were mixture of ethyl acetate/hexane (20:80).

General Procedure

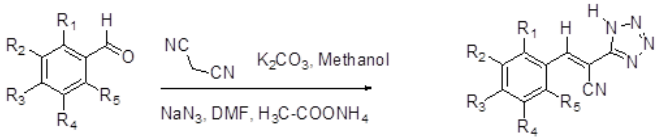
0.01 mole of aldehydes and 0.012 moles of malenonitrile was dissolved into 20 ml ethanol. In this reaction mixture 0.01 mole K_2CO_3 was added to initiate the reaction. The reaction mixture was reflux for 30 minutes. Solid was obtained that indicate completion of the reaction, further confirmed by thin layer chromatography. Then solid intermediate was isolated by filtration and then washed by using cold alcohol. The filtrate was dried at 60^0c in oven. In second step, 0.01 mole of above intermediate, 0.03 moles of sodium azide, 0.01mole sodium acetate and 20 ml dimethyl

formaamide was added as a solvent and heated at 100^0c for 6 hours. The progress of the reaction was monitored by thin layer chromatography. After completion of the reaction solvent was evaporated and 20 ml ethyl acetate was added into the flask to dissolve the residue obtained after the evaporation of dimethyl formaamide. Then the washing of 20 ml 10% hydrochloric acid was given to ethyl acetate layer. After washing ethyl acetate layer was dried over sodium sulphate and then ethyl acetate was evaporated to obtain tetrazole derivative. Using this typical procedure, other analogs of this series were prepared. Their structures have been confirmed by analyzing method such as ^{1}HNMR and IR spectra.

IR (1a) (cm-1): 1090 (C-Cl), 2350 (nitrile), 1585 (C=C), 1580 (C=N).

^{1}H-NMR (1a) (DMSO-d6) δ ppm: 7.24 (dd, 1H, Ar-H, J=2.5 &8.84 Hz), 7.21(dd, 1H, Ar-H, J=3.5 & 7.4 Hz), 7.22 (dd, 1H, Ar-H, J=3.5 &7.4 Hz), 7.24 (m, 1H, Ar-H), 7.54 (s, 1H, =C-H), 4.2 (s, 1H, N-H).

The reaction scheme for synthesis of novel tetrazole derivatives [1(a-i)] have been
Presented below in scheme 1.



Scheme 1

Table 1. Substituent attached to the aromatic ring of scheme 1.

Compound	R_1	R_2	R_3	R_4	R_5
1a	H	H	Cl	H	H
1b	OH	H	H	H	H
1c	H	OH	H	H	H
1d	H	H	OH	H	H
1e	H	H	OCH_3	OCH_3	H
1f	H	H	H	H	H
1g	H	H	OH	OCH_3	H
1h	H	H	F	H	H
1i	H	H	Br	H	H

III. RESULTS AND DISCUSSION

The novel tetrazole derivatives were synthesized successfully having good yields. The newly synthesized compounds were analyzed from ^{1}H-NMR and IR spectral analysis. Using disc diffusion method, newly synthesized compounds were screened for antimicrobial activity.

Antimicrobial activity

Compounds 1(a-i) were screened for their antimicrobial activity against Pseudomonas aeruginosa (ATCC 27853), Escherichia coli (ATCC 25922), Staphylococcus aureus (ATCC 25923) by paper disc diffusion method using gentamycin as a reference standard drug. At 100 µg/ml concentration, all the tests were evaluated. The culture media was Muller Hinton agar. After 24 h of incubation at 37°C the zone of inhibition was measured in mm. Microbial data for 1(a-i) as summarized in Table 2.

Table 2. Antimicrobial analysis data of compounds 1(a-j)

Sr. No.	Compound number	Pseudomonas aeruginosa (ATCC 27853)	Escherichia coli (ATCC 25922)	Staphylococcus aureus (ATCC 25923)
1	1a	No Zone	No Zone	No Zone
2	1b	No Zone	No Zone	No Zone
3	1c	No Zone	No Zone	No Zone
4	1d	No Zone	No Zone	No Zone

5	1e	No Zone	No Zone	No Zone
6	1f	No Zone	No Zone	No Zone
7	1g	No Zone	No Zone	No Zone
8	1h	No Zone	No Zone	No Zone
9	1i	No Zone	No Zone	No Zone
10	1j	No Zone	No Zone	No Zone
11	Gentamycin	23 mm	28 mm	32 mm

IV. CONCLUSION

The newly synthesized compounds were screened for their antimicrobial activity against Candida sp., and Gram-negative as well as Gram-positive bacterial strains. The synthesized compounds do not shown any activity as compared to standard drug. Chalcones are intermediate in the biosynthesis of flavonoid. They are a very valuable compounds whether from bioactivity aspects or from organic synthesis aspects. Chalcones exhibit diverse pharmacological activities and can serve as synthons for synthesis of heterocyclic compounds. Due to these reasons, various preparation procedures were developed by many working Scientist and groups, including ecofriendly protocol.

V. ACKNOWLEDGEMENT

The authors are thankful to UGC, WRO, Pune for financial support & The Principal of Deogiri college, Aurangabad for providing laboratory facilities.

VI. REFERENCES

[1]. T. S. Lin, W. H. Prusoff, J. Med. Chem. 1978, 21, 109-112.
[2]. Zablocky, J. A.; Miyano, M.; Sashidhar, N. R.; Panzer-Knodle, S.; Nicholson, N.;
[3]. Feigen, L. J. Med. Chem. 1992, 35, 4914-4917.
[4]. B. Das, C. R. Reddy, D. N. Kumar, M. Krishnaiah, R. Narender, Synlett, 2010, 391-394.
[5]. Kumar, A.; Narayanan, R.; Shechter, H. J. Org. Chem. 1996, 61, 4462-4465.
[6]. Sreedhar, B.; Kumar, A. S.; Yada, D. Tetrahedron Lett. 2011, 3565-3569.
[7]. Mohite P.B., Bhaskar V.H. International Journal of Pharm Tech Research Vol.3, No.3,pp 1557-1566,
[8]. Lang, L.; Li, B.; Liu, W.; Jiang, L.; Xu, Z.; Yin, G. Chem. Commun. 2010, 448-450.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Density Functional Theory Based Investigation of (2E)-1-(Anthracen-9-yl)-3-(3,4-Dichlorophenyl)Prop-2-En-1-One

R. K. Dongare*
Department of Chemistry, Ahmednagar College, Ahmednagar, Maharashtra, India

ABSTRACT

DFT/B3LYP method has been employed to study recently synthesized (2E)-1-(Anthracen-9-yl)-3-(3,4-dichlorophenyl)prop-2-en-1-one. In the present work, the calculated values, i.e. geometric parameters, mulliken charges, frontier orbital analysis, dipole moments and QSAR properties are reported.
Keywords: DFT, B3LYP, QSAR

I. INTRODUCTION

Chalcones are an important class of natural compounds and have been broadly applied as synthons in synthetic organic chemistry. Synthetic analogues of chalcones are being investigated worldwide for the development of more potent and efficient drugs for the treatment of a number of diseases such as cancer, diabetes, HIV, tuberculosis,malaria etc[1-8]. The nonlinear optical [NLO] properties of the different chalcone derivatives have also been reported [9-12]. The density functional theory provides the ground state properties of a system, and the electron density plays a key role. DFT predicts a great variety of molecular properties molecular structures, ionization energies, electric and magnetic properties.

II. COMPUTATIONAL STUDY

The structure of recently synthesized[13] (2E)-1-(Anthracen-9-yl)-3-(3,4-dichlorophenyl)prop-2-en-1-one. was optimized (RMS gradient = 0.0005994) with Density Functional Theory (DFT) using B3LYP method with 6-31G(d,p) basis set in GAMESS package[14]. Initial geometry of the compound was generated using Chem Bio3D Ultra 14.0. Geometry optimization was carried out without any geometrical constraints. The calculation of QSAR properties are performed by Chem Bio3D Ultra 14.0.

III. RESULTS AND DISCUSSIONS

3.1 DFT structural parameters

The DFT calculations were carried out with B3LYP/6-31G (d,p). The geometry parameter viz. Calculated bond distances, bond angle and torsion angles of compound is given Table 1

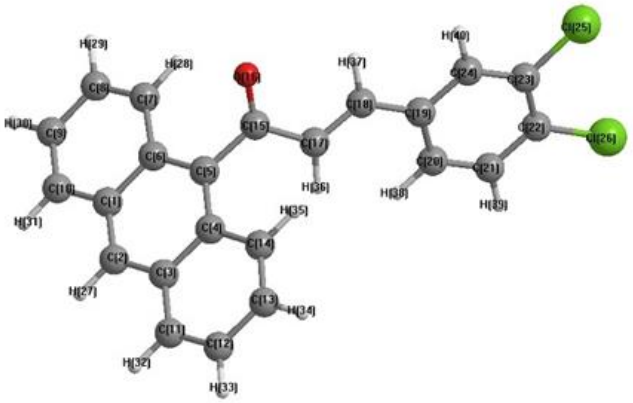


Figure 1. DFT / B3LYP optimized structure of the compound.

Table 1. Selected structure parameters

Bond distances		Bond angles		Torsion angles	
C15-O16	1.229	C4-C5-C15	119.827	C4-C5-C15-O16	-122.213
C5-C15	1.509	C6-C5-C15	119.091	C6-C5-C15-O16	61.327
C15-C17	1.487	C5-C4-C14	122.821	C5-C15-C17-C18	174.478
C17-C18	1.346	O16-C15-C17	121.893	C6-C5-C15-C17	-114.136
C18-C19	1.462	C5-C15-O16	121.958	C4-C5-C15-C17	62.324
C22-Cl26	1.745	C21-C22-Cl26	118.841	C17-C18-C19-C24	-169.019
C23-Cl25	1.748	C24-C23-Cl25	118.801	Cl25-C23-C24-C19	-179.885

3.2 Frontier Orbital Energy Analysis

According to the frontier molecular orbital theory, HOMO and LUMO are the most important factors that affect the bioactivity. HOMO has the priority to provide electrons, while LUMO can accept electrons first [15]. The energies of HOMO-2 to LUMO +2 orbitals are given in Table 2. HOMO – LUMO energy gap is 2.9823 eV (0.1096 a.u.).

Table 2. Energy levels (a.u.) of MOs calculated in their ground state in the gas phase.

HOMO-2	HOMO-1	HOMO	LUMO	LUMO+1	LUMO+2
-0.2427	-0.2393	-0.1973	-0.0877	-0.0636	-0.0290

3.3 Mulliken Atomic Charges

Table 3 exhibits the calculated Mulliken atomic charges except for atoms H. C_{15} is the most positively charged one, which can interact with the negative charged part of the receptor easily. The negative charges is mainly located on atom O_{16}, so it can interact easily with the positive part of the receptor. C_{15} being most positive and O_{16} most negative therefore C_{15}-O_{16} bond polarity plays a key role. Longer the C_{15}-O_{16} bond, more is C–O polarity and the biological activity must be the strong.

Table 3. Mulliken atomic charges except for atoms H (e) using DFT.

Atom No.	Charge
C1	0.105876
C2	-0.201911
C3	0.108796
C4	0.083506
C5	-0.054081
C6	0.086334
C7	-0.122284
C8	-0.094692
C9	-0.09225
C10	-0.12209
C11	-0.121815
C12	-0.09354
C13	-0.09432
C14	-0.136398
C15	0.31722

O16	-0.473207
C17	-0.139154
C18	-0.081395
C19	0.124539
C20	-0.101601
C21	-0.071268
C22	-0.0889
C23	-0.094678
C24	-0.10585
Cl25	0.024011
Cl26	0.026779

QSAR properties

QSAR studies facilitate to be acquainted with and calculate the physico chemical properties of a drug and its effect on biological activity. The common physico chemical properties include hydrophilic, electronic and steric nature. Hydrophobic character of a drug is important in recognizing its effortlessness in crossing the cell membrane and its interaction with the receptor.

Table 4. QSAR properties

Dipole Moment(Debye)	**LogP**	**Molar Refractivity (cm^3 / mol)**	**Partition Coefficient (Octanol/water)**
3.366	6.688	110.826	8.184

IV. CONCLUSION

DFT calculations reveal that small HOMO-LUMO gap of 2.9823 eV, location of HOMO on C15-O16 bond and bond polarity of C15-O16 bond as seen from Mulliken charge analysis will be key factors deciding biological activity of the molecule. QSAR properties generated show good penetrating capacity of the molecule into cell membrane.

V. REFERENCES

[1]. C.W. Mai, M. Yaeghoobi, N. Abd-Rahman, Y.B. Kang, and M.R. Pichika, Chalcones with electron-withdrawing and electron- donating substituents: anticancer activity against trail resistant cancer cells, structure-activity relationship analysis and regulation of apoptotic proteins, Eur. J. Med. Chem., 77(2014) 378-387.

[2]. S. Mukherjee,V. Kumar, A.K. Prasad ,H.G. Raj, M.E. Bracke, C.E. Olsen, S.C. Jain and V.S. Parmar, Synthetic and biological activity evaluation studies on novel 1,3-diarylpropenones, Bioorg. Med. Chem., 9 (2001) 337-345.

[3]. Y.M. Lin, Y. Zhou, M.T. Flavin, L.M. Zhou, W. Nie and F.C. Chen, Chalcones and flavonoids as anti-tuberculosis agents, Bioorg. Med. Chem., 10 (2002) 2795-2802.

[4]. S.N. Lopez, M.V. Castelli, S.A. Zacchino, J.N. Dominguez, G. Lobo, C.C Jaime, J.C.G. Cortes, J.C. Ribas, C. Devia, M.R. Ana and D.E. Ricardo, In vitro antifungal evaluation and structure-activity relationships of a new series of chalcone derivatives and synthetic analogues, with inhibitory properties against polymers of the fungal cell wall, Bioorg. Med. Chem., 9 (2001) 1999-2013.

[5]. A. Agarwal, K. Srivastava, S.K. Puri and P.M.S. Chauhan, synthesis of 2,4,6-trisubstituted pyrimidines as antimalarial agents, Bioorg. Med. Chem., 13 (2005) 4645-4650.

[6]. R. Abonia, D, Insausty, J. Castillo, B. Insausty, J. Quiroga, M. Nogueras and J. Cobo, Synthesis of novel quinoline-2-one based chalcones of potential anti-tumor activity,Eur. J. Med. Chem., 57 (2012) 29-40.

[7]. V.Sharma, A. Chaudhary, S. Arora, A.K. Saxena and M.P.S Ishar, β-Ion one drived chalcones as potent antiproliferative agents, Eur. J. Med. Chem., 69 (2013) 310-315.
[8]. S. Shenvi, K. Kumar, K.S. Hatti, K. Rijesh and L. Diwakar, Synthesis, anticancer and antioxidant activities of 2, 4, 5-trimethoxy chalcones and analogues from asaronaldehyde: Structure-activity relationship, Eur. J. Med. Chem., 62 (2013) 435-442.
[9]. B.K. Sarojini, B. Nrayana, B.V. Ashalatha, J. Indira and K.G. Lobo, Synthesis, crystal growth and studies on non-linear optical property of new chalcones, J. Cryst. Growth. 295(2006) 54-59.
[10]. S. Shettigar, G. Umesh, K. Chadrasekharan, B.K. Sarojini and B. Narayana, Studies on third-order nonlinear optical properties of chalcone derivatives in polymer host, Optical Materials. 30 (2008) 1297-1303.
[11]. P. Poornesh, S. Shettigar, G. Umesh, K.B. Manjunatha, K.P. Kamath, B.K. Sarojini and B. Narayana, Nonlinear optical studies on 1, 3-disubstituent chalcones doped polymer films, Optical Materials. 31 (2009) 854-859.
[12]. J. Indira, P.P. Karat and B.K. Sarojini, Growth, characterization and nonlinear optical property of chalcone derivative, J. Cryst. Growth, 242 (2002) 209-214.
[13]. V. D. Singh, V. V Salian, B. Narayana, B. K. Sarojini, Kamni1,S. Anthal, R.Kant, Synthesis and Crystal Structure of (2E)-1-(Anthracen-9-yl)-3-(3,4-dichlorophenyl)prop-2-en-1-one, Journal of Applied Chemistry, 10 (2017) 53-57.
[14]. M.W.Schmidt, K.K.Baldridge, J.A.Boatz, S.T.Elbert, M.S.Gordon, J.H.Jensen, S.Koseki, N.Matsunaga, K.A.Nguyen, S.J.Su, T.L.Windus, M.Dupuis, J.A.Montgomery, J.Comput.Chem. 14 (1993) 1347-1363.
[15]. Liu X.H., Chen P.Q., Wang B.L., Li Y.H., Wang S.H., Li Z.M. Bioorg. Med. Chem. Lett. 17 (2007) 3784-3788.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Isolation, Synthesis and Characterization of Novel Process Related Impurities in Cetirizine Dihydrochloride by Mass and NMR Spectrometry

Laki P. Magar[*1], Bhaskar H. Zawarea[2] ,Kishor More[2], Brajesh Sharma[2], Kailas Shikhare[2], Rajesh Kamath[2], Prashant Patil[2], Leena Gupta[2]

[1]Department of chemistry, New Arts, Commerce and Science college, Ahmednagar, Maharashtra ,India
[2]IPCA Laboratories Ltd. Chemical Research Division, Kandivali Industrial Estate,Kandivali (West). Mumbai, Maharashtra, India

ABSTRACT

Two new process related impurities were observed in Cetirizine dihydrochloride samples when analyzed by United States Pharmacopeia (USP) described high performance liquid chromatography method (HPLC). These impurities were isolated using Preparative high performance liquid chromatography followed by full characterization using analytical techniques like mass, ^{1}H, ^{13}C-NMR and designated as (±)-2,2-bis[4-[(4-chlorophenyl)phenylmethyl]piperazin-1-yl]ethoxy]acetic acid and bis[[1-(4-chlorophenyl)-1-phenyl]methyl]ether. These impurities were also synthesized and reconfirmed by co-injection in HPLC.

Keywords: Cetirizine; Process-related impurities, Identification, Synthesis, HPLC

I. INTRODUCTION

(±)-[2-[4-[(4-chlorophenyl)phenylmethyl]piperazin-1-yl]ethoxy]acetic acid also known by the generic name of cetirizine is a non-sedating type histamine H1-receptor antagonist and is used for the treatment of allergic syndromes, such as chronic and acute allergic rhinitis including seasonal and perennial allergic rhinits, allergic conjunctivitis, pruritus, urticaria, and the like [1-3]. Cetirizine is a second-generation antihistamine and is less able to cross the blood-brain barrier and therefore have diminished effects on the central nervous system compared to first-generation drugs [4]. Cetirizine, and more in particular its dihydrochloride is a molecule of great success on the market and hence different methods of its synthesis have been studied [5-8]. Our route of synthesis has shown in Figure 1.

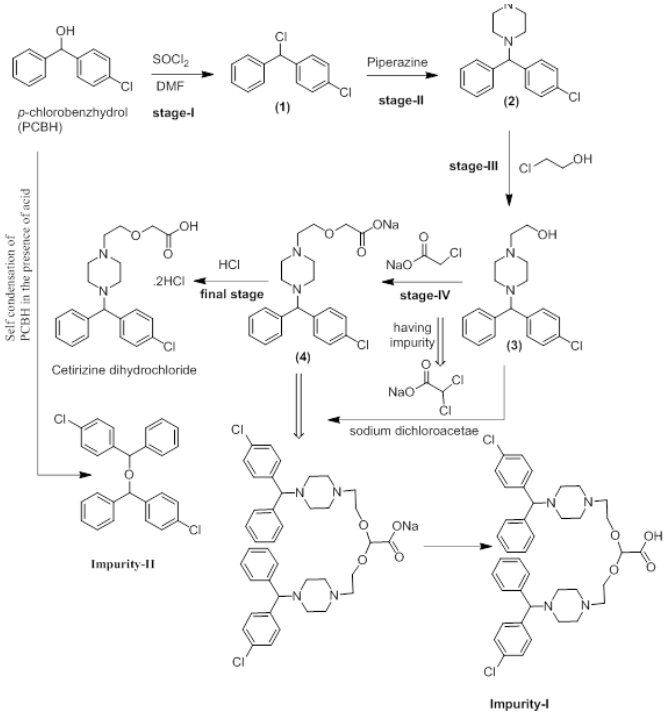


Figure 1. Route of synthesis of cetirizine dihydeochloride showing the plausible formation of impurities 1 and 2

Safety and quality of pharmaceutical products can be affected by the impurities present in the Active

Pharmaceutical Ingredients (APIs); hence impurity profile study of the API to be used in the manufacturing of drug substance is necessary. The impurity profile of API may vary if there are any changes in synthetic route and/or key raw materials. Therefore it is essential to know all the possible impurities that can be generated during the manufacturing process of drug substance. According to International Conference on Harmonization (ICH) guidelines identifying and characterizing all impurities that are present at a level of 0.10% or more are recommended [9].

On HPLC analysis of the batches which were manufactured during the lab development process, it was found that apart from USP listed impurities there were two impurities which were new and unknown [10]. These two impurities were observed at RT 62.886 (impurity-I) and RT 94.482 (impurity-II) at a level > 0.1%. Since these impurities were present at a level more than the identification threshold, therefore identification of these impurities was done by their isolation using Preparative high performance liquid chromatography, followed by full characterization using spectral techniques like MS, ^{1}H and ^{13}C-NMR. After identification these impurities were synthesized and further confirmed by co-injection in HPLC.

Herein we wish to discuss the identification, isolation, synthesis and full characterization of two new process related impurities using sophisticated techniques like Mass and NMR spectrometry.

II. MATERIALS AND METHODS

Samples and reagents

Cetirizine dihydrochloride batches were synthesized at manufacturing site of Ipca Laboratories Ltd. (Mumbai, India). HPLC grade acetonitrile and concentrated sulfuric acid was from Merck. Deuterated chloroform and D2O were purchased from Merck KGaA, Darmstadt, Germany. Millipore MilliQ Plus Water purification system was used to obtain high purity water.

High performance liquid chromatography

HPLC analysis was performed on Waters Alliance HPLC with, pump-alliance (2695), auto sampler (2695); with empower software ^{R} (Waters USA) using UV detector (2489) as well as 2996 photo diode array (PDA) detector. The output was being monitored with Empower 3.0 Software version. The separation was carried out on Symmetry shield RP-18, 250 × 4.6 mm × 5µ m column. The mobile phase was a mixture of solution A (dissolve2 g of tetrabutylammonium hydrogen sulfate and 3 g of sodium phosphate monobasic in 1litre of water, pH adjusted to 2.7 with 1N sodium hydroxide) and solution B (methanol) with time gradient program as mentioned in USP [10]. The injection volume was 10 µl and chromatographed under prescribed condition at 232 nm.

Preparative high performance liquid chromatography

A Waters Model Alliance 2555 Separation Module (Waters Corporation, Milford, MA, USA) equipped with a Waters 2489 UV Detector and Empower software was used. The column used for separation was Unisphere C18 250 ×50 mm× 10µ m. Mobile phase used for the separation was Buffer: ACN (50: 50). Buffer was the water having pH 2.5 adjusted with TFA. Injection volume was 5ml with 2.5 g of sample. The flow rate was maintained at 30 ml / min with output monitored at 232 nm.

Mass spectrometry

The High Resolution Mass Spectra of isolated impurity was obtained from a Thermo Scientific Q-Exactive-Orbitrap mass spectrometer (Waltham, Massachusetts, United States**)** with 17500 resolutions. Sample prepared in isocratic mixture of acetonitrile and water (50:50, v/v) was introduced by syringe pump and ionization was achieved by HESI ionization source in the positive ion detection mode. Nitrogen was used as both the sheath gas and the auxiliary gas at 30psi and 10 psi respectively. HESI source parameters were set as capillary temperature $320^{0}C$, spray voltage of 4 kV and heater temperature $250^{0}C$. Scanning of sample was done over mass range of 150-1000 m/z. Operating software used was Thermo Xcalibur 3.0.63.

Nuclear magnetic resonance spectroscopy

The ^{1}H, ^{13}C NMR spectra were recorded on AVANCE 400 (Bruker, Fallanden, Switzerland) instrument at 300K. Solvent used for impurities sample run was $CDCl_3$ and for Cetirizine it was D_2O. Distortionless enhancement by polarization transfer (DEPT) spectral editing revealed the presence of methyl and methine groups as positive peaks while the methylenes as negative peaks

III. RESULTS AND DISCUSSIONS

Detection of unknown impurity

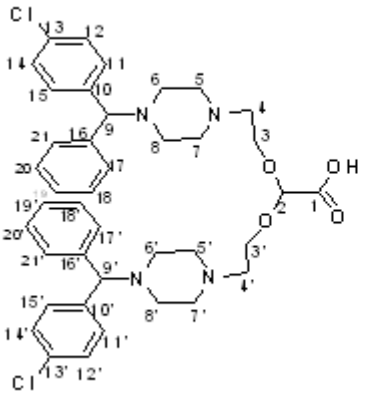
Cetirizine dihydrochloride samples were analyzed by the USP described HPLC method (section 2.2). Two new impurities at RT 62.886 (impurity-I) and 94.482 (impurity-II) were observed along with Cetirizine at RT 32.396. These two new impurities were isolated from the sample by using Preparative high performance liquid chromatography as described in section 2.3 and fully characterized to get the exact structure.

Structure elucidation of impurities

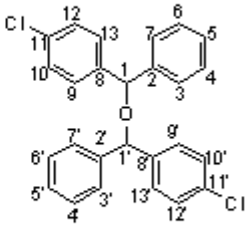
Impurities isolated were found to have HPLC purity ≥ 95%. These impurities were directly used for structure elucidation without any further purification. On the basis of spectral data like mass, ^{1}H and ^{13} C-NMR (Table 1), structure of theses impurities were designated.

Table 1. 1H and 13C NMR data of impurities

Impurity-I



Impurity-II



Position	Integrat	δ(ppm) multiplicit	^{13}C δ(ppm)	?	Position	Integra	δ(ppm) multiplicity	^{13}C δ(ppm)
1	-	-	172.04		1, 1’	2H	5.43, s	79.6, 79.5
2	1H	4.98, s	99.7					
3, 3’	4H	4.05, t	61.9					
4, 4’		(3.27-3.31)	56.1					
6,6’	12H	bs + m	48.7					
8,8’			48.7					
5, 5’	8H	2.72, bs	53.1					
7, 7’			53.1					
9, 9’	2H	4.31, s	74.5					
10,10’	-	-	140.1		2, 2’	-		140.6, 140.7
11,11’	2H		129.1		3, 3’	2H		127.2-127.9
12,12’	2H	m(7.18-7.34	128.9		4, 4’	2H		128.5-128.7
13,13’	-	-	133.2		5, 5’	2H	m (7.28-7.41)	128.5-128.7
14,14’	2H		128.9		6, 6’	2H		128.5-128.7
15, 15’	2H		129.1		7, 7’	2H		127.2-127.9
16,16’	-	-	140.9		8, 8’	-		141.4, 141.5
17,17’	2H		127.8		9, 9’	2H		127.2-127.9
18,18’	2H		128.9		10, 10’	2H		128.5-128.7
19,19’	2H		128.9		11, 11’	-		133.3, 133.4
20,20’	2H		128.9		12, 12’	-		128.5-128.7
21, 21’	2H		127.5					

Impurity I

ESI mass spectrum of impurity-I displayed protonated molecule peak at m/z 717.29 $[M+H]^+$ in positive ion mode, indicating the mass of to be 716.29 which is 61.49 amu less than that of double of Cetirizine. On subjecting to elemental composition calculator this impurity found to have molecular formula $C_{40}H_{46}Cl_2N_4O_4$. This indicates that the impurity can be a molecule which would be structurally close to dimer of Cetirizine molecule. ^{1}H NMR spectrum of this impurity has shown the presence of 18 aromatic protons which are double of Cetirizine aromatic protons. 2 protons showed singlet at δ 4.316 ppm, which could be same as that of CH proton of Cetirizine molecule. Also the singlet of 2 protons (alpha to carboxylic acid) of Cetirizine that appeared at δ 4.06 ppm has been replaced by singlet of 1 proton at δ 4.98 ppm in this impurity. Same conclusion can be withdrawn from ^{13}C NMR spectrum. It showed 1 CH peak at 99.7 ppm instead of Cetirizine CH_2 (alpha to carboxylic) peak. Based on the above collective spectral analysis the structure of impurity was proposed as (±)-2,2-bis[4-[(4-chlorophenyl)phenylmethyl]piperazin-1-yl]ethoxy]aceticacid. For further confirmation the impurity was synthesized as described in section 3.3 and confirmed by co-injection with the API sample.

Impurity II

ESI mass spectrum of this impurity was done both in positive ion mode and negative ion mode. But due to inconsistency in mass value it was not possible to predict any possible structure. Then its proton NMR and Carbon NMR was taken. In ^{1}H NMR there were only 2 aliphatic protons found to shown singlet at δ 5.431 ppm rest 18 aromatic protons were in aromatic region. This pattern was same as of its starting material p-chlorobenzhydrol (PCBH). Only difference was in the number of protons which were only 2 protons less (20 protons) than the double of PCBH protons (11× 2= 22 protons). This made us think on the possibility of the self condensation of PCBH to give ether linkage dimer type molecule with loss of one water molecule. Looking at ^{13}C spectra of the impurity same conclusion can be drawn as the ^{13}C spectra pattern was same as that of PCBH with double number of carbon atoms. For further confirmation this possible impurity was synthesized as discussed in section 3.3 and confirmed after co-injection with the API sample.

IV. SYNTHESIS OF IMPURITIES

Preparation of impurity I

3.28 g (0.01 mole) of Cetirizine ethanol (Stage –III intermediate stage) and 0.03 moles of potassium t-butoxide was dissolved in 15 ml of dimethylformamide. Reaction mass was heated to 55-60 °C for 1 h. then 0.5 g (0.003 mole) of sodium dichloroacetate was added to this reaction mixture and heated to 55-60 °C for 6h (monitored by TLC). Reaction mass was cooled to room temperature and 30 ml of water was added to it. Wash the aqueous layer thrice with ethyl acetate (20 ml ×3). pH of aqueous layer was adjusted to 4 by adding dilute hydrochloric acid. Extract this aqueous layer with methylene dichloride (MDC). MDC was distilled out to obtain the crude mass which was purified using MDC: methanol (95.5:0.5) as an eluent with HPLC purity ≥ 95%.

Preparation of impurity II

5 g (0.0228 mole) of p-chlorobenzhydrol and 0.5 g (0.003 mole) were taken in 50 ml toluene. Reaction mass was heated to 110-115 °C for 2 h (monitored by TLC). Water was removed azeotropically and reaction mass was cooled to room temperature. 50 ml water was added to reaction mixture followed by layer separation. Toluene layer was washed with 8% sodium bicarbonate solution and dried over sodium sulfate. Solvent was removed under reduced pressure to get the crude mass which was purified by passing it through a column of silica gel using ethyl acetate: hexane (1:9) as an eluent. HPLC purity of impurity-II obtained was more than 95%.

Pathway of the formation of impurities

The route of synthesis of Cetirizine dihydrochloride along with the formation of these identified impurities has shown in fig. 1. Possibility of the formation of impurity-I seems from the presence of sodium dichloroacetate impurity in key starting material sodium monochloroacetate. During the formation of intermediate **(4),** impurity sodium dichloroacetate reacts with intermediate **(3)** to give the impurity-I. While PCBH (one of the USP-listed impurity), which might be present as an impurity in intermediate **(4)** will undergo self condensation via removal of water molecule in the presence of hydrochloric acid at final stage to give impurity-II.

V. CONCLUSIONS

To the best of our knowledge this is for the first time two new process related impurities named as (±)-2,2-bis[4-[(4-chlorophenyl)phenylmethyl]piperazin-1-yl]ethoxy]acetic acid and bis[[1-(4-chlorophenyl)-1-phenyl]methyl]ether have been identified in Cetirizine dihydrochloride drug substance when analyzed by USP described chromatographic method.

VI. ACKNOWLEDGEMENTS

The authors are thankful to the management of Ipca Laboratories Ltd., for encouragement and support. We also want to acknowledge all our colleagues of analytical department for providing valuable analysis and spectral data.

VII. REFERENCES

[1]. R. B. Nieman, Cetirizine in patients with seasonal rhinitis and concomitant asthma, J. Allergy Clin. Immunol. 97 (1996) 716-717.

[2]. J. Kalivas, D. Breneman, M. Tharp, S. Bruce, M. Bigby, Urticaria: Clinical efficacy of cetirizine in comparison with hydroxyzine and placebo, J. Allergy Clin. Immunol. 86 (1990) 1014-1018.

[3]. F. Estelle R. Simons, Keith J. Simons, Histamine and H1-antihistamines: Celebrating a century of progress, J. Allergy Clin. Immunol. 128 (2011) 1139-1150.

[4]. A. M. Snowman, S. H. Snyder, Cetirizine: Actions on neurotransmitter receptors, J. Allergy Clin. Immunol. 86 (1990) 1025-1028.

[5]. B. Lal, S. Lahiri, C. P. Bapat, R. S. Kulkarni, D. K. Mulla, A. Y. Hawaldar, Novel water based process for the preparation of substituted diphenylmethyl piperazines, US 2011/0172425 A1.

[6]. S. P. Singh, M. Siddiqui, M. Jaweed, A. Y. Merwade, A. R. Khan, 2-[2-[4-[(4-chlorophenyl) phenylmethyl]-1-piperazinyl]ethoxy]acetic acid monohydrochloride as anti-allergenic compound and process for its production, WO 2004/103982 A1.

[7]. J. Reiter, P. Trinka, F. Bartha, G. Simig, K. Nagy, G. V. Donath, N. Nemeth, G. Clementis, P. Tompe, P. Vago, Process for the preparation of {2-[4-α-phenyl-p-chlorobenzyl)piperazin-1-yl]ethoxy} acetic acid and novel intermediates therefor, US 6908999 B2, 2005.

[8]. M. Lussana, E. Vigano, E. Pizzatti, Process for obtaining cetirizine dihydrochloride, US 20090030205 A1.

[9]. ICH Guideline, Impurities in New Drug Substances Q3A (R2), October 25, 2006.

[10]. United States Pharmacopeia, Cetirizine Hydrochloride, Revision Bulletin, 2010.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Synthesis and Characterization of Impurities Listed in United States Pharmacopeia of Risperidone Tablets

Laki P. Magar[1,2*], Bhaskar H. Zaware[1], Brajesh Sharma[2], Kishor R. More[2],Kailas Shikhare[2], Leena Gupta[2]

[1]Department of chemistry, New Arts, Commerce and Science college, Ahmednagar, Maharashtra, India
[2]IPCA Laboratories Ltd. Chemical Research Division, Kandivali Industrial Estate,Kandivali (West). Mumbai, Maharashtra, India

ABSTRACT

A very simple and efficient synthesis of three impurities of Risperidone tablets named Risperidone-cis-N-oxide, Risperidone-trans-N-oxide and Bicyclorisperidone mentioned in Unites States Pharmacopeia (USP) of Risperidone tablets has been presented in this manuscript. These three impurities were synthesized and fully characterized on the basis of mass, proton and carbon spectra.

Keywords: Risperidone N-oxide, Bicyclorisperidone, Impurities, Synthesis.

I. INTRODUCTION

Risperidone is an antipsychotic agent belonging to 3-piperidinyl-l-,2-benzisoxazole derivative and has chemical name 3-[2-[4-(6-fluoro-l,2-benzisoxazol-3-yl)-l-piperidinyl]ethyl]-6,7,8,9- tetrahydro-2-methyl-4H-pyrido[l,2-a]pyrimidin-4-one. It is an antipsychotic compound having combined serotonin ($5\text{-}HT_2$) and dopamine (D_2) receptor antagonist effects which plays an important role in the treatment of schizophrenia[1, 2]. Schizophrenia is one of the most severe and debilitating major psychiatric diseases. The introduction of antipsychotic drugs was indisputably a great advance in the pharmacotherapy of mental disorders. There are many advantages offered by Risperidone over typical antipsychotic drugs like faster onset of antipsychotic action, a lower incidence of extrapyramidal effects and greater efficacy against the negative symptoms of schizophrenia [3, 4].

Today, one of the main challenges for the pharmaceutical industry is to develop new drugs that are safe, effective and of high quality when they reach the patients[5]. Impurity profiling (identification and quantification) of a drug plays an important role in order to meet the challenges to ensure high degree of purity of drug substances and drug products[6, 7]. The important and sometimes critical step in impurity profiling is the synthesis of impurity standards that could be useful for analytical method development and validation purpose[8].

In this context, we have undertaken the synthesis of three United States Pharmacopeia (USP) listed impurities of Risperidone tablets named Bicyclorisperidone, Risperidone trans-N-oxide and Risperidone cis-N-oxide[9]. The synthesis and characterization of these impurities have not been reported so far in the literature. These impurities were first synthesized in high purity, characterized by Mass, NMR and further confirmed by their relative retention time (RRT) when injected in HPLC system applying same chromatographic conditions as *described* in USP monograph of Risperidone tablets.

II. RESULTS AND DISCUSSION

Synthesis of all three impurities was carried out from Risperidone sample. Treatment of Risperidone with 30% H_2O_2 in methanol for around 48 hrs gave the mixture of two oxidative products i.e. mixture of cis- and trans-Risperidone N-oxide Figure 1.

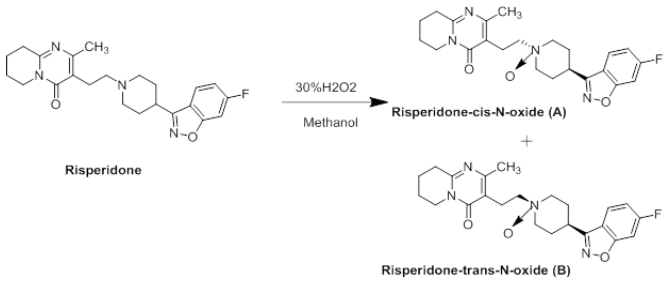


Figure 1. synthesis of Risperidone cis/trans-N-oxide

The reaction was monitored on thin layer chromatography (TLC; 2% Methanol in MDC). After complete conversion of Risperidone into oxides, the mixture of oxides was subjected to flash chromatography for their separation. To assign cis and trans they were injected in HPLC system with the same conditions as mentioned in USP monograph. On comparing RRT values of these oxides with standard values mentioned in USP monograph, we designated cis (RRT: 1.81)and trans (RRT: 1.65)to the obtained oxides. It was observed that the oxide which came above as compared to another oxide on TLC was cis (less polar) and the later one was trans-oxide (more polar).

For further confirmation, characterization was carried out using mass and NMR spectra. ESI mass spectra of theses oxides was recorded and for both M^+ ion peaks appeared at 427.215, which corresponds to the addition of one oxygen atom in Risperidone molecule. ^1H and ^{13}C-NMR was taken and compared with Risperidone. In both oxides, the ^1H and the ^{13}C chemical shifts of the methylene groups attached to the nitrogen atom in the piperidine ring found to be deshielded when compared to those of Risperidone. Further, in trans-oxide the equatorial protons of methylene group were observed with higher value of chemical shift (δ= 3.71 ppm) when compared to cis-oxide (δ= 3.39 ppm). Rest, not much difference was observed in their δ values.

Synthesis of Bicyclorisperidone was achieved by heating Risperidone in the presence of potassium carbonate and potassium iodide (as a catalyst) in DMF at 120°C for 30-34 hrs. It seems that Risperidone undergoes Boulton-Katritzky type rearrangement[10, 11] under such conditions and converted into Bicyclorisperidone Figure 2.

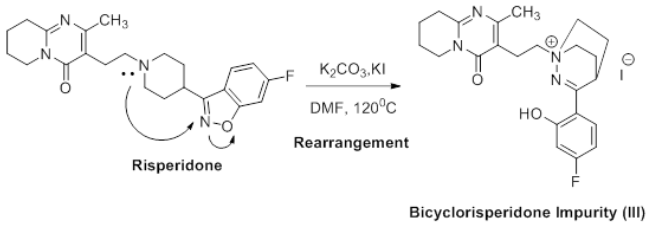


Figure 2. Synthesis of Bicyclorisperidone

Conversion was around 30-40%. After isolating Bicyclorisperidone using flash chromatography in 95% purity, it was injected in HPLC system with the same conditions as mentioned in USP monograph and on comparison of RRT value of Bicyclorisperidone (RRT: 0.68) with standard value mentioned in USP monograph, its formation was predicted.

For further confirmation, characterization was done by recording ESI mass spectra and ^1H NMR spectra. Mass spectra of this impurity showed m/z at 411.222 corresponds to exact mass of bicyclo cation and m/z 411.22 also refers to the M^+ molecular ion peak of Risperidone molecule. Both bicyclo and Risperidone has same number of protons and equal to 27. Now to confirm the formation of bicyclo cation impurity i.e. Bicyclorisperidone, its proton and carbon NMR was taken and compared with Risperidone. Bicyclic cation formation was clearly understood by seeing the chemical shift values of methylene protons of piperidine ring. Their values increased from 1.99 to 3.29/3.19 because of positive charge on nitrogen atom. Methylene protons attached to N^+ also shifted to downfield (3.28 ppm) as compared to Risperidone (2.45 ppm). Also CH proton of piperidine ring in bicyclo impurity shifted to upfield (1.18 ppm) as compared to Risperidone (2.98 ppm). All these chemical shifts confirm the formation of Bicyclorisperidone impurity.

III. EXPERIMENTAL

General procedure for the synthesis of Risperidone *cis* and *trans*-N-oxides:

Synthesis of Risperidone-N-oxides has been carried out as shown in Figure 1. To the solution of 2 g of Risperidone in 40 ml methanol, 10 ml of 30% hydrogen peroxide was added. Reaction mixture was maintained at 30-35 °C for 48 hrs. Reaction progress was monitored on TLC (2% Methanol in MDC). After completion of reaction, mixture was distilled out under vacuum at 30°C. 100 ml of water was added to obtained residue

and extracted twice with 100 ml of methylene dichloride. 3 g of residue was obtained which contained mixture of cis and trans-N-oxide. Now this mixture was subjected to flash chromatography (Combiflash) and *cis/trans*-N-oxides were separated. *Cis*-N-oxide (Impurity-I) weight obtained was 1 g and *trans*-N-oxide (Impurity-II) weighed 0.20 g.

Characteristic data of Risperidone *cis*-N-oxide (Impurity-I):

^{1}H NMR (MeOD, 400 MHz, δ ppm): 7.98(dd, J= 8.4Hz, J= 6.8 Hz, Ar1H), 7.43 (dd, J = 8.4 Hz, J= 2.0 Hz, Ar1H), 7.19-7.24(m, Ar1H), 3.75(t, 2H, J= 6.2Hz, -CH_2NCO), 3.58-3.61(m, 4H, -NCH_2CH_2), 3.52-3.39(m, 3H, CH and 2–$NCH_{equi.}$ of piperidine ring), 3.14-3.18(m, 2H, 2–$NCH_{axial.}$ of piperidine ring), 2.90(t, 2H, J=6.6 Hz, CH_2C=N), 2.75-2.2.81(m, 2H, 2–$NCH_2CH_{equi.}$of piperidine ring), 2.40(s, 3H), 2.13-2.17(m, 2H, 2–NCH_2CH_{axial} of piperidine ring), 1.89-2.05(m, 4H, -CCH_2CH_2C); ^{13}CNMR (MeOD, 400 MHz, δ ppm): 165.7, 164.0, 163.9, 163.2, 162.7, 160.1, 159.7, 158.2, 123.0, 122.8, 116.9, 116.0, 112.4, 112.2, 96.9, 96.6, 68.0, 63.1, 42.9, 31.7, 30.6, 29.4, 24.8, 21.3, 19.6, 19.5, 18.5.Characteristic data of Risperidone *trans*-N-oxide (Impurity-II): ^{1}H NMR (MeOD, 400 MHz, δ ppm): 7.94 (dd, J = 8.4 Hz, J= 5.0 Hz, Ar1H), 7.42(dd, J= 8.6Hz, J= 1.8 Hz, Ar1H), 7.18-7.23(m, Ar1H), 3.75(t, 2H, J= 6.2Hz, -CH_2NCO), 3.71-3.74(m, 3H, CH and 2–$NCH_{equi.}$ of piperidine ring), 3.38-3.42 (m, 4H, -NCH_2CH_2), 3.05-3.10(m, 2H, 2–$NCH_{axial.}$ of piperidine ring), 2.89 (t, 2H, J= 6.6 Hz, CH_2C=N), 2.67 (bs, 2H, 2–$NCH_2CH_{equi.}$of piperidine ring), 2.37(s, 3H, CH_3), 2.25-2.28(m, 2H, 2–$NCH_2CH_{axial}$of piperidine ring), 1.87-2.01(m, 4H, -CCH_2CH_2C); ^{13}CNMR (MeOD, 400 MHz, δ ppm): 165.7, 163.8, 163.6, 163.2, 162.7, 159.5, 158.1, 123.0, 122.9, 117.2, 115.9, 112.5, 112.3, 96.8, 96.5, 63.0, 62.7, 42.9, 30.6, 29.3, 24.9, 21.3, 19.6, 19.5, 18.4.

General procedure for the synthesis of Bicyclorisperidone (Impurity-III)

To the solution of 2 g of Risperidone in 10 ml of dimethylformamide, 1.35 g of potassium carbonate and 0.08 g of potassium iodide was added. Reaction mixture was heated at 120 °C and refluxed for 30-35 h. Reaction was monitored on TLC. After completion of reaction, mixture was distilled out under vacuum at 50°C. Residue obtained was loaded on column chromatography to obtained pure 0.05 g of Bicyclorisperidone using 10% methanol/MDC as eluent system Figure 2. ^{1}H NMR (DMSO-d_6, 400 MHz, δ ppm): 6.81-6.93(m, 1H), 6.92(d, J= 10 Hz, 1H), 7.59 (dd, J = 8.8 Hz, J= 7.2Hz, 1H), 4.0-4.016(m, 2H, -CH_2NCO), 3.74-3.82(m, 6H, -N^+ $(CH_2)_3$), 3.07-3.09(m, 2H, -CH2CCO), 2.79 (t, 2H, J= 6.4 Hz, -CH_2C=N), 2.28(s, 3H, CH_3), 1.77-1.86(m, 8H, -$N^+CH_2CH_2$, -$N^+CH_2CH_2$ and -CCH_2CH_2C), 1.23-1.28(m, 1H, CH); ^{13}CNMR (DMSO-d_6, 400 MHz, δ ppm): 166.6, 164.6, 162.7, 162.2, 155.2, 153.0, 132.2, 116.0, 114.4, 108.3, 104.1, 64.6, 59.1, 46.8, 35.0, 31.4, 26.3, 22.7, 21.6, 20.4, 18.5, 16.1.

IV. CONCLUSION

Keeping in view the importance given by different regulatory authorities to impurity profiling of Drug substance/Drug product, we decided to synthesize three USP listed impurities of Risperidone tablets whose synthesis and characterization have not been reported so far and also characterized them successfully.

V. ACKNOWLEDGMENTS

The authors are thankful to management of Ipca Laboratories for providing necessary support for the work.

VI. REFERENCES

[1]. Reynolds, G. P. Ther. Adv. Psychopharmacol. 2011, 1, 197-204.
[2]. He, H.; Richardson, J. S.International Clinical Psychopharmacology, 1995, 10, 19-30.
[3]. Marder, S. R.; Meibach, R. C. Am. J. Psychiatry. 1994, 151, 825-35.
[4]. Miyamoto, S.; G E Duncan, G. E.; Marx, C. E.; Lieberman, J. A. Molecular Psychiatry, 2005, 10, 79–104.
[5]. Paul, S. M.; Mytelka, D. S.; Christopher T. Dunwiddie, C. T.; Persinger, C. C.; Munos, B. H.; , Lindborg, S. R.; Schacht, A. L. Nature Reviews Drug Discovery, 2010,9, 203-214.
[6]. Holm, R.; Elder, D. P. Eur. J. Pharm. Sci. 2016, 87, 118-135.
[7]. International Conference on Harmonisation, ICH (2006) Q3B (R2): Impurities in new drug product.
[8]. International Conference on Harmonisation, ICH (2005) Q2B (R1): Validation of analytical procedures: Text and methodology.
[9]. USP monograph: Risperidone Tablets, USP38-NF33, Pharmacopeial forum, 32(4), 1109.

[10]. Raymond, C. F. Jones.; Chatterley, A.; Marty, R.; Owton, W. M.; Mark, R. J. Elsegood, Chem. Commun., 2015, 51, 1112-1115.
[11]. J. J. Li, Name Reactions, 4th ed., 2009, 62-63.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Physico-Chemical Analysis of Soil Samples in Osmanabad District, Maharashtra

V.V.Naiknaware
Department of Chemistry Swa. Sawarkar college, Beed, Maharashtra, India

ABSTRACT

Regarding yield of the crops and growth regulation fertility of soil is most important but today's scenario of agriculture farming in India is not care about it. The present study has been undertaken to investigate the physic-chemical characteristics of soil samples collected from different villages of Osmanabad district, Maharashtra, India. The soil characterization was carried out for the parameters like P^H, Electrical conductivity, Total organic Carbon,Nitrogen,Phosphorous(P_2O_5),Potassium(K_2O).This study leads us to the conclusion of the nutrients quality of soil of different villages of Osmanabad district. The present study result shows that average all the villages of Osmanabad district have medium or high minerals content. This information will help farmers to solve the problems related to soil nutrients amount of which fertilizer to be added to increase the yield of crops.

Keywords: Soil quality, Organic carbon, Nitrogen, Phosphorous, Osmanabad District.

I. INTRODUCTION

Soil resources are of vital importance for survival and welfare of the people. As a very small fraction of the huge soil mass is used for analysis, it becomes extremely important to get a truly representative soil sample of the field. One of the most serve and widespread problems facing the agriculture, industry is degradation of soil quality due to salinity. In fact almost 40% of the world's land surface is affected by salinity problem (Bacchevar 2011). Soil sampling is perhaps the most vital step for any soil analysis. As a very small fraction of the huge soil mass is used for analysis, it becomes extremely important to get a truly representative soil sample of the field. Soil test based nutrients management has emerged as a key issue in effort to increase agriculture productivity and production since optional uses of nutrients, based on soil analysis can improve crop productivity and minimizing wastage of these nutrients, thus minimizing impact on environmental leading to bias through optical production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated area (Kaur H. 2002). Soil is natural body on which agriculture product grows and it has fragile ecosystem. Soil is medium in which crop growth to food and cloth the world. Fertility of soil is one of the most important factors which regulate growth and yield of crops. Due to an imbalance and an inadequate use of fertilizers, improper irrigation and various cultural practices, the soil quality is depleting rapidly(Pandeeswari N 2012). Soil is an important natural resource and plays a crucial role in maintaining environmental balance (Bear F E1976). Certain external factor control plant growth, air, temperature, mechanical support, nutrients and water. Plant had element for their growth and completion of life cycle of plant. Growth of all plants is essential of elements like carbon, Oxygen, Nitrogen, Potassium, Phosphorous, Hydrogen etc.

The present work is undertaken to study the physico-chemical analysis of soil samples collected from different villages of Osmanabad district, Maharashtra. In present study characterization of soil was characterized various parameters like PH, electrical conductivity, Total organic carbon, Nitrogen, Potassium(K2O), Phosphorous(P2O5), etc. This study leads us to the conclusion of the nutrients quality of soil of different villages of Osmanabad district.

II. MATERIAL AND METHODS

The soil samples were collected from ten different villages in the depth of 0 to 25cm from the surface of

soil in the polythene bags. The soil samples were collected in the month of Feb. 2014. The ten samples cites from Osmanabad district are Tadwale, Dhoki, Jagaji, Yedashi, Palsap, Ter, Upale, Khamgaon. Analysis of the physico-chemical parameters of the soil sample were suspended in distilled water and allowed to settle down the particles. The PH of the suspension was determined using PH meter. Electrical conductivity (EC) of the soil was determined in the filtrate of water extract using conductivity meter (Chandra R 2009). Percentage of organic carbon content was determined by adopting chromic acid wet digestion method. Nitrogen, Phosphorous and Potassium are determined by standard procedure. Results were compared with standard values.

III. RESULTS AND DISCUSSION

Table 1. Physico-chemical analysis of soil samples from different villages of Osmanabad District Maharashtra(India)

Sr.No.	Name of Villages	P^H	Electrical conductivity mhos	% of organic Carbon	% of Nitrogen	% of Phosphorous	% of Potassium
1	Tadwale	7.65	0.64	0.78	0.06	0.032	0.96
2	Dhoki	7.44	0.80	0.64	0.05	0.028	1.06
3	Jagaji	7.30	0.75	0.78	0.07	0.034	1.12
4	Yedashi	7.80	0.42	0.82	0.08	0.046	0.88
5	Palsap	7.93	1.34	0.62	0.06	0.030	1.26
6	Ter	8.15	0.68	0.86	0.04	0.042	1.04
7	Upale	7.58	0.56	0.48	0.03	0.026	0.98
8	Khamgaon	8.45	1.06	0.74	0.05	0.032	1.03

The physico-chemical analysis of different parameters of soil samples collected from different villages of Osmanabad district is given in table no. 1. The $P^H$is an important parameter as it helps in ensuring availability of plant nutrients (Dalwadim R 2008).P^Halso helps in maintaining the good soil condition. In the above study P^H values ranges from 7.30 to 8.45 shows basic nature. The measurement of electrical conductivity (EC) is for measure the current that give clear ideas of soluble salts present in the soil. Conductivity depends upon the dilution of the soil suspension. TheEC values ranges from 0.42 to 1.34 mhos suggest normal values(Deshmukh K.K.2012). The organic matter includes all the dead plants material and live or dead animal. Most living in soil including plants, insects, bacteria, protozoa and fungi are dependenton organic matter for nutrition and energy. In the present study the organic carbon percentage ranges from 0.48 to 0.86 shows normal soil. The percentage of nitrogen ranges from 0.03 to 0.08 suggests normal values. The percentage of phosphorous ranges from 0.026 to 0.046 suggest normal values.(Jackson M. L. 1967) and the percentage of potassium ranges from 0.88 to 1.26 also suggest normal values.

IV. CONCLUSION

The present investigation helps in determining the values of different chemical parameters and the nutrient concentration of soil samples collected from ten villages of Osmanabad district of Marathawada region in Maharashtra. All the parameters either directly or indirectly influence on the soil ecosystem. There is a necessity to use of fertilizer depends on soil contains nutrient for good growth of crops.

V. REFERENCES

[1]. Bear F. E.(1976) Chemistry of soils 2nd Oxford and IBH publication corporation, New Delhi.

[2]. Bacchewar G. K. and B. R. Gajbhiya, (2011) correlation studies on secondary nutrients and soil properties in soils of Latur District of Maharashtra. Research Journal of Agricultural sciences, 2(1) 91-94.

[3]. Chadra R. and S. K. Singh (2009) Fundamentals and management of soil quality. Weatvile publishing House, New Delhi.

[4]. KaurH. Environmental chemistry 2ndEdition PragatiPrakashan (2002)416.
[5]. Jackson M. L. Soil Chemical Analysis Prentice-Hall of India Pvt.,Ltd. New Delhi(1967)123-126.
[6]. Pandeeswari N. and Kalarasu S. International Journal of current Research: 4(07)(July2012)pp143-145.
[7]. Dr. Dalwadi M. R. Bhatt V. R. Soil and water testing AnandGujrat India 2008.
[8]. Deshmukh K. K.(2012) Studies on Chemical Characteristics of soils from sangamner area, Ahmednagar District Maharashtra, India, Rasayan J. Chemistry, Vol. 5 No.1 74-85.
[9]. Miller R. W. and R. L. Donahue(1992) Soil: An introduction to soils and plant growth prentice Hall of India Pvt. Ltd. ,New Delhi.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Study of Conduction Mechanism of Bi_2O_3 Doped Sr_2CoO_4 Nanocomposite Material and its Gas Sensing Behavior

G.Y.Rohokale[1], D. R. Thube[2], P.G. Rohokale[*2]

[1]Department of Chemistry, Arts, Science and Commerce College, Rahuri, Ahmednagar, Maharashtra, India
[2]Department of Chemistry, New Arts, Commerce and Science College, Parner, Ahmednagar, Maharashtra, India

ABSTRACT

Nanocrystalline 10 Wt% Bi_2O_3 doped Sr_2CoO_4 was prepared by sol-gel citrate method, and calcined at different temperature. The Sr_2CoO_4 nanoparticles were characterized by Impedance analysis, and Gas sensing. The ac conductivity was studied for the sample 10 Wt% Bi_2O_3 doped Sr_2CoO_4 calcined at 650^OC, at temperatures 100 to 700^OC and over a wide range of frequencies (50 Hz to 200 kHz). Experimental results indicate that the ac conductivity depend on temperature, frequency and concentration of dopent. Nanocrystalline 10 Wt% Bi_2O_3 doped Sr_2CoO_4 was found to be good ammonia sensor with high sensitivity and selectivity.

Keywords: Sol- Gel Citrate, Gas, Sensing

I. INTRODUCTION

Ammonia is a natural gas that is present throughout the atmosphere in concentrations of low-ppb to sub-ppb levels as the result of emission from anthropogenic and natural sources [1]. It is produced in large quantities by chemical industry for the production of fertilizers and other nitrogen-containing compounds and for the use in refrigeration systems as cooling agent. Natural source include production by bacteria.

In the environment, high concentrations of ammonia lead to eutrophication and acidification of both ground and water, whereas in indoor environments it is a health hazard to humans [2-3]. Therefore ammonia is an important target gas in applications like leakage control in refrigeration systems and air conditioners on one hand or in the emission control and quality monitoring of waste and drinking water on the other hand [4-5]. Other application areas for ammonia sensors include high temperature sensing in the exhaust of cars and, as it is a product of biochemical processes, ammonia is also a useful reporter molecule in a variety of medial applications. This need have supported the development of devices capable of the detection and quantification of gaseous and dissolved ammonia. Many aspects of ammonia sensing are summarized in a recent review by Timmer et al. and information on ammonia sensing in solution can be found.

For the use in work place safety and indoor monitoring applications devices capable of detecting ammonia in concentrations of 1–50 ppm in ambient air are required. These devices must not be prone to strong humidity interferences. Several regulations on the allowed ammonia concentration and exposure times exist, as there are the acceptable exposure limits (AEL) in Germany/Switzerland, the long time (LTEL) or short time (STEL) exposure limits in the UK, or the permissible exposure limit (PEL), usually a time-weighted average (TWA), in the USA. The values given therein are in the range from 25 to 50 ppm. Many commercial ammonia gas sensors as well as analytical devices are offered for this application area and concentration range [6-10].

The scientific literature describes the development of many sensor types. Optical ammonia sensors detect ammonia by the change in absorbance of an acid-base indicator, fluorescence of an ammonia complex, or a change in refractive properties of a coating. Infrared (IR) based gas sensors measure the absorbance change induced by the ammonia molecule. Electrochemical sensors rely on a change in resistance, capacitance or

potential of the sensitive layer. Finally, resonator devices measure the mass of absorbed ammonia. Reported as sensitive layers in chemical gas sensors are different metal oxides, CuBr, TiN, and many different polymers and polymer blends [11]. In this paper we are presenting the nanocrystalline Sr_2CoO_4 as a ammonia gas sesnsor.

II. EXPERIMENTAL DETAILS

The nanocrystalline Sr_2CoO_4 specimens were prepared by using sol-gel citrate method. A stoichiometry mixture of strontium nitrate and cobalt nitrate were magnetically stirred with citric acid and ethylene glycol at 80°C for 2 h to get homogeneous and transparent solution. The solution was further heated at about 130°C for 12 h in a pressure vessel to form the gel precursor. The prepared product was subjected to 3 h heat treatment at 350°C in a muffle furnace and then milled to a fine powder. The dried powder then calcined in the range of 450-750°C in order to improve the crystallinity of materials. The solution of Bismuth nitrate was used as dopant in the precursors of Sr_2CoO_4.

III. RESULT AND DISCUSSION

Figure 1 shows Complex impedance formalism helps in determining inter-particle interaction like grain, grain boundary effects, etc. To study the contribution due to different effects, Cole–Cole analyses have been done at different temperatures. It also provides information about the nature of dielectric relaxation. For pure monodispersive Debye process, one expects semicircular plots with the centre located on the *Z'*axis whereas, for polydispersive relaxation, these argand plane plots are close to circular arcs with endpoints on the axis of reals and the centre below this axis. From the graph it is observed that the semicircular diameter decreases with increasing frequency, thus the resistivity of the sample decreases i.e. conductivity of the sample increases.

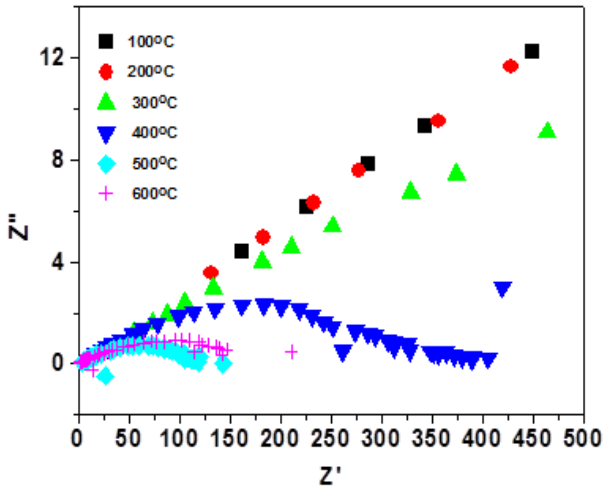


Figure 1. Nyquist plot for 10 Wt% Bi_2O_3 doped Sr_2CoO_3 nanocomposite.

The ac conductivity increases with increase of the frequency and temperature applied in the experiment. The rise of conductivity upon increasing the frequency and temperature is a common respond for semiconductor samples. It is due to the tremendous increase of the mobility of charge carriers in the composite film. As shown in Figure 2, there are two trends appeared, the first one is frequency independent conductivity and another is frequency dependent conductivity. The first trend is contributed by free charges available in the composite system whereas the second, which is frequency dependent conductivity, is due to trapped charges which are only active at higher frequency region.

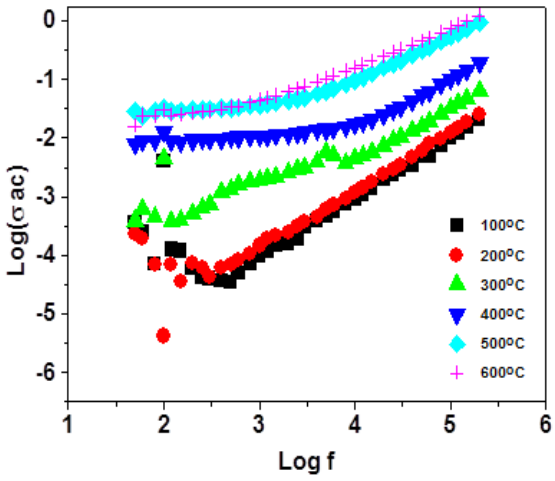


Figure 2. Variation of conductivity with frequency for the 10 Wt% Bi_2O_3 doped Sr_2CoO_3 Nanocomposite.

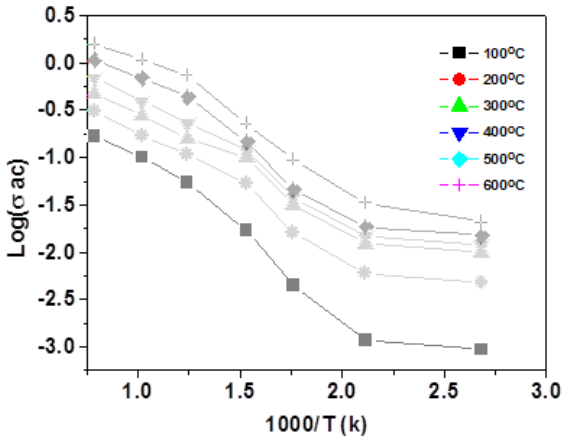


Figure 3. Arrhenius plot for conductivity for 10 Wt% Bi_2O_3 doped Sr_2CoO_3 nanocomposite.

Figure 3 presents the experimental results of the electrical conductivity for all orthophosphate samples in the standard Arrhenius plot

$$\sigma = \sigma_0 \exp(-Ea/kBT),$$

where Ea is the activation energy. These results show an increase of the conductivity with increasing temperature for all compounds indicating a characteristic activated behavior over the complete temperature range studied. Furthermore, plots of log(s) vs. 1/T were found to be linear in the temperature range considered. From impedance measurements, the total conductivity activation energies, Ea, were derived, yielding activation energies 0.000116, 9.59E-05, 9.57E-05, 9.11E-05, 8.87E-05 and 8.4E-05 eV for the frequencies 10, 50, 100, 120, 150 and 200 kHz respectively. From activation energy values it is clear that the activation energy decreases with increasing frequency thus the conductivity of the sample increases with the increasing frequency.

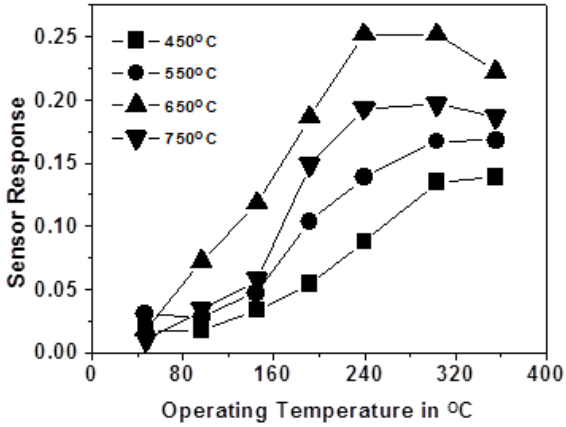


Figure 4. Sensor response to 1000 ppm NH_3 gas as a function of the operating temperature for undoped Sr_2CoO_4 films calcined at 450, 550, 650 and 750°C.

Figure 4 shows the effect of calcination temperatures on the response of Sr_2CoO_4 sensors to 1000 ppm ammonia gas at a various operating temperatures ranging from 50-350°C. Although the maximum responses of Sr_2CoO_4 obtained at different heating temperatures appear at different operating temperatures, it is clearly seen that the response to ammonia gas are greatly affected by the heating temperature. The response of Sr_2CoO_4 obtained at 650°C for 6 h reached a maximum at an operating temperature of 250°C.

Selectivity is the ability that a gas sensor to distinguishes between different kinds of gases. Figure 5 shows the cross sensitivity of Sr_2CoO_4 for NH_3, CO, LPG and H_2 gases as a function of operating temperature. It is evident from the figure that the Sr_2CoO_4 sensor was highly selectivity to NH_3 gas against CO, LPG and H_2 gases. The sensor shows high degree of selectivity towards NH_3 gas than other reducing gases at an operating temperature of 250°C.

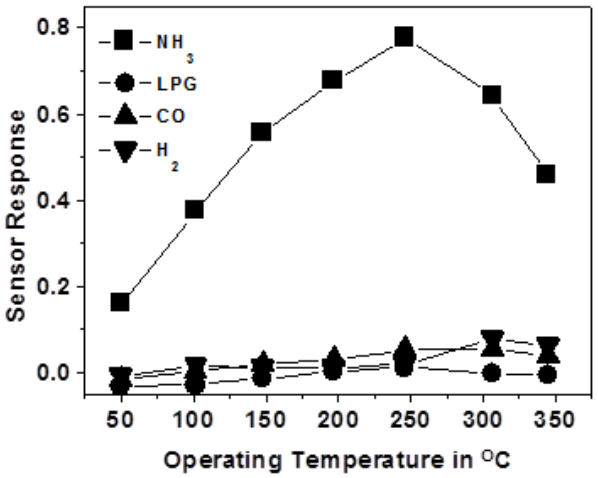


Figure 5. Sensor response of Sr_2CoO_4 thick films calcined at 650°C to 1000 ppm of NH_3, LPG, CO and H_2 as a function of operating temperature.

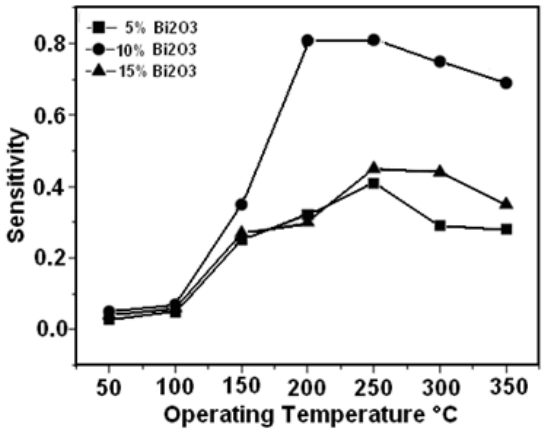


Figure 6. Sensor response of 5%, 10% & 15% Bi_2O_3 doped Sr_2CoO_4 films calcined at 650°C for 1000 ppm NH_3 gas at an operating temperature 200°C.

In order to promote gas sensitivity, dopants were shown to effectively influence the semiconductive properties of sensor materials. Fig. 6 shows the different wt% (5, 10 and 15) of Bi_2O_3 doped Sr_2CoO_4 calcined at 650^OC for 6h for 1000 ppm NH_3 gas at an various operating temperatures ranging from 50-350^{o}C. The gas response of the Sr_2CoO_4 was markedly promoted for 10wt% Bi_2O_3 doped Sr_2CoO_4 calcined at 650^{o}C at an operating temperature of 200°C.

IV. CONCLUSION

In this work, Sr_2CoO_4 have been presented as suitable semiconductor materials for selective NH_3 detection. The electrical conductivity of Sr_2CoO_4 is strongly dependent on the amount of Bi_2O_3 doped Sr_2CoO_4. The electrical conductivity increased with increasing Bi_2O_3 content and attained the maximum at 10 wt% Bi_2O_3 doped Sr_2CoO_4 calcined at 650^OC. The impedance spectra for 10 wt% Bi_2O_3 doped Sr_2CoO_4 shows the sample resistance decreases with increase in temperature. The sensor shows high degree of selectivity towards NH_3 gas than other reducing gases. The best sensor response was found at an operating temperature of 200°C for NH_3 gas.

V. ACKNOWLEDGEMENTS

Authors pay much gratitude towards the Principal, Arts, Science and Commerce College, Rahuri to make available the required facility for this research work.

VI. REFERENCES

[1]. P. Warneck, Chemistry of the Natural Atmosphere, Academic Press Inc., 1998.
[2]. P. Davies, The Fifth Miracle, Simon & Schuster, 1999.
[3]. J.R. Istas, R. de Borger, L. de Temmerman, Guns, K. Meeus Verdinne, A. Ronse, P. Scokart, M. Termonia, Effect of ammonia on the acidification of the environment, European Communities, Report No. EUR 11857 EN, 1988.
[4]. D. Tsiulyanu, S. Marian, V. Miron, H.D. Liess, High sensitive tellurium based NO2 gas sensor, Sens. Actuators B 73 (2001) 35.
[5]. D. Tsiulyanu, S. Marian, H.D. Liess, Sensing properties of tellurium based thin films to propylamine and carbon oxide, Sens. Actuators B 85 (2002) 232.
[6]. D. Kohl, Function and application of gas sensors, topical review, J. Phys. D34 (2001) R125-R149.
[7]. N. Docquier, S. Candel, Combustion control and sensors, a review, Progr. Energy Combust. Sci. 28 (2002) 107-150.
[8]. J. Riegel, H. Neumann, H.M. Wiedenmann, Exhaust gas sensors for automotive emission control, Solid State Ionics 152/153 (2002) 783-800.
[9]. S. Ampuero, J.O. Bosset, The electronic nose applied to dairy products: a review, Sens. Actuators B 94 (2003) 1-12.
[10]. A. Dubbe, Fundamentals of solid state ionic micro gas sensors, Sens. Actuators B 88 (2003) 138-148].
[11]. J.W. Erisman, R. Otjes, A. Hensen, P. Jongejan, P.v.d. Bulk, A. Khlystov, H. M¨ ols, S. Slanina, Instrument development and application in studies and monitoring of ambient ammonia, Atmos. Environ. 35 (2001) 1913-1922.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Microwave Assisted, L-Tyrosine Catalyzed Efficient Synthesis of Tetrahydrobenzo[b] Pyrans

Balaji D. Rupnar[*1], Sunil S. Bhagat[1], Amol J. Sirsat[1], Rajendra P. Pawar[2]
[1]Department of Chemistry, R.B. Attal Arts, Science and Commerce College, Georai, Beed, Maharashtra,India
[2]Department of Chemistry, Deogiri College, Aurangabad, Maharashtra,India

ABSTRACT

A mild and efficient protocol has been developed for the synthesis of Tetrahydrobenzo[b]pyrans, from aldehyde, malononitrile and dimedone in presence of L-Tyrosine under Microwave irradiation. High yield, simple workup procedure and mild reaction condition are main feature of this protocol.

Keywords: Microwave, L-Tyrosine, Tetrahydrobenzo[B]Pyrans, Multicomponent Reaction.

I. INTRODUCTION

Pyran derivatives are one of the most common compounds present in various biologically active natural and synthetic products[1]. Among them, functionalized chromenes (benzopyrans) are also an important class of compounds, which constitute the structural unit of series of biologically active natural products and drugs[2]. Chiefly, among various chromene derivatives, Tetrahydrobenzo[b]pyranswithcyano-functionality have potential applications in the treatment of rheumatoid, psoriasis, and cancer[3]. Other properties such as laser dyes[4], optical brighteners[5], fluorescence markers[6], pigments[7], cosmetics, and potent biodegradable agrochemicals[8] are well known for decades. In addition chromenes have been used for the treatment of numerous neurodegenerative diseases, which include Parkinson's disease, Alzheimer's disease, Huntington's disease, amyotrophic lateral sclerosis, AIDS associated dementia and Down's syndrome and also used in the treatment of schizophrenia and myoclonus[9]. Antihypertensive and anti-ischemic behavior has been exhibited by aminochromene derivatives[10] and other substituted chromenes encourage apoptosis in tumor cells by binding to the Bcl-2 protein[11].The currentinterest in Tetrahydrobenzo[b]pyranderivativefor the treatment of human inflammatory TNFa-mediated diseases, such as psoriatic arthritis and rheumatoid and in cancer therapy[12].

A literature studyrevealed that Tetrahydrobenzo[b]pyranswith nitrile and amino functions at the 3 and 2 positions,are known to possess diverse pharmaceutical properties, such as cytotoxic, antioxidant, anti-bacterial, anti-proliferative, anti-microbial, anti-HIV, anti-rheumatic, anti-cancer activities[13].Because of increasing environmental concerns, the development of a clean synthetic procedure has become crucial and demanding research. Organic synthesis, experienced thoughtful changes in recent years with more sustainable processes that avoid the extensive use of toxic and hazardous solvents and reagents, vigorous reaction conditions, costly and complicated catalytic systems[14].

MW irradiation has emerged as an effective heating source for organic synthesis due to shorter reaction times, uniform and selective heating, higher yields, cleaner reactions, easy work up[15].

We have selected L-tyrosine organo catalyst for this purpose. In this sense Microwave-assisted organic synthesis has become a significant tool for accelerating drug discovery and development processes. The choice of L-tyrosine is based on the fact that it is an efficient, bi-functional, zwitterionic and eco-friendly organocatalyst capable of playing multiple catalytic roles as an acid and base.its catalytic activity in various organic transformations is till unnoticed. Very few report of the catalytic ability of L-tyrosine is reflected, such as Bigenelli reaction[16],Knoevenagel condensation reaction under grindstone [17].Recently

AnamikaKhaskelet al. used L-Tyrosine loaded nanoparticle for the synthesis of Biscoumarin and Hantzschdihydropyridines[18].

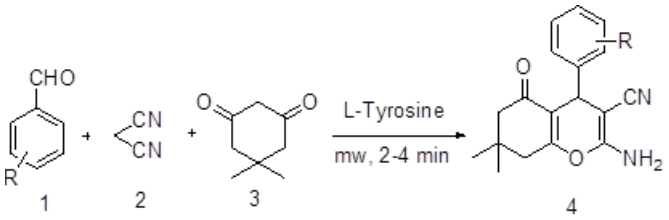
II. EXPERIMENTAL

A. Materials and Apparatus

All chemical and reagents are purchased from SD Fine chemical company with high purity and used without further purification. Melting points were determined in open capillaries using an Electrothermal Mk3 apparatus. Infrared (IR) spectra in KBr were recorded using a Perkin-Elmer spectrum 65 FT-IR spectrometer. ^{1}H NMR spectra were recorded on an 400 MHz FT-NMR spectrometer in DMSO or $CDCl_3$ as a solvent and chemical shift values are recorded in units δ (ppm) relative to tetramethylsilane (Me_4Si) as an internal standard. The microwave irradiation was carried out in a scientific microwave oven (CATA-4R-Model No. QW-99, India makes), 2450 MHz Frequency, with power output of 140-700 W. The progress of reaction was monitored by TLC (Thin Layer Chromatography).

B. General procedure for synthesis of tetrahydrobenzo[b]pyrans

A mixture of malononitrile (1mmol), aromatic aldehyde (1mmol), dimedone (1mmol), ethanol and L-Tyrosine (15mol %), **(Scheme 1)**was added in a caped 10mL microwave vessel and kept in irradiation cavity. The mixture was irradiated with microwaves at the power of 140W. The total period of microwave irradiation was 1-3 min (Table 2). The progress of reaction was monitored by TLC (ethyl acetate: hexane 4:1). After completion of reaction, the reaction mixture was cooled to room temperature and poured on 10 ml ice water. The separated solid was filtered and washed with water. The residue was dried and recrystallized from ethanol to get the corresponding tetrahydrobenzo[b]pyrans. The products were confirmed by comparisons with authentic samples, IR, ^{1}H NMR, mass spectra and melting points.



Scheme 1

III. RESULT AND DISCUSSION

In a preliminarily investigation onthe model reaction of 4-chlorobenzaldehyde, dimedoneandmalononitrile (entry 4, Table 3), it was found that the reaction could be finished in the presence of catalytic amount of L-Tyrosine under microwave conditions which gave the desired product in good yield. In order to optimize the amount of catalyst, modelreaction was carried out with different amounts of catalyst. With 1 mmol of each reactant, reaction with 5, 10, 15, and 20 mol% of catalyst was tried and it was found that 15 mol% of catalyst is sufficient to get the product in good yield (Table 1). No significant increase in yield was observed with increase in the amount of catalyst. Thus, 15 mol% of catalyst was chosen as optimum amount to catalyze the reaction.In order to optimize the solvent, model reaction was carried out in various solvents and the excellent yield found when ethanol used as solvent Table 2.

Table 1. Optimization of catalyst amount

Entry	Amount of catalyst (mol%)	Time	Yield%
1	-----	30 min	35
2	5	20 min	60
3	10	10 min	92
4	15	2min	92
5	20	2 min	90

Table 2. Optimization of solvent

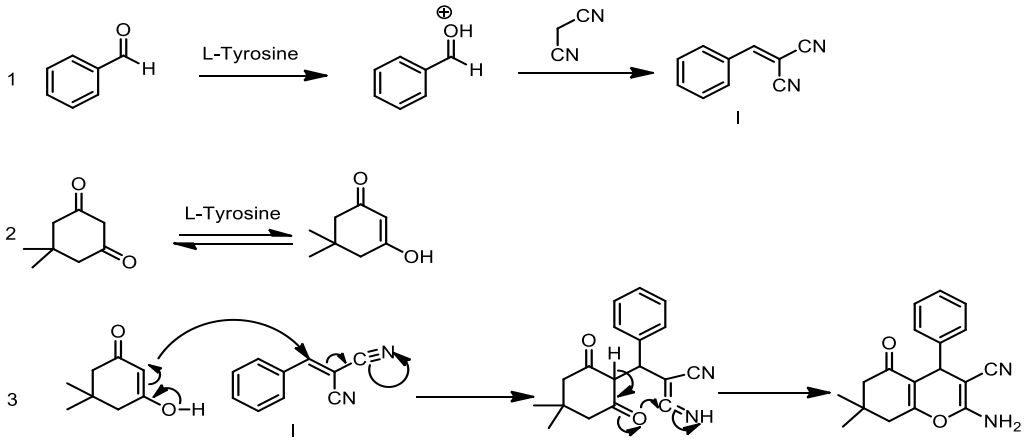
Entry	Solvent	Time	Yield %
1	DMF	30 min	55
2	Acetonitrile	30 min	50
3	Water	30 min	65
4	Methanol	10 min	75
5	Ethanol	2 min	92

After optimization of the reaction conditions, to explore theefficiency and the scope of presented protocol,dimedone (1mmol) and malononitrile (1 mmol) were treated with structurally diverse aromatic aldehydes in the presence of L-Tyrosine as catalyst.The corresponding results are summarized in Table 3. As Table 3 indicates, all aldehydes(including benzaldehyde and arylaldehydes bearing halogens, electron-withdrawing substituents) were successfully reacted to produce the corresponding chromenederivatives in good to excellent yields and in relatively short reaction times. The presented method was successfully used for arylaldehydes with various groupsat different positions such as halides, nitro and hydroxyl.

Table 3. One-pot synthesis of tetrahydrobenzo[b]pyrans catalyzed by L-Tyrosine

Entry	Aldehyde R	Time (min)	Yield%	Melting Point°C	
				Found	reported
1	H	3.5	88	226-228	230-235[13]
2	4-NO_2	1.5	94	147-149	150-153[13]
3	3-NO_2	2	93	210-212	206-208[13]
4	4-Cl	2	92	203-205	225[11]
5	4-OH	2.8	90	216-218	226-228[11]
6	3-OH	3.2	90	235-237	230-232[13]
7	4-Br	2.2	91	218-220	213-215[13]
8	4-F	2	93	236-238	235-237[14]
9	4-OMe	4	92	202-204	201-203[14]
10	3,4-diOMe	4.2	88	164-166	158-160[13]
11	4-Me	3.6	85	210-212	215[13]
12	4-OH, 3-OMe	4.2	86	225-227	230-232[13]
13	Thiophene	3	84	211-213	216-218[13]
14	2-Cl	2.5	88	217-219	215-217[13]
15	2-NO_2	3.3	87	180-182	185-187[13]

4.1.4a. Mechanism



Scheme 17

Spectral data

1. **2-amino-5,6,7,8-tetrahydro-7,7-dimethyl-4-(4-nitrophenyl)-5-oxo-4*H*-chromene-3-carbonitrile (Table 3, entry 2).**

Melting point: 247-249^{0}C. IR (KBr) cm^{-1}: 3476 and 3229 (NH_2), 3117 (C-H), 2196 (CN), 1690 (C=O), 1650(C=C),1594, 1516, 1492, 1352. ^{1}H NMR (DMSO-d_6, 400 MHz, δ ppm): 8.12 (d, 2H, Ar-H), 7.42 (d, 2H, Ar-H), 6.94 (s, 2H, NH_2), 4.35 (s, 1H, CH), 2.19-2.50 (m, 4H, 2CH_2), 1.09 (s, 3H, CH_3), 0.96 (s, 3H, CH_3).

2. **2-amino-5,6,7,8-tetrahydro-4-(4-hydroxy-3-methoxyphenyl)-7,7-dimethyl-5-oxo-4*H*-chromene-3-carbonitrile (Table 3, entry 12).**

Melting point: 225-227^{0}C. IR (KBr) cm^{-1}: 3474 and 3223 (NH_2), 3118 (C-H), 2195 (CN), 1695 (C=O), 1651(C=C). ^{1}H NMR (DMSO-d_6, 400 MHz, δ ppm): 8.64 (s, 1H, OH), 6.6 (m, 4H, ArH, NH), 6.5 (s, 1H, NH), 4.09 (s, 1H, CH), 3.73 (s, 3H, OCH_3), 2.0-2.5 (m, 4H, 2CH_2), 1.09 (s, 3H, CH_3), 0.98 (s, 3H, CH_3).

IV. CONCLUSION

We reported an atom-economical multicomponent reaction, using energy-efficient microwave irradiation; L-Tyrosine as mild, cost effective and 'greener' catalyst along with eco-friendly green solvent ethanol for the synthesis of tetrahydrobenzopyran. The attractive features of this protocol are the mild reaction conditions, high conversions, operational simplicity and inexpensive and ready availability of the catalyst; which makes it a useful and attractive strategy for the preparation oftetrahydrobenzopyran.

V. ACKNOWLEDGEMENTS

The authors express appreciation to the principal Dr. S. N. Thore, Deogiri College, Aurangabad for providing laboratory facility. We also thank to SAIF Chandigarh for providing spectral data.

VI. REFERENCES

[1]. BriocheJ. C. R., GoodenoughK. M., Whatrup D. J.,Harrity, J. P. A., Investigation of an

[2]. Organomagnesium-Based [3 + 3] Annelation to Pyrans and Its Application in the Synthesis of Rhopaloic Acid A, J. Org. Chem., 2008, 73, 1946.

[3]. TapasA. R., SakarkarD. M., KakdeR. B., Flavonoids as Nutraceuticals: A Review, Trop. J.Pharm. Res., 2008, 7, 1089.

[4]. GaoY.,YangW.,Du D. M., efficient organocatalytic asymmetric synthesis of 2-amino-4H-chromene-3-carbononitrile derivatives, Tetrahedron: Asymmetry 2012, 23, 339.

[5]. ReynoldsG. A.,DrexhageK. H., New coumarin dyes with rigidized structure for flashlamp-pumped dye lasers,Opt. Commun, 1975, 13, 222.

[6]. ZollingerH., Color Chemistry, 3rd ed.; Verlag Helvetica ChimicaActa: Zurikh and Wiley-VCH: Weinheim, 2003.

[7]. BissellE. R., MitchellA. R., SmithR. E., Synthesis and chemistry of 7-amino-4-(trifluoromethyl)coumarin and its amino acid and peptide derivatives, J. Org. Chem. 1980, 45, 2283.

[8]. EllisG. P., The Chemistry of Heterocyclic of Compounds. Chromenes, Harmones and Chromones; A.Weissberger,E. C. Taylor, Eds.; John Wiley: New York, NY, 1977; Chapter II, 11.

[9]. Hafez E. A. A., ElnagdiM. H.,ElagameyA. G. A., El-TaweelF. M. A. A.,Nitriles in Heterocyclic Synthesis: Novel Synthesis of Benzo[c]coumarin and of Benzo[c]pyrano[3,2-c]quinoline Derivatives, Heterocycles, 1987, 26, 903.
[10]. KonkoyC. S., FickD. B., CaiS. X., LanN. C.,KeanaJ. F., PCTW. Int. Appl WO 0075123, 2000; Chem. Abstr.2001, 134, 29313.
[11]. BurgardA., LangH. J., GerlachU.,A new cyclic tetrapeptide composed of alternatingL-proline and 3-aminobenzoic acid subunits, Tetrahedron 1999, 55, 7555.
[12]. YuN., AraminiJ. M., Germann M. W.,HuangZ., Reactions of salicylaldehydes with alkyl cyanoacetates on the surface of solid catalysts: syntheses of 4H-chromene derivatives, Tetrahedron Lett., 2000, 41(36), 6993.
[13]. WlodkowicD., SkommerJ., MattoM., ErayM., PelkonenJ.,HA14-1, a small molecule Bcl-2 antagonist, induces apoptosis and modulates action of selected anticancer drugs in follicular lymphoma B cells, Leuk. Res, 2006, 30, 322-331.
[14]. PanditK.S., Chavan P. V., Desai U. V., KulkarniM. A., WadgaonkarP. P.,Tris-hydroxymethylaminomethane (THAM) a novel organocatalyst for environmentally benign synthesis of medicinally important tetrahydrobenzo[b]pyrans and pyran-annulated heterocycles, New J.Chem., 2015,39, 4452.
[15]. GuptaM., GuptaM., Rajnikant and GuptaV. K.,Salicyldimine-based Schiff's complex of copper(II) as an efficient catalyst for the synthesis of nitrogen and oxygen heterocycles, New J. Chem., 2015,39, 3578.
[16]. CandeiasN. R., BrancoL. S. C., GoisP. M. P., AfonsoC. A. M., TrindadeA. F., More Sustainable Approaches for the Synthesis of N-Based Heterocycles, Chem. Rev., 2009, 109, 2703.
[17]. YoungS. N., PsychiatryJ.,L-Tyrosine to alleviate the effects of stress?,Neurosci, 2007, 32, 224.
[18]. KhaskelA., GogoiP., BarmanP., BandyopadhyayB.,Grindstone chemistry: a highly efficient and green method for synthesis of 3,4-dihydropyrimidin-2-(1H)-ones by L-tyrosine as an organocatalyst: a combined experimental and DFT study, RSC Adv, 2014, 4, 35559.
[19]. ThirupathiG., VenkatanarayanaM., DubeyP. K. and BharathiKumariY., L-tyrosine catalyzed Knoevenagel condensation: Facile synthesis of cyanoacrylonitriles cyanoacrylates and cyanoacrylamides in solvent free condition under grindstone method.Der PharmaChemica, 2012, 4(5), 1897.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Study of Antimicrobial and Antifungal Activity of the Bis-Indole Derivatives of 2-Phenyl-1-H-Indole

Ismail Shaikh[1,2], Mazahar Farooqui[3], Gajanan Sanap[4], Syed Abed[*5]

[1]Post Graduate and Research Centre, Maulana Azad College, Aurangabad, Maharashtra, India
[2]P. G. Department of Chemistry, Shri Anand College Pathardi, Ahmednagar, Maharashtra, India
[3]Dr. Rafiq Zakaria College for Women, Navkhanda Aurangabad, Aurangabad, Maharashtra, India
[4]S. B. College of Science, Aurangabad, Aurangabad, Maharashtra, India
[5]Government College of Arts and Science Aurangabad, Aurangabad, Maharashtra, India

ABSTRACT

The novel clay material was found to catalyze electrophilic substitution reaction of 2-phenyl-1-H-indole with a variety of aromatic aldehydes to excellent yields of bis (indolyl)methanes at room temperature. The compound 3-((4-chlorophenyl)(2-phenyl-1H-indol-3-yl)methyl)-2-phenyl-1H-indole shows more antibacterial activity towards S. aureus and E. coli than standard drug Amplicillin.

Keywords : Novel Clay, BIM, DIM, XRD, EDS, FESEM,2-phenyl-1-H-indole, substituted aromatic aldehydes, nanomaterial, E.coli, P.aeruginosa, S.aureus, S.pyogenus, C.albicans, A.niger, A.clavatus.

I. INTRODUCTION

Indole derivatives are one of the most promising heterocyclic moieties, which have active sites in treating various diseases. Numerous reports were published on indole fragment and its derivatives, capable to exhibit antimicrobial activities [1].Infectious diseases caused by microbes such as bacteria and fungi are one of the leading causes of morbidity and mortality and The major reason for the increase in microbial infections is the resistance developed by these microbial organisms, particularly gram-positive bacteria s. aureus towards existing antimicrobial drugs. Therefore development of alternative new more effective antimicrobial agents with new modes of action and a broad spectrum of activities is a one of the major challenges in drug discovery. Molecular hybridization involves combining two or more heterocyclic rings in a single molecule wherein combining units are derived from known bioactive molecules [2].The emergence and spread of antimicrobial resistance has become one of the most serious public health concerns across the world.

Antimicrobial resistance refers to micro-organism that has developed the ability to inactivate, exclude or block the inhibitory or lethal mechanism of the antimicrobial agents. Electron-rich nitrogen heterocycles play an important role in diverse medicinal chemistry [3].The indolering system are ubiquitous heterocycles that represents an important structural component in many pharmacologically active compounds, agro chemistry, dyes, material science as well as in synthetic chemistry [4].Derivatives of 2-phenyl-1-H-indole were found to inhibit the growth of human breast cancer cells by different mechanisms depending on the type and position of the substituents [5]. Substituted methane with two units of indole is commonly known as bis (indolyl) methane (BIM) or diindolylmethane (DIM) is present in various natural products possessinganticancer activity. DIMs induce apoptosis in many cancer cells by signaling various proapoptotic genes and proteins [6].

Bis (indolyl) methane (BIMs) isolated from marines or terrestrial matrices exhibit a wide range of pharmacological activities against various tumor cells. Naturally occurring BIMs such as vibrindoles are useful in the treatment of fibromyalgia, chronic fatigue and irritable bowel syndrome [7]. Indole and its derivatives have wide range of applications in biological and medicinal activities [8].Bis indole derivatives not only increase the natural metabolism of hormones in the

body and also used as anticancer drug [9].Such as anti-bacterial antitumor. Bis(indolyl) methane are members of promising new drug class these are diarylamidine derivatives that target DNA synthesis, providing a broad-spectrum antibacterial activity [10].For the synthesis of bis indole from indole different catalyst are reported such asI_2, PCl_5, PPA/SiO_2, silica sulphuric acid, Lewis acid, protic acid [11].However, many of procedures have significant drawbacks such as required stoichiometric amount of catalyst, long reaction time, expensive catalyst, low yield and use of environmentally toxic reagents. But in the present work, we replaced this catalyst by low cost cheaply available clay.

II. MATERIAL AND METHODS

2.1. Chemistry

All chemicals were purchased from major chemical suppliers of high or highest purity grade and used without further purification. As a part of our study of Chemistry indole [Biological active moiety] we have synthesized bis indole derivatives by using Novel Clay catalyst. TLC is run in N- hexane and ethyl acetate in required amount.FT-IR is recorded in KBr, HNMR in $CDCl_3$ from Central instrumentation facility (CIF), Savitribai Phule Pune University. X-Ray Powder diffraction (XRD) is recorded from department of Physics. Energy Dispersive X-Ray Spectroscopy (EDS) and Field Emission Scanning Electron Microscope (FESEM) by using instrument Nova Nano SEM 450 UOP were recorded from (CIF),Savitribai Phule Pune University, Maharashtra.

All the synthesized drugs were used for antibacterial test procedures, All necessary controls like drug control, vehicle control, agar control, organism control, known antibacterial drugs control, all MTCC cultures were tested against above mentioned known and unknown drugs, muellerhinton broth was used as nutrient medium to grow and dilute the drug suspension for the test bacteria, inoculum size for test strain was adjust to 10^8cfu [Colony Forming Unit] per milliliter by comparing the turbidity, Following common standard strains were used for screening of antibacterial and antifungal activities: The strains were procured from Institute of Microbial Technology, Chandigarh.

E.coli	P.aeruginosa	S.aureus	S.pyogenus	C.albicans	A.niger	A.clavatus
MTCC 443	MTCC 1688	MTCC 96	MTCC 442	MTCC 227	MTCC 282	MTCC 1323

DMSO was used as diluents / vehicle to get desired concentration of drugs to test upon Standard bacterial strains.Minimal Inhibition Concentration [mic] the main advantage of the 'Broth Dilution Method'for MIC determination lies in the fact that it can readily be converted to determine the MIC as well.Serial dilutions were prepared in primary and secondary screening.The control tube containing no antibiotic is immediately sub cultured [before inoculation] by spreading a loopful evenly over a quarter of p[late of medium suitable for the growth of the test organism and put for incubation at 37 ^{0}C Overnight. The tubes are then incubated overnight.The MIC of the control organism is read to check the accuracy of the drug concentrations. The lowest concentration inhibiting growth of the organism is recorded as the MIC. The amount of growth from the control tube before incubation [which represents the original inoculum] is compared.

Methods used for primary and secondary screening, each synthesized drug were diluted obtaining 2000 microgram /ml concentration, as a stock solution.In primary screening 1000 micro/ml, 500 micro/ml, and 250 micro/ml concentrations of the synthesized drugs were taken. The active synthesized drugs found in this primary screening were further tested in a second set of dilution against all microorganisms. Secondary screen the drugs found active in primary screening were similarly diluted to obtain 200 micro/ml 100 micro/ml, 50 micro/ml, 25 micro/ml, 12.5 micro/ml, 6.250 micro/ml, and concentrations. Reading result the highest dilution showing at least 99 % inhibition zone is taken as MIC.The result of this is much affected by the size of the inoculum. The test mixture should contain 10^8 organism/ml.

2.2. Preparation of catalyst

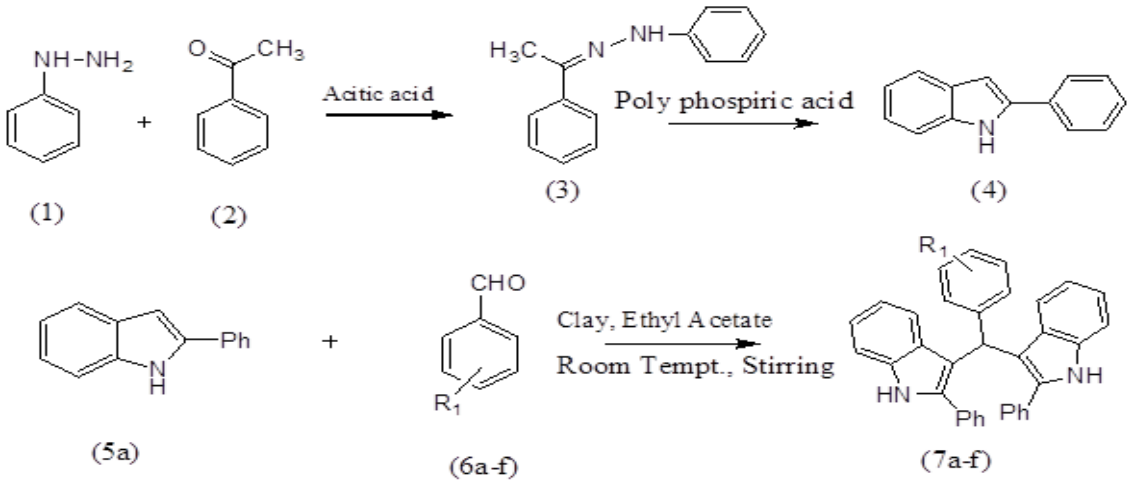
The activation of clay catalyst was done as per the procedure explained in our previous report [8, 15, and 16]. The clay was obtained from the field of Bashir Farm (Jatadevala) Tq Pathardi& Dist. Ahmednagar, Maharashtra, India.

2.3. Synthesis of 2-phenyl-1-H-Indole

Acetophenone (1mole) and phenyl hydrazine (1mole) is taken in beaker, two to three drop of acetic acid is added to mixture, stirred well and heat reaction mixture in water bath for five minutes solid hydrazone product is separated recrystallize with ethanol. Take 5 ml poly phosphoric acid in beaker and add hydrazone prepared in last stage stir well heat this mixture in water bath for five minutes the then pour this reaction mixture in to ice cold water solid product is separated out filter it and dry and recrystallize with ethanol.

2.4. The synthesis of bis-indole derivatives.

Themixture of aldehydeone mole,2-Phenyl-1-H-indole twomoles and catalyst 0.10 mg in ethyl acetate is grinded in mortar and pestle for specific period. The reaction was monitored by TLC.Reactions checked by TLC then add 10ml dichloromethane then reaction mixture was filtered. Catalyst is separated by filtration. This catalyst was reused. Then some amount of n-hexane is added in solvent.This mixture was kept in deep freezer pure crystals are separated. We have synthesized five bis-indole derivative syntheses by this method. The general scheme is given below we also compare this reaction with stone powder as catalyst but the reactive gives moderate yield and require longer duration of time.



III. RESULT

Table 1

Sr. no.	Compound name	Antibacterial Activity				Antifungal Activity	
		E.coli	P.aeruginoa	S.aurus	S.pyogenus	Calibicans	A.niger
01	3-((4-nitrophenyl)(2-phenyl-1H-indol-3-yl) methyl)-2-phenyl-1H-indole.	125	62.5	125	125	≥1000	500
02	3-((4-chlorophenyl)(2-phenyl-1H-indol-3-yl) methyl)-2-phenyl-1H-indole.	62.5	100	100	200	500	500
06	Gentamycin	0.05	1	0.25	0.5	-	-
07	Ampicillin	100	-	250	100	-	-
08	Chloramphenicol	50	50	50	50	-	-
09	Ciprofloxin	25	25	50	50	-	-
10	Norfloxacin	10	10	10	10	-	-
11	Nystatin	-	-	-	-	100	100
12	Greseofulvin	-	-	-	-	500	100

IV. DISCUSSION

3-((4-nitrophenyl)(2-phenyl-1H-indol-3-yl)methyl)-2-phenyl-1H-indoleshows antibacterial activity for bacteria E.coli at 125 mg/ml, P.aeruginosa at 62.5 mg/ml, S.aureus 125 mg/ml and S.pyogenus 125 mg/ml. Standard drug Amplicillin for E.coli 100 mg/ml, S.aureus 250 mg/ml and S.pyogenus 100 mg/ml. this conclude that this compound shows two times better reactivity than standard drug Amplicillin for bacteria S. aureus and less reactivity than Amplicillin for bacteria E. coli, P. aeruginosa and S. pyogenus. Gentamycin for E.coli 0.05 mg/ml, P.aeruginosa 1 mg/ml, S.aureus 0.25 mg/ml and S.pyogenus 0.5 mg/ml Standard drug Chloramphenicol for E.coli 50 mg/ml, P.aeruginosa 50 mg/ml, S.aureus 50 mg/ml and S.pyogenus 50 mg/ml. Standard drug Ciprofloxacin for E.coli 25 mg/ml, P.aeruginosa 25 mg/ml, S.aureus 50 mg/ml and S.pyogenus 50 mg/ml. Standard drug Norfloxacin for E.coli 10 mg/ml, P.aeruginosa 10 mg/ml, S.aureus 10 mg/ml and S.pyogenus 10 mg/ml. Hence the compound first shows less reactivity than all standard drugs.Antifungal activity of compound first for fungus C.albicans is 500, A. niger is 500 and minimal fungicidal concentration for standard drug Nystatin 100 mg/ml, A.niger 100 mg/ml, A.clavatus 100 mg/ml. Standard drug Nystatin 500 mg/ml, A.niger 100 mg/ml, A.clavatus 100 mg/ml.

3-((4-chlorophenyl)(2-phenyl-1H-indol-3-yl)methyl)-2-phenyl-1H-indole shows antibacterial activity for bacteria E.coli at 62.5 mg/ml, P.aeruginosa at 100 mg/ml, S.aureus 100 mg/ml and S.pyogenus 200 mg/ml. Standard drug Gentamycin for E.coli 0.05 mg/ml, P.aeruginosa 1 mg/ml, S.aureus 0.25 mg/ml and S.pyogenus 0.5 mg/ml. Standard drug Amplicillin for E.coli 100 mg/ml, S.aureus 250 mg/ml and S.pyogenus 100 mg/ml. Standard drug Chloramphenicol for E.coli 50 mg/ml, P.aeruginosa 50 mg/ml, S.aureus 50 mg/ml and S.pyogenus 50 mg/ml. Standard drug Ciprofloxacin for E.coli 25 mg/ml, P.aeruginosa 25 mg/ml, S.aureus 50 mg/ml and S.pyogenus 50 mg/ml. Standard drug Norfloxacin for E.coli 10 mg/ml, P.aeruginosa 10 mg/ml, S.aureus 10 mg/ml and S.pyogenus 10 mg/ml. Hence the compound first shows less reactivity than all standard drugs.Antifungal activity of compound first for fungus C.albicans is 500, A. niger is 500 and minimal fungicidal concentration for standard drug Nystatin 100 mg/ml, A.niger 100 mg/ml, A.clavatus 100 mg/ml. Standard drug Nystatin 500 mg/ml, A.niger 100 mg/ml, A.clavatus 100 mg/ml. according this it observed that greseofulvin and this compound shows that similar antifungal activity fungi C.Albicans.

V. CONCLUSION.

Ecofriendly synthesis of bisindole by using novel clay catalyst with substituted aldehyde and 2-phenyl-1-H-indole is reported at room temperature, this procedure has short reaction time and clean and good yield. Compound3-((4-nitrophenyl)(2-phenyl-1H-indol-3-yl)methyl)-2-phenyl-1H-indole and 3-((4-chlorophenyl)(2-phenyl-1H-indol-3-yl)methyl)-2-phenyl-1H-indoleshows more antibacterial activity towards S. aureus than standard drug Amplicillin 3-((4-chlorophenyl)(2-phenyl-1H-indol-3-yl)methyl)-2-phenyl-1H-indoleshows more antibacterial activity towards E. coli than standard drug Amplicillin.

VI. REFERENCES

[1]. SirassuNarsimha, NukalaSatheesh Kumar, Kumara SwamyBattula , Vasudeva Reddy Nagavelli, S. K. AlthafHussain, M. SrinivasaRao, Indole-2-carboxylic acid derived mono and bis 1,4-disubstituted1,2,3-triazoles: Synthesis, characterization and evaluation ofanticancer, antibacterial, and DNA-cleavage activities, Bioorganic &Medicinal Chemistry Letters 26 (2016) 1639–1644.

[2]. Harjinder Singh, JayantSindhu, Jitender M. Khurana, Chetan Sharma, K.R. Aneja, Ultrasound promoted one pot synthesis of novel fluorescent triazolylspirocyclicoxindoles using DBU based task specific ionic liquids and their antimicrobial activity, European Journal of Medicinal Chemistry 77 (2014) 145-154.

[3]. Anand R. Saundane, KatkarVijaykumar, A. VermaVaijinath, Synthesis of novel 2-amino-4-(5-substituted2-phenyl-1H-indol-3-yl)-6-aryl-4H-pyran-3-carbonitrilederivativesas antimicrobial and antioxidant agents,Bioorganic & Medicinal Chemistry Letters 23 (2013) 1978–1984.

[4]. Bai Lin Li, Dan-QianXu, Ai GuoZhong, Novel SO3H-functionalized ionic catalyzed a simple, green and efficient procedure for Fischer indole synthesis in water under microwave irradiation, Journal of Flourine Chemistry 144 (2012) 45-50.

[5]. Sally S. El-Nakkady, Mona M. Hanna, Hanna M. Roaiah, Iman A. Y. Ghannam, Synthesis, molecular docking study and antitumor activity of novel 2-phenylindole derivatives. European Journal of Medicinal Chemistry 47 (2012) 387-398.

[6]. VellekkattJamsheena, GanesanShilpa, JayaramSaranya, Nissy Ann Harry, Ravi Shankar Lankalapalli, SulochanaPriya. Anticancer activity of synthetic bis(indolyl)methane-ortho-biaryls against human cervical cancer (HeLa) cells, Chemico-Biological Interactions.

[7]. Carla Grosso, Ana Lucia Cardoso, AmericoLemos, Joao Varela, Maria Joao Rodrigues, Luisa Brreira, Teresa M.V.D. Pinoho e Melo. Novel approach to bis(indolyl)methanes: De novo synthesis of 1-hydroxyiminomethyl derivatives with anti-cancer properties. European Journal of Medicinal Cheemistry 93(2015) 9-15.

[8]. Ismail Shaikh, SheseraoPawar, Muktar Shaikh and Syed Abed. Synthesis of Bisindole using Novel Clay catalyst. Research journal of pharmaceutical, Biological and Chemical Sciences 2016, 7(4) 2932-2938.

[9]. A. Dandia, D. S. Bhati, A. K. Jain, G.N. Sharma, Ultrasound promoted clay catalyzed efficient and one pot synthesis of substituted oxindoles. Ultrasonic sonochemistry 18 (2011) 1143-1147.

[10]. Binbin Song, XinQu, Li Zhang, Kailin Han, Dan Wu, Cen Xiang, Hanrui Wu, Tianjiao Wang, YuouTeng and Peng Yu. Synthesis and antitumor properties of bis-indole derivatives. Journal of Chemical and Pharmaceutical Research, 2014, 6(10): 239-245

[11]. GopalpurNagendrappa, Organic synthesis using clay and clay-supported catalysts. Applied Clay Science 53(2011)106-138.

[12]. Michael R. Jacobs, SaraleeBajaksouzian, Caryn E. Good, Michelle M. Bulter, John D. Williams, Norton P. Peet, Terry L. Bowlin, Andrea Endimiani, Robert A. Bonomo, Novel bis-indole agents active against multidrug-resistant Acinebacterbaumannii. Diagnostic Microbiology and Infectious Disease 69 (2011) 114-116.

[13]. Roshan Pokhrel, Dipanjan Ghosh, Sangeeta Jha, Nayan Kamal Bhattacharyya, Satadru Jha. International Journal of Innovative Research in Science, Engineering and Technology 3 (8) 2014, 15666-15671.

[14]. V.K. Redasni, V.S. Kumawat, R. P. Kabra, P. Kansagara, S. J. Surana. Applications of Green Chemistry in Organic Synthesis. International Journal of Chem tech Research 2010, 2(3).

[15]. M. Karthik, A. K. Tripathi, N. M. Gupta, M. Palanichamy, V. Murugesan, Zeolite catalyzed electrophilic substation reaction of indoles with aldehydes: synthesis of bis(indolyl)methanes, Catalysis Communications 5 (2004) 371-375.

[16]. Ismail Shaikh, Sheserao Pawar, Muktar Shaikh and Syed Abed. A Novel Clay catalyst: N-Acetylation of Aniline. Journal of Chemical and Pharmaceutical Research, 2016, 8(5):725-729.

[17]. Clinical microbiology procedure handbook, vol.II, chapter 5 page no 5.0.1Henry d. Isenberg, 2nd edition.

[18]. Indian journal of chemistry, section-b, vol.46b, March 2007, pp.550-553.

[19]. National Committee for Clinical Laboratory Standards.Methods for Dilution, Antimicrobial Susceptibility Tests for Bacteriathat Grow Aerobically Approved Standard, (M7A5), 5th ed.; NationalCommittee for Clinical Laboratory Standards: Wayne, PA, 2000.

[20]. Shadomy, S. In Manual of Clinical Microbiology; Albert,B., Ed.; ASM Press: Washington, DC, 1991; p 1173.

[21]. Rattan, A. Antimicrobials in Laboratory Medicine; BIChurchill Livingstone: India, 2000; p 85.

[22]. Ismail Shaikh, Muktar Shaikh, MazaharFarooqui and Syed Abed, Application of Novel Clay catalyst for the Synthesis of bis-indole derivatives from 2-phenyl-1-H-indoleJ. of Ultra Chem. 13 (2) (2017):25-29.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Synthesis of Some Novel Chlorochromones Containing Pyrazole Moiety

Amol J. Shirsat[1], Sunil S. Bhagat[1], Balaji D. Rupnar[1], Gopal K. Kakade[*2]

[1]Department of Chemistry, R. B. Attal Arts, Science & Commerce College, Georai, Beed, Maharashtra, India
[2]Department of Chemistry, Arts, Commerce & Science College, Kille- Dharur, Beed, Maharashtra, India

ABSTRACT

A mild and proficient method has been developed for the synthesis of chlorochromones from oxidative cyclization of chalcones. High yield, simple workup procedure and mild reaction condition are main feature of this method. All synthesized chlorochromones has been evaluated for their antimicrobial activity against Gram +ve and Gram –ve microorganisms.

Kewords: Chalcones, Chlorochromones, Antimicrobial, Gram +Ve And Gram –Ve Microorganisms.

I. INTRODUCTION

Heterocyclic compounds are widely distributed in natural products and comprise a huge number of biologically active compounds. Halogenated chromones with a variety of substituents at second position are reported to have coronary spasmolytic, broncho-dilatory and antisarcom-180 properties. The 3-chlorochromones are related with antibacterial and antifungal activities[1-3]. Chalcones are starting materials for the synthesis of chlorochromones. Chalcones and their analogues having an-unsaturated carbonyl system are very adaptable β, α substrates for the evaluation of a variety of organic reactions.[4] The chalcones were initiate to have good antibacterial, analgesic and anti-inflammatory activities.[5] The chalcones, intermediates for the synthesis of a variety of heterocyclic compounds, are well-known for their antiinfective, particularly antibacterial and antifungal activities, since a long time [6].

The diverse methods for the synthesis of 3-halochromones were reported by different coworkers. Gammill[7] synthesized 3-halochromone from enaminoketone with halogen containing reagents. The 3-Chlorochromones are allied with antifungal, antibacterial, antiviral and antioxidant activities [8]. Compounds containing chlorochromone moiety are synthetically versatile molecules with a reactive carbonyl group having large significance for their biological activities[9-10]

II. MATERIALS AND METHODS

All the chemicals necessary for the synthesis of the compounds were obtained from Sigma Aldrich and SD Fine chemicals. Melting points were recorded in open capillaries and are uncorrected. ^{1}H NMR spectra were recorded on Bruker Avance II 400 MHz NMR Spectrophotometer in DMSO-d_6 and TMS as an internal standard. Using FT-IR Spectrophotometer Model RZX (Perkin Elmer) the infra-red spectra were recorded as potassium bromide disk. Mass spectra were recorded on Macromass mass spectrophotometer (Waters) by electro-spray method (ES). Using TLC silica gel coated plates obtained from Merck as stationary phase and solvent mixture of ethyl acetate/hexane (20:80) as mobile phase, purity of the synthesized compounds was checked.

III. GENERAL PROCEDURE

General Procedure for the synthesis of (*E*)6-bromo-2-(3-(3-bromothiophen-2-yl)-1-phenyl-1*H*-pyrazol-4-yl)-3-chloro-4*H*-chromen-4-one (2g): (0.25 gm, 0.0007 mmole) of chalcone as starting material was dissolved in 15 ml of DMSO. In this reaction mixture catalytic amount of cuprous chloride ($CuCl_2$) was added. The reaction mixture was heated in an oil bath for 4 hr

at 120°C. After completion of reaction (monitored by TLC) reaction mass was left overnight. 10 ml cold water was gradually added to the flask and the separated product was filtered, washed with water followed by dil. HCl for several times. It was again washed with water, dried out under vacuum and crystallized from ethanol to afford 2g. The physical data of the compounds 2(a-g) is recorded in Table 1.Their structures have been confirmed by ^{1}HNMR, Mass and IR spectra.

IR (2g) (cm^{-1}):960(C-Cl), 1076(Ar-Br), 1562(C=C), 1595 (C=N), 1649(C=O).

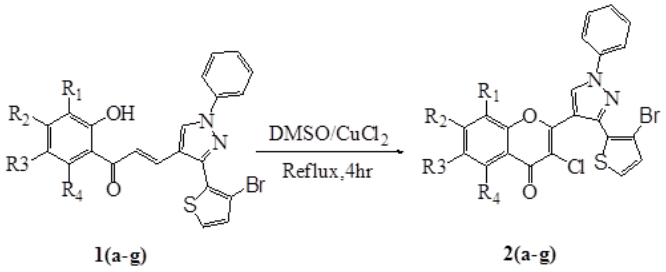
^{1}H NMR (2g) (DMSO-d_6)δ ppm: 6.5266(s, 1H, Ar-H), 7.0051-7.0274(d, 1H, Ar-H, *J*=8.92 Hz), 7.1473-7.1606(d, 1H, Ar-H, *J*=5.32 Hz), 7.4278-7.4648(dd, 1H, Ar-H, *J*=7.36 & 7.44Hz), 7.5332-7.6022(m, 2H, Ar-H), 7.7881-7.8145(dd, 1H, Ar-H, *J*=5.32 & 6.84Hz), 7.8521-7.9210 (m,1H, Ar-H), 7.9584-8.0046(dd, 2H, Ar-H, *J*=10.76 & 7.72Hz), 8.1861-8.1922(d,1H, Ar-H, *J*=2.44 Hz), 8.2097(s, 1H, pyrazole-H).

ES-MS (2g) (m/z):561(M+1), 563(M+2), 565(M+3), 567(M+5).

IR (2c) (cm^{-1}):958(C-Cl), 1079(Ar-Br), 1558(C=C), 1598 (C=N), 1652(C=O).

^{1}H NMR (2c) (DMSO-d_6)δ ppm: 6.6725(s, 1H, Ar-H), 7.0231-7.0325(d, 1H, Ar-H, *J*=3.76 Hz), 7.2451-7.2899(d, 1H, Ar-H, *J*=17.92 Hz), 7.4485-7.4688(dd, 1H, Ar-H, *J*=7.86 & 7.97Hz), 7.6231-7.6564(m, 2H, Ar-H), 7.7968-7.8234(dd, 1H, Ar-H, *J*=7.32 & 8.84Hz), 7.8651-7.9482(m,1H, Ar-H), 7.9651-8.0023(dd, 2H, Ar-H, *J*=9.75 & 7.84Hz), 8.2131-8.2436(d,1H, Ar-H, *J*=12.2 Hz), 8.2713(s, 1H, pyrazole-H).

ES-MS (2c) (m/z):517(M+1), 519(M+2), 521(M+3), 523(M+5).



Scheme 1. Synthesis of various (E) 6-bromo-2-(3-(3-bromothiophen-2-yl)-1-phenyl-1H-pyrazol-4-yl)-3-chloro-4H-chromen-4-one

Table 1. Physical data of compounds 2(a-g)

Comp.	R_1	R_2	R_3	M.P. (°C)	Yield (%)
2a	H	H	H	158-160	71
2b	H	H	CH_3	192-194	69
2c	H	H	Cl	176-178	73
2d	Cl	H	Cl	210-212	79
2e	H	H	F	208-210	69
2f	H	CH_3	Cl	164-166	78
2g	H	H	Br	188-190	82

IV. RESULT AND DISCUSSION

The chlorochromones derivatives were synthesized successfully in reasonable to good yields. All newly synthesized compounds were identified on the basis of melting point range, IR, ^{1}H NMR, Mass spectral analysis. All the newly synthesized derivatives were screened for antimicrobial activity using disc diffusion method.

Antimicrobial activity: Compounds1 and 2(a-g) were screened for their in vitro antimicrobial activity against Staphylococcus aureus (ATCC 25923), Escherichia coli (ATCC 25922), Pseudomonas aeruginosa (ATCC 27853) by paper disc diffusion method using Gentamycin as a reference standard drug. Antifungal activity was screened against Candida sp. using Nystatin as standard drug. At 100 μg/ml concentration all the tests were evaluated. The culture media was Muller Hinton agar. The region of inhibition was measured in mm after 24 hr of incubation at 37°C.Microbial data for copounds 1 & 2(a-g)are summarized below in Table 2.

Table 2. Antimicrobial Analysis Data

Sr. No.	Comp.No.	Escherichia coli (ATCC 25922)	Pseudomonas aeruginosa (ATCC 27853)	Staphylococcus aureus (ATCC 25923)	Candida sp.
1	2	No Zone	No Zone	No Zone	No Zone
2	2a	No Zone	No Zone	No Zone	No Zone
3	2b	No Zone	No Zone	No Zone	No Zone
4	2c	No Zone	No Zone	No Zone	No Zone
5	2d	No Zone	No Zone	No Zone	No Zone
6	2e	No Zone	No Zone	No Zone	No Zone
7	2f	No Zone	No Zone	No Zone	No Zone
8	2g	No Zone	No Zone	No Zone	No Zone
9	Gentamycin	28 mm	23 mm	32 mm	--
10	Nystatin	--	--	--	23 mm

V. CONCLUSION

The newly synthesized compounds were screened against Candida sp. and Gram positive as well as Gram negative bacterial strains. The synthesized compounds do not shown any activity compared to standard drug. The data obtained during the present work shows a good agreement between the experimental and computed spectral data.

VI. ACKNOWLEDGEMENT

The authors are thankful to UGC, WRO, Pune for financial support & The Principal Dr. R.V. Shikhare for providing laboratory facilities. The authors are thankful to Director, SAIF/CIL, Panjab University, Chandigarh for providing spectral data & thankful to Uday Khedkar, Director, BAC-TEST Laboratory, Nashik for antimicrobial analysis.

VII. REFERENCES

[1]. Wiley P F; J Am Chem Soc,4 (1952) 4329.
[2]. Jongerbreur G; Arch Intern Pharmacodynamic,90 (1952) 384. b) Schmitz J,Hirt R,Eichenberger F E and Lavener H H; Helv Chim Acta 36 (1953) 620. c) Wander A G; Brit Pat,27 (1955) 4329.
[3]. Donnelly D,Geoghegen R,Brein O,Phibin E and Wheeler T S; J Med Chem,8 (6) (1965) 872.
[4]. Kelly D. R.,Carroff E.,Lood R. W. F.,Heal W. and Roberts S. M.,Chem Commun,2004; 2016.
[5]. Sam Solomon W. D.,Ravi T. K. and Annadurai K.,Indian Drugs,1999; 36(7),466.
[6]. Mokle SS,Sayeed MA,Kothawar C. Synthesis and antimicrobial activity of some chalcone derivatives. International Journal of Chemical Sciences 2004; 2 (1): 96-100.
[7]. Gammill R. B.,Synthesis,1979; 901.
[8]. Randhavane P,Karale B. Synthesis and biological screening of some fluorinated dibenzofuran containing 3- chlorochromones and benzothiazepines. Journal of Heterocyclic Chemistry 2009; 46(4): 732-736.
[9]. Madje B R,Shindalkar S. S.,Ware M. N. and Shingare M. S.,Arkivoc,2005; 14,82.
[10]. Gerwick W. H.,Lopez A.,Van Duyne G. D.,Clardy J.,Ortiz W. and Buez A.,Tetrahedron Lett,1979; 270,1986.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

First Report on Butea Monosperma Flower Extract Based Nickel Nanoparticles Green Synthesis and Characterization

Ujwala S. Tayade[1], Amulrao U.Borse[2], Jyotsna S. Meshram[*3]

[1]School of Chemical Sciences, Chemistry, University North Maharashtra University, Jalgaon, Maharashtra, India
[2]School of Chemical Sciences, Chemistry, University North Maharashtra University, Jalgaon, Maharashtra, India
[*3]Department of Chemistry, Chemistry, Rashtrasant TukadojiMaharaj University, Nagpur, Maharashtra, India

ABSTRACT

Herein we study the Butea monosperma for the preparation of nickel nanoparticles. The plant extraction carried out in aqueous medium and screening for exact phytochemicals present in it. The nickel nanoparticles were prepared in one step in simple, cheap and less time consuming manner. The nickel nanoparticles are important for their semiconductor properties. We, therefore, study its optical properties by using tauc plot method. This also proves that confirmation of nanoparticles synthesized. The increase in band gap value indicates that decrease in particle size i.e. nanoparticle synthesis. The plant extract is useful in various fields such as medicines, dyes, and pesticides. Here the report of plant extracts as a reducing agent in nanoparticle synthesis. The nanoparticles synthesis were confirmed by various characterizations techniques such as Ultra violet -Visible spectrometer (UV), Fourier transform-Infrared spectrometer (FT-IR), X-ray diffraction (XRD), Scanning electron microscope (SEM) and calculating its band gap value which is 3.85 eV.

Keywords: Nickel Nanoparticles; Butea Monosperma; Phytochemicals Screening; Semiconductor; Band Gap

I. INTRODUCTION

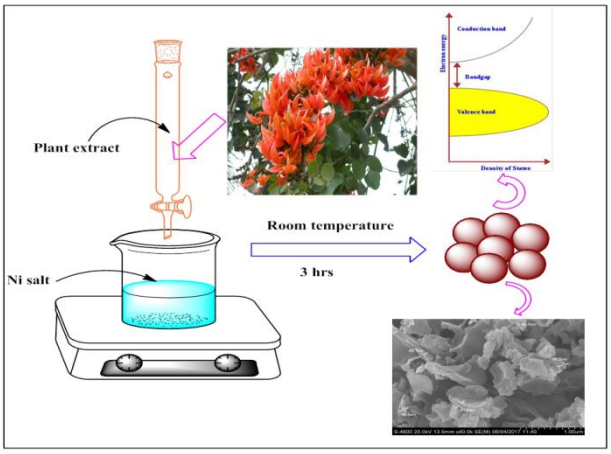


Figure 1. Graphical abstract of Nickel nanoparticles synthesis

In the nanotechnology nickel nanoparticles has been received more attention due to their electrical, magnetic and catalytic properties [1].the wide range of application in various fields included the fabrication of catalysis, electro chromic films, fuel cell electrodes and gas sensors, battery cathodes, pn -junctions, magnetic materials, photovoltaic devices, electrochemical super capacitors, smart windows and dye-sensitized photocathodes [2].therefore, NiO became one of the most important transition metal oxides. However, most of these applications require particles with a small size and a narrow size distribution. With the volume effect, the quantum size effect and the surface effect, NiO nanoparticles are expected to possess many improved properties and even more attractive applications than those of bulk-sized NiO particles. The plant mediated synthesis of nickel nanoparticles is having more importance over the conventional method. This requires number of chemicals, instruments for the methods like laser ablation, lithography, chemical reduction method, thermal decomposition [3-5], carbonyl method, sol-gel technique [6], microwave pyrolysis [7], solvothermal [8], anodic arc plasma [9], sonochemical [10], precipitation [11] and microemulsion [12].The green approach in nanomaterials synthesis is superior to other synthetic methods because of cost effectiveness, less optimization required and easy synthesis. Therefore the

combination of biological principles (i.e., oxidation/ reduction) by microbial enzymes or plant phytochemicals with physical and chemical approaches results in the synthesis of nanoparticles (Nps) with desired functions [13, 14, and 15]. Nps with an added advantage of stabilizing the formed Nps as plant secondary metabolites besides acting as synthetic agents also acts as a capping agent.Recently, NiO nps are studied widely because of their electrocatalysis, high chemical stability, super conductance characteristics, and electron transfer capability [16]. NiO is a p-type semiconductor metal oxide having a band gap ranging from 3.6 to 4.0 eV depending upon the nature of defects and their density. The bio-based method is important in case of nano -material synthesis some basic requirement should follow by them such as i] choice of proper solvent, ii] choice of an eco-friendly reducing agent and iii] choice of nontoxic stabilizing agent for nps. Thus by choosing proper solvent, surfactant and reductant biosynthesis produces nps with controlled morphology without producing any toxic environmental pollutant [17].the essential property of bio-synthesis is that they produce a non-toxic nanomaterial which is useful in biomedical and drug delivery system by removing toxic suefaces of nanoparticles.

In the present study, the Butea monosperma (B.monosperma) based nickel oxide nanoparticles are formed by the green approach. The phytochemicals present in the extract were useful for reduction as well as the capping of the metal precursor to form nanoparticles. Also, the solvent for extraction and preparation of nanoparticles is water which is more suitable for synthesis. We analyse the phytochemicals present in it by standard protocol. The phytochemicals of B.monosperma are more soluble in water as compare to any other solvents. All aspects of green chemistry followed by nickel nanoparticles and show the special morphological property with optical properties shows the band gap value of 3.5 ev.

II. EXPERIMENTAL

Materials: Nickel nitrate hexahydrate (Ni $NO_3.6H_2O$) [Sigma Aldrich], Deionized water, Butea monosperma petals etc.

Method:

Preparation of plant extract:

The 1 gm. of Butea monosperma petals are washed and dried. Then the petals are crushed in mortar and piston. The crushed petals are mixed with 100 ml of deionized water and continue the reflux condensation for 2 hrs. After that plant extract are filtered through Whatman filter paper. The filtrate is used as plant extract for further uses it is store at 4°C.

Phytochemical Screening:

Qualitative Analysis

Following standard protocols were used for qualitative analysis of samples to check for the presence of Alkaloids, Carbohydrates, Cardiac glycosides, Flavonoid, Phenols, Saponins, Tannins, Terpenoids, Quinones, and Proteins respectively.

1. Test for Flavaonoids: 2 ml of each extract was added with few drops of 20% sodium hydroxide, the formation of intense yellow color is observed. To this, few drops of 70% dilute hydrochloric acid was added and yellow color was disappeared which indicates the presence of flavonoids in the sample extract.

2. Test for Alkaloids: To 1 ml of each extract, 1 ml of marquis reagent, 2ml of concentrated sulphuric acid and few drops of 40% formaldehyde were added and mixed, the appearance of dark orange or purple color indicates the presence of alkaloids.

3. Test for Saponins: To 2 ml of each extract, 6 ml of distilled water were added and shaken vigorously; formation of bubbles or persistent foam indicates the presence of Saponins.

4. Test for Tannins: To 2 ml of each extract, 10% of alcoholic ferric chloride was added; formation of brownish blue or black color indicates the presence of tannins.

5. Test for Phenols: To 2 ml of each extract, 2 ml of 5% aqueous ferric chloride was added; formation of a blue colour indicates the presence of phenols in the sample extract.

6. Test for Proteins: To 2 ml of each extract, 1 ml of 40% sodium hydroxide and few drops of 1% copper sulphate were added; formation of violet color indicates the presence of peptide linkage molecules in the sample extract.

7. Test for Cardiac Glycosides: To 1 ml of each extract, 0.5ml of glacial acetic acid and 3 drops of 1% aqueous ferric chloride solution were added and

formation of the brown ring at the interface indicates the presence of cardiac glycosides in the sample extract.

8. Test for Terpenoids: Take 1 ml of an extract of each solvent and add 0.5 ml of chloroform followed by a few drops of concentrated sulphuric acid, the formation of reddish brown precipitate indicates the presence of Terpenoids in the extract.

9. Test for Carbohydrates: Take 1 ml of extract, add few drops of Molish reagent and then add 1 ml of concentrated sulphuric acid at the side of the tubes. The mixture was then allowed to stand for 2 to 3 minutes. Formation of red or dull violet color indicates the presence of carbohydrates in the sample extract.

Preparation of Nanoparticles:

The Salt of (Ni $NO_3.6H_2O$) of 1 M solution dissolve in 100 ml of deionized water then slowly add 5 ml of plant extract to this solution.The drop wise addition of plant extracts to given metal solution and keep the solution for 3 hrs. During the reaction, the change in color of salt to the change in color of addition process will be observed.The final observation of color change will confirm the formation of nanoparticles. The synthesized nanoparticles centrifuge at 3000 rpm for 20-30 min. The supernent was washed up to complete removal of any impurity present in it. Then the supernant was decanted and nanoparticles are separated.

Instruments and techniques

Structural characteristics, Crystallinity, and purity information were recorded by X-ray diffraction (XRD) patterns were recorded using a Rigaku Rotalflex RU-200B diffractometer with a CuKα (λ= 1.5418A°) in the scanning angle of 20 to 80 degrees. Surface morphological studies were performed by using a scanning electron microscope (FE-SEM) unit (S-4800 instrument from Hitachi, Japan) operated at 15.0 kV. Infrared spectroscopy (FT-IR) was measured on a Shimadzu FTIR-8400 FT-IR spectrometer 400 cm^{-1} to 4000 cm^{-1} at room temperature. The UV-Vis absorption study was performed at room temperature in the wavelength range of 200-800 nm on a UV-Vis spectrometer (Shimadzu UV-1700).

III. RESULTS AND DISCUSSIONS

Phytochemical screening:

Table 1. Phytochemicals analysis

Sr.no.	Phytochemicals test	Procedure	Present/Absent
1	Carbohydrates	Plant extract + 1-naphthol + Conc. Sulphuric acid	-
2	Protein	Plant extract + copper sulphate solution + KOH solution	+
3	Alkaloids	Plant extract + Meyers Reagent	_
4	Flavonoid	2 ml plant extract + ammonium hydroxide solution	+
5	Terpenoids	2ml plant extract+ Chloroform + Conc. sulphuric acid	+
6	Cardiac Glycosidase	2ml plant extract+ 3ml of Chloroform+ 10% ammonia solution	+
7	Tannins	Plant extract + few drops of lead acetate	+
8	Saponins	Plant extract + distilled water	-

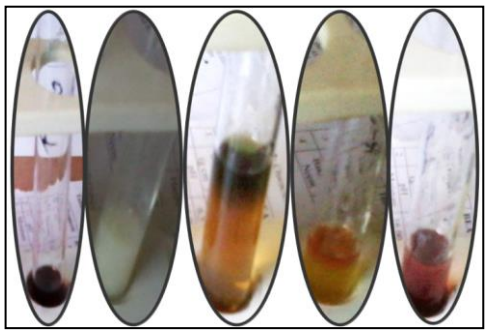


Figure 2. Phytochemicals present in B.monosperma

In this plant extract performing the various tests for phytochemical screening which indicates the presence of Proteins, Flavonoids, Terpenoids, Cardiac Glycosidase and Tannins etc. plays a more fundamental role in bio based nanoparticles synthesis shown in Figure 2 and Table 1.

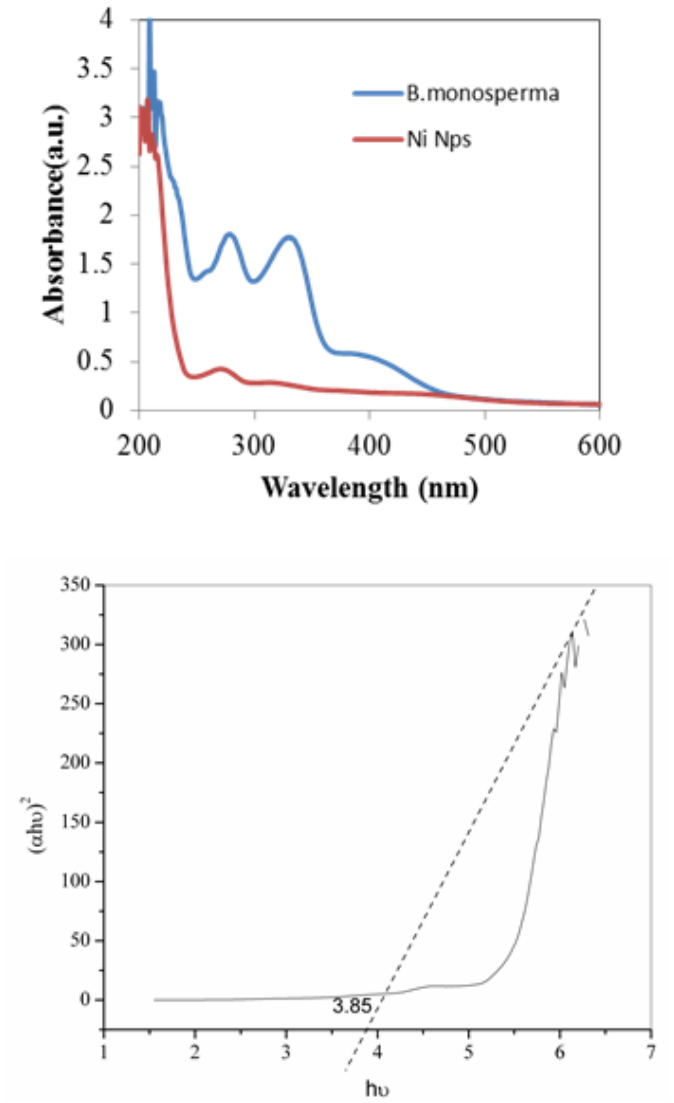


Figure 3. (a) UV-Visible Spectrum of Nickel nanoparticles (b) Band gap calculation

The color changes observed in metal solution after the B. monosperma extract addition and confirmation of nanoparticles was done by using UV-Visible spectroscopy (Figure 3 a). The UV-visible spectra imply that rapid bio-reduction takes place by using B. monosperma extract. In this study, we can conclude that the plant extract plays an important role in bio-reduction as well as stabilization of nanoparticles. The uv-visible absorption spectrum of the NiO particles obtained at room temperatures and dispersed in Water. The optical band gap energy of NiO nanoparticle produced at RT. A strong absorption peak at 285 nm is observed, attributable to the n to π* transition of Ni-O bonds. The small absorption peak observed in the range 300-400 nm due to water present in (Ni $NO_3.6H_2O$) [18]. The B. monosperma extract shows two major peaks in 200-400 nm which is characteristic of flavonoid moiety [19, 20]. According to the data of the absorption spectra, the optical band gaps (Eg) of NiO nanoparticles can be estimated by using the following equation:

$$(\alpha h\nu)^n = A\,(h\nu - E_g)$$

Where hν is photo energy, α is absorption coefficient, A is a constant relative to the material and n is either 2 for direct band gap material or 1/2 for an indirect band gap material. According to the equation, the optical band gap for the absorption peak can be obtained by extrapolating the linear portion of the $(\alpha h\nu)^n$ hν curve to zero. The increasing trends of the band gap energy upon the decreasing particles size is likely due to the defects or vacancies present in the inter granular regions generating new energy level to reduce the band gap energy [21].No linear relation was found for n = 1/2, suggesting that the as-synthesized NiO nanostructures are semiconducting with the direct transition at this energy [22].

The FT-IR spectrum of Nickel nanoparticles and B.monosperma:

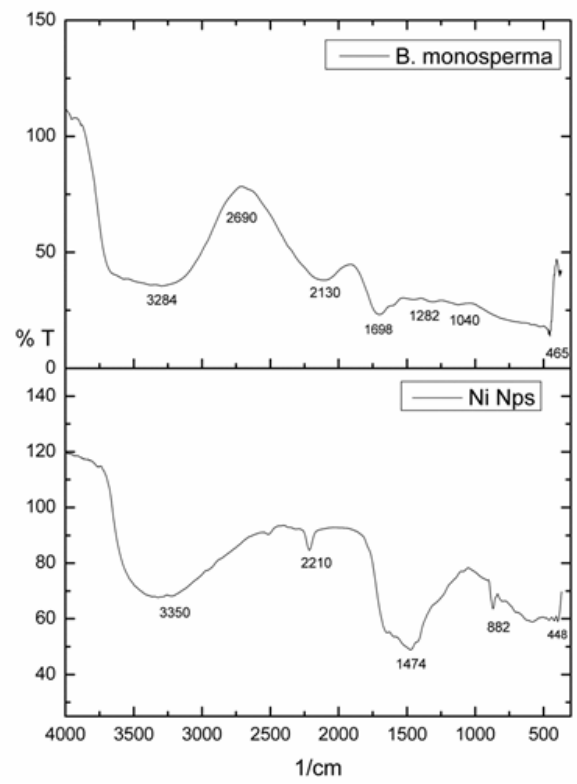


Figure 4. FT-IR spectrum of Nickel nanoparticles and B.monosperma

In the FT-IR spectra of Butea monosperma flower extract Figure 4(a). the strong absorption peaks observed at 3284cm-1 (Hydrogen bonded OH Stretch), 2690 cm-1 (C-H Stretch in CH_2), 1698 cm-1 (C=C Symmetric Stretch), 1463.19 cm-1(C-H deformation in

CH_2 and CH_3), 1282 cm-1(C-H Stretch), 1040 cm-1 (C-O Stretch of secondary alcohol), below 800 cm-1(=C-H bending exocyclic CH_2) [23]. The nickel nanoparticles in Figure no.4 (b) intercalated hydroxyl group from water between 3100 and 3500 cm−1 [24, 25]. The 2210 cm-1 is revealed to -CN group frequency.Also, an H-O-H bend is observed at 1474 cm−1 from the vibration of free water molecules [24].The spectrum also shows a sharp O-H stretch at 882 cm−1 from the hydroxyl lattice vibration and a weak peak at 448 cm−1 indicating a Ni-O lattice vibration [25].

X-ray diffraction of Nickel Nanoparticles:

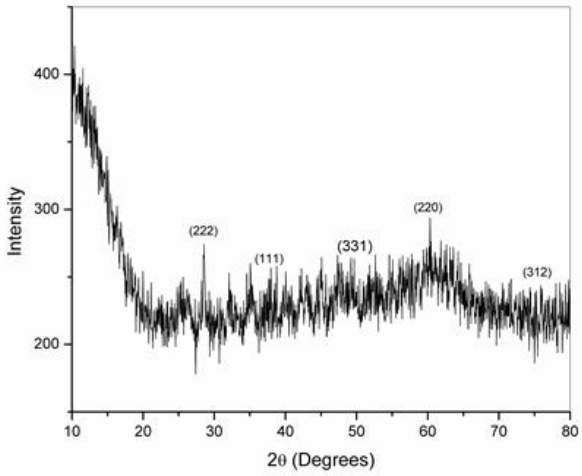


Figure 5. XRD spectrum of Nickel nanoparticles

XRD is used for the identification, purity, and quantitative analysis of NPs. The phase of NPs is determined by recording the peaks at 2θ value; these peaks give the value of crystal planes for particular type of NPs [26]. In figure no.5 by comparing the position and intensity of these diffraction peaks with Joint Committee on Powder Diffraction Standard (JCPDS) card number (each)type of metal has specific JCPDS card number) one can identify the NPs and their phase (Cubic, spherical, wurtzite etc.).The intensity of XRD spectrum peaks is function of particle crystallinity. When the NPs have good crystallinity then intense and sharp peaks are observed and vice versa. The NPs size can also be calculated using Scherrer equation; when particle size is large then XRD patterns become broad:

$$D = \frac{0.98\lambda}{\beta Cos\theta} \qquad [1]$$

Where, is particle size, λ is wavelength (CuKα), β is FWHM, and θ is diffraction angle. The average particle size calculated by Debye-Scherrer formula was found to be 31.77 nm. In this study the X-ray diffraction study the scanning angle is 10° to 80 °.In this the, major peak values are mached 37.27 (222), 47.402 (331), 43.298 (200), 62.836 (220) and 75.437 (312) with JCPDS card no.89-5881 and 780643, which clears that Cubic size nanoparticles are synthesized. The d value obtain from the more intense peak is1.6250 which is in good agreement with standard result of nickel nanoparticles.The inter planer distance (d) was calculated from Bragg's law,

$$2d \sin\theta = n\lambda \qquad [2]$$

Surface morphology:

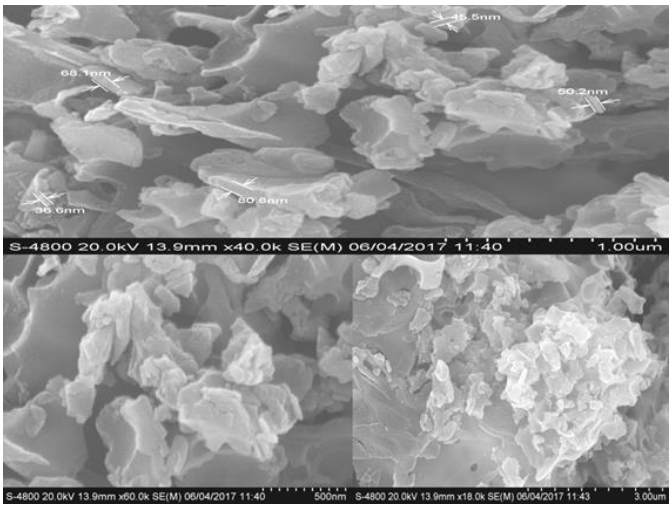


Figure 6. SEM image of Nickel nanoparticles

In Figure 6 the SEM is used to study morphology and composition of nanoparticles by scanning the surface with a high energy beam, produced by a heated filament.It is known that grain size and morphology of particles depends on reaction parameters such as temperature and gases generated (N_2, NO_2, CO_2, and H_2O).The aggregation occurs in nanoparticles because of magnetic interaction in nanoparticles[27].The results indicate that the nanoparticles were monocrysalline in nature and the average particle size was observed 56-60 nm.The flowers petal like morphology observed in SEM images.The plant extract plays a crucial role in stabilizing as well as capping the nanoparticles.The aggregation observed in nickel nanoparticles and due to that some nanoclusters like morphology appeared.

XRD crystallinity index:

It is generally agreed that the peak breadth of a specific phase of the material is directly proportional to the mean crystallite size of that material. From our XRD data, a peak broadening of the nanoparticles is noticed. The average particle size, as determined using the Scherer equation, is calculated to be 31.77 nm.

Crystallinity is evaluated through comparison of crystallite size as certained by SEM particle size determination. Crystallinity index Equation is presented below:

$$Icry = \frac{D_p(SEM)}{D_{cry}(XRD)} I_{cry} \geq 1 \qquad [3]$$

Where I_{cry} is the crystallinity index; Dp is the particle size (obtained from either TEM or SEM morphological analysis); Dcry is the particle size (calculated from the Scherrer equation).

Table 2. Crystallinity index of the sample

Sample	D_p(nm)	D_{Cry} (nm)	I_{Cry} (unitless)	Particle type
NiO	60	31.77	1.8885	Monocrystalline

Table.2. displays the crystallinity index of the sample that scored higher than 1.0. The data indicate that the NiO is highly crystalline. If the I_{cry} value is close to 1, then it is assumed that the crystallite size represents mono-crystalline whereas a polycrystalline have a much larger crystallinity index [28].

The SEM is used to study morphology and composition of nanoparticles by scanning the surface with a high energy beam, produced by a heated filament.The results indicate that the nanoparticles were monocrysalline in nature and the average particle size was observed 56-60 nm.The flowers petal like morphology observed in SEM images.The plant extract plays a crucial role in stabilizing as well as capping the nanoparticles.The aggregation observed only on the surface of nickel nanoparticles but the pure nanoparticles show their own morphology and charecteristics.

IV. CONCLUSION

The use of Butea monospermaextract is more useful than any other reductants because of faster bioreduction rate of production of nanoparticles.The green methodof nanoparticle synthesis is simple, effiecient, ecofriendly and did not require ample of reactants, draggy procedures and complex apparatus which were required for conventional methods.The Butea monospermaextract is more suitable for capping and stabilization of nickel nanoparticles.In this study, the formed nanoparticles show the band gap value of 3.85 eV which larger than bulk value 3.73 eV.The in band gapvalue decrases particle size.i.e. formation of nanoparticles.These features help in the commercialization of Ni and NiO NPs in the fields of environmental cleaning and nanomedicine, electrical, optical devices.

V. ACKNOWLEDGEMENTS

The authors are sincerely thankful to the School of Chemical Science, North Maharashtra University, Jalgaon for providing laboratory facility.

VI. REFERENCES

[1]. N. R. Jana, Y. F. Chen, X. G. Peng, Size- and Shape-Controlled Magnetic (Cr, Mn, Fe, Co, Ni) Oxide Nanocrystals via a Simple and General Approach, Chemistry of Materials, 16(2004) 3931-3935.

[2]. W.Wei, X. Jiang, L. Lu, X. Yang, X. Wang, Study on the catalytic effect of NiO nanoparticles on the thermal decomposition of TEGDN/NC propellant, Journal of Hazardous Materials,168(2009) 838-842.

[3]. W. Wang, Y. Liu, C. Xu, C. Zheng, G. Wang, Synthesis of NiO nanorods by a novel simple precursor thermal decomposition approach, Chemical Physics Letters, 362 (2002) 119-122. [4]N.M. Hosny, Synthesis, characterization and optical band gap of NiO nanoparticles derived from anthranilic acid precursors via a thermal decomposition route, Polyhedron, 30 (2011) 470-476.

[4]. X. Li, X. Zhang, Z. Li, Y. Qian, Synthesis and characteristics of NiO nanoparticles by thermal decomposition of nickel dimethylglyoximate rods, Solid State Communications,137 (2006) 581-584.

[5]. L. Xiang, X.Y. Deng,Y. Jin, Experimental study on the synthesis of NiO nano-particles, Scripta Materialia, 47 (2002) 219-224.

[6]. Y. Wang, J.-J. Ke, Preparation of nickel oxide powder by decomposition of basic nickel carbonate in microwave field with nickel oxide seed as a microwave absorbing additive, Materials Research Bulletin, 31 (1996) 55-61.

[7]. K. Anandan, V. Rajendran, Morphological and size effects of NiO nanoparticles via solvothermal process and their optical properties, Materials Science in Semiconductor Processing, 14 (2011) 43-47.

[8]. Z. Wei, H. Qiao, H. Yang, C. Zhang, X. Yan, Characterization of NiO nanoparticles by anodic arc plasma method, Journal of Alloys and Compounds, 479 (2009) 855-858.

[9]. S. Mohseni Meybodi, S.A. Hosseini, M. Rezaee, S.K. Sadrnezhaad, D. Mohammadyani, Synthesis of Wide Bandgap Nanocrystalline NiO Powder via a Sonochemical Method, Ultrasonics Sonochemistry, 19 (2012) 841-845.

[10]. X.Deng, Z. Chen, Preparation of nano-NiO by ammonia precipitation and reaction in solution and competitive balance, Materials Letters, 58 (2004) 276-280.

[11]. Y. Du, W. Wang, X. Li, J. Zhao, J. Ma, Y. Liu, G. Lu, Preparation of NiO nanoparticles in microemulsion and its gas sensing performance, Materials Letters, 68 (2012) 168-170.

[12]. R. C. Monica, R. Cremonini, Nanoparticles, and higher plants, Caryologia, 62(2009) 161-165.

[13]. A. Ahmad, P. Mukherjee, S. Senapati et al., Extracellular biosynthesis of silver nanoparticles using the fungus Fusarium oxysporum, Colloids and Surfaces B: Biointerfaces, 28(2003)313-318.

[14]. S.J.Kulkarni, Synthesis of Silver nanoparticles from the plant and fruit extracts-summary on research and studies, International Journal of Scientific Research in Chemistry, 2(2017)16-21.

[15]. F. T. Thema, E. Manikandan, A. Gurib-Fakim, M. Maaza, Single phase Bunsenite NiO nanoparticles green synthesis by Agathosma betulina natural extract, Journal of Alloys and Compounds, 657(2016) 655-661.

[16]. M. Singh, S.Manikandan, A. Kumaraguru, Nanoparticles: a new technology with wide applications, Research Journal of Nanoscience and Nanotechnology, 1(2011) 1-11.

[17]. M. A. Nasseri, F. Ahrari, B. Zakerinasab, A green biosynthesis of NiO nanoparticles using an aqueous extract of Tamarix serotina and their characterization and application, Applied organometallic Chemistry, 30 (2016) 978-984.

[18]. J. B. Harborne, Phytochemical methods: Guide to modern techniques of plant analysis, 3rd ed. Springer, India (1973) 60-79.

[19]. Tun, A. A., A. M. Hlaing, H. P. Aung, M. M. Htay., Isolation and characterization of flavonoids from the flowers of Butea monosperma Lam (Pauk), Journal of the Myanmar Academy of Arts and Science. 2 (2004) 85-90.

[20]. F.F.Lange,Powder processing science and technology for increased reliability,Journal of the American Ceramic Society, 72 (1989) 3-15.

[21]. S.S. Hwang, A.L. Vasiliev, N.P. Padture, Improved processing and oxidation-resistance of ZrB2 ultra-high temperature ceramics containing SiC nanodispersoids, Materials Science and Engineering: A, 464 (2007) 216-224.

[22]. M. K. Das, P. M. Mazumder, S. Das, Antiepileptic Activity of Methanol Extract of Butea monosperma (Lam.) Kuntze and its Isoalted Bioactive Compound in Experimentally Induced Convulsion in Swiss Albino Mice, International Journal of Drug Development and Research 8(2016) 1.

[23]. K. Harish, R. Renu, S. R. Kumar, Synthesis of nickel hydroxide nanoparticles by reverse micelle method and its antimicrobial activity, Research Journal of Chemical Sciences, 1(2011) 42-48.

[24]. Q. Song, Z. Tang, H. Guo, S. L. I. Chan, Structural characteristics of nickel hydroxide synthesized by a chemical precipitation route under different pH values, Journal of Power Sources, 112 (2002) 428-434.

[25]. B.T. Sone, X.G. Fuku, M. Maaza, Physical and Electrochemical Properties of Green Synthesized Bunsenite NiO Nanoparticles via Callistemon Viminalis' Extracts, International Journal of Electrochemical Science,11 (2016) 8204 - 8220.

[26]. R. A. Raj, M. S. AlSalhi, S. Devanesan, Microwave-Assisted Synthesis of Nickel Oxide Nanoparticles Using Coriandrum sativum Leaf Extract and Their Structural-Magnetic Catalytic Properties,Materials 10 (2017) 460.

[27]. P. Xubin, M. R. Iliana, M. Ray, L. Jingbo, Nanocharacterization and bactericidal performance of silver modified Titania photocatalysts, Colloids and Surfaces B: Biointerfaces. 77(2010)82-89.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

An Efficient and Green Protocol for The Synthesis Of 2-Arylbenzimidazoles Using Malic Acid as a Homogeneous and Reusable Catalyst

Sandeep B. Kasar, Shankar R. Thopate*
Prof. John Barnabas Post Graduate School for Biological Studies, Department of Chemistry, Ahmednagar College, Ahmednagar, Maharashtra, India.

ABSTRACT

A straightforward convenient and eco-friendly methodology is developed for the synthesis of substituted 2-arylbenzimidazoles by using malic acid as a catalyst in aqueous medium. O-phenylenediamines and aromatic aldehydes condenses together to give benzimidazole derivatives. This methodology uses easily available non-toxic naturally occurring malic acid as a catalyst. The reaction is very simple, convenient and straightforward and gives moderate to high yields of 2-arylbenzimidazoles.

Keywords: O-Phenylenediamine, Benzimidazole, Aldehyde, Malic Acid.

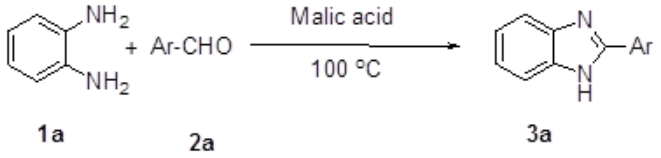
I. INTRODUCTION

Benzimidazole and benzthiazole are important structural motifs of biologically important compounds. These heterocycles are well known to exhibt range of pharmacological activities such as antibacterial, antiulcers, antihypertensives, antivirals, antifungals, anticancers and antihistaminics [1]. Therefore there synthesis is important part of hetrocyclic chemistry.

There are many methods reported in literature for the synthesis of benzimidazole derivatives. The condensation of 1,2-phenylenediamines with carboxylic acids or their derivatives is a most common method, but it needs harsh conditions like polyphosphoric acid [2] at 170-180 °C, use of different catalysts Indion 190 resin [3], $BF_3.OEt_2$ [4], Ceric ammonium nitrate [5], iodine, [6] Silica sulfuric acid [7], $In(OTf)_3$ [8], $SiO_2/ZnCl_2$ [9], silica supported sodium hydrogen sulphate [10], PEG [11], H_2O_2/ $Fe(NO_3)_3$ [12]. In recent years, Solvent-free synthesis of benzimidazoles under microwave irradiation using $Yb(OTf)_3$ [13], KSF clay [14], metal halide supported alumina [15] and solid support [16,17] has been reported. However most of the methods suffer from drawback like use of harsh reaction conditions, strong acidic conditions, toxic reagents, catalyst or solvents etc. Therefore, highly efficient and environmentally benign methodology is still a hot topic of interest for the synthesis of benzimidazole derivatives.

II. RESULTS AND DISCUSSION

We started our work with optimization of reaction condition, we selected O- phenyldiammine 1a and benzaldehyde 2a as a starting compounds. Firstly the reaction was performed at room temperature without catalyst in water (5 mL) under stirring condition for one hour but desired product was not obtained under this condition. Then reaction was carried out in presence of malic acid (1%) as a catalyst at room temperature for one hour but only trace quantity of product was formed under these conditions as indicated by TLC. In order to improve the results catalyst percentage and temperature was varied; we found that 10 mol % of catalyst at 100 °C for two hours gave desired product 3a in 90% yield Table 1.



Scheme 1. Synthesis of benzimidazoles.

Table 1. Optimization studies using O-phenyldiammine 1a and aldehyde 2a in water and under conventional heating condition.

Entry	Catalyst (mol%)	Temp.(^{o}c)	Time hr	Yield[a] (%)
1	0	R.T.	1	-
2	1	R.T.	1	Trace
3	2	50	1	10
4	5	70	1	20
5	5	70	2	30
6	10	100	2	90

[a.]Isolated yield.

In order to evaluate the scope and limitations of malic acid catalysis, the protocol was extended to other examples, under the optimized reaction conditions in water. Firstly, various aromatic aldehydes were treated with *O*-phenyldiammine under optimized reaction conditions to give the corresponding benzimidazole derivatives in good to excellent yields (Figure 1). Results are summarized in Table 2. Aqueous solution of the catalyst can be successfully used for the next cycles without any pretreatment. It shows the high reusability of malic acid catalyst in synthesis.

Table 2. Synthesis of 2-substituted benzimidazoles from O-phenylenediamine and aldehydes.

Sr. No.	Ar	Product	Yield %	Nature	Observed M.P. °C	Reported[18] M.P. °C
1	Phenyl	3a	90	Off white solid	287-289	289-291
2	2-Chlorophenyl	3b	80	Pinkish red solid	230-232	231-233
3	3-Chlorophenyl	3c	78	Colorless solid	232-234	234-236
4	4-Chlorophenyl	3d	70	Colorless solid	286-298	289-291
5	2-Methylphenyl	3e	75	Colorless solid	220-222	220-222
6	4-Methylphenyl	3f	76	Colorless solid	264-266	265-267
7	2-Methoxyphenyl	3g	67	Colorless solid	174-176	175-176
8	4-Methoxyphenyl	3h	60	Colorless solid	218-220	220-221

III. EXPERIMENTAL SECTION

Materials and method

All the reagents were used as received from commercial source without further purification. Thin-layer chromatography (TLC) was performed on silica gel $60F_{254}$ (0.25 mm thickness) plates and were visualized under short (254 nm) and long (365 nm) UV light. Column chromatography was performed using silica gel 200-400 mesh. Melting points (m.p.) were determined in open capillary tubes using paraffin oil bath and are uncorrected. ^{1}H and ^{13}C NMR spectra were recorded on a 400 and 100 MHz NMR spectrometer using $CDCl_3$ and DMSO-d_6 as solvent. Chemical shifts δ are reported in ppm relative to Me_4Si internal standard. The multiplicity of signals is designated by the following abbreviations: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet).

General procedure for synthesis of benzimidazoles.

A mixture of *O*-Phenylenediamine **1a** (1.0 mmol), aldehyde **2a** (0.5 mmol), and malic acid (10mol %), in H_2O (5 mL) was refluxed at 100 °C for 2h. After the completion of reaction (TLC check), reaction mixture was cooled to room temperature and extracted with ethyl acetate (3 × 5 mL), organic layer was dried over Na_2SO_4 and concentrated under vacuum. The crude residue was purified by column chromatography on silica gel using ethyl acetate: hexane as eluent. All compounds are reported in the literature. Melting points were recorded in an open capillary and are uncorrected. All melting points and spectral data match with the reported values given in the literature.

^{1}H data of selected compounds:

1) 2-Phenylbenzimidazole (**3a**): Off white solid; m.p: 287-289 °C; (lit [18]. 289-291°C).
   ^{1}H NMR (DMSO-d_6): δ 12.02 (br s, 1H), 7.80 (d, *J* = 7.6 Hz, 2H), 7.57-7.65 (m, 1H), 7.60- 7.49 (m, 4H), 7.20-7.18 (m, 2H).
2) 2-(3-Chlorophenyl) benzimidazole (**3c**): Colorless solid; m.p: 232-234 °C; (lit.[18]. 234-236 °C) ^{1}H NMR (DMSO-d_6): δ 12.60. (br s, 1H), 8.50 (s, 1H), 8.33 (d, *J* = 6.8 Hz, 1H), 7.70-7.60 (m, 4H), 7.40-7.32 (m, 2H).

IV. CONCLUSION

In conclusion, we have developed an efficient and green protocol for the synthesis of 2-aryl benzimidazoles by using malic acid as a reusable catalyst which is non toxic naturally occurring and inexpensive. The operational simplicity, cleaner reaction condition use of water as a green solvent, moderate to high yields, and avoids use of hazardous mineral acids or Lewis acids makes this protocol superior to many other existing methods.

V. ACKNOWLEDGEMENTS

We thank Dr. R. J. Barnabas (Ahmednagar College, Ahmednagar) for helpful discussion and suggestions.

VI. REFERENCES

[1]. Synthetic approaches to benzimidazoles from O-phenylenediamine: A literature review, Shatha Ibrahim Alaqeel, Journal of Saudi Chemical Society, 21 (2017) 229-237 and references therein.

[2]. E. Alcalde, I. Dinares, L. P. Garcia and T. Roca, "An Advantageous Synthesis of 2-Substituted Benzimidazoles Using Polyphosphoric Acid. 2-(Pyridyl)-1H-benzimidazoles, 1-Alkyl-(1H-benzimidazol-2-yl)pyridinium Salts, Their Homologues and Vinylogues," Synthesis, 4 (1992) 395-398.

[3]. V. S. Padalkar, V. D. Gupta, K. R. Phatangare, V. S. Patil, P. G. Umape and N. Sekar, "Indion-190 Resin: Efficient, Environmentally Friendly and Reusable Catalyst for Synthesis of Benzimidazoles, Benzoxazoles and Benzothiazoles," Green Chemistry Letters and Reviews, 5 (2012) 139-145.

[4]. R. R. Nagawade and D. B. Shinde, "BF3.OEt2 Promoted Solvent Free Synthesis of Benzimidazole Derivatives," Chinese Chemical Letters, 17 (2006) 453- 456.

[5]. M. Kidwai, A. Jahan and D. Bhatnagar, "Polyethylene Glycol: A Recyclable Solvent System for the Synthesis of Benzimidazole Derivatives Using CAN as Catalyst," Journal of Chemical Sciences, 122 (2012) 607-612.

[6]. P. Sun and Z. Hu, "The Convenient Synthesis of Benzimidazole Derivatives Catalyzed by I2 in Aqueous Media," Journal of Heterocyclic Chemistry, 43 (2006) 773-775.

[7]. B. Sadeghi and M. G. Nejad, "Silica Sulfuric Acid: An Eco Friendly and Reusable Catalyst for Synthesis of Benzimidazole Derivatives," Journal of Chemistry, Vol. 2013 (2013) Article ID: 581465.

[8]. R. Trivedi, S. K. De and R. A. Gibbs, "A Convenient One-Pot Synthesis of 2-Substituted Benzimidazoles," Journal of Molecular Catalysis A: Chemical, 245 (2006) 8-11.

[9]. R. G. Jacob, L. G. Dutra, C. S. Radatz, S. R. Mendes, G. Perin and E. Lenardao, "Synthesis of 1,2-Disubstituted Benzimidazoles Using SiO2/ZnCl2," Tetrahedron Lett. 50 (2009) 1495-1497.

[10]. R. K. Kumar, P. V. V. Satyanarayana and S. B. Reddy, "NaHSO4-SiO2 Promoted Synthesis of Benzimidazole Derivatives," Archives of Applied Science Research, 4 (2012) 1517-1521.

[11]. C. Mukhopadhyay and P. K. Tapaswi, "PEG-Mediated Catalyst-Free Expeditious Synthesis of 2-Substituted Benzimidazoles and Bis-Benzimidazoles under Solvent-Less Conditions," Tetrahedron Lett. 49 (2008) 6237-6240.

[12]. K. Bahrami, M. M. Khodaei and F. Naali, "H2O2/ Fe(NO3)3-Promoted Synthesis of 2-Arylbenzimidazoles and 2-Arylbenzothiazoles" Synlett, 4 (2009) 569-572.

[13]. L. Wang, J. Sheng, H. Tian, et al., "An Efficient Procedure for the Synthesis of Benzimidazole Derivatives Using Yb(OTf)3 as Catalyst Under Solvent-Free Conditions," Synth. Commun, 34 (2004) 4265-4272.

[14]. A. Loupy, A. Petit, J. Hamelin, et al., "New Solvent-Free Organic Synthesis Using Focused Microwaves," Synthesis, 9 (1998) 1213-1234.

[15]. G. V. Reddy, V. V. V. N. S. Ramarao, B. Narsaiah, et al., "A Simple and Efficient Method

for the Synthesis of Novel Trifluoromethyl Benzimidazoles under Microwave Irradiation Conditions," Synth. Commun, 32 (2002) 2467-2476.

[16]. G. Penieres, I. Bonifas, G. Lopez, et al., "Synthesis of Benzimidazoles in Dry Medium," Synth. Commun, 30 (2000) 2191-2195.

[17]. K. Bougrin, A. Loupy, A. Petit, et al., "Nouvelle Voie de Synthèse des 2-Trifluorométhylarylimidazoles sur Montmorillonite K10 en 'Milieu Sec' Sous Micro-Onde," Tetrahedron 57 (2001) 163-168.

[18]. Facile and Efficient Method for Synthesis of Benzimidazole Derivatives Catalyzed by Zinc TriflateRamineni Srinivasulu1, Kannasani Ravi Kumar2, Peruri Veera Venkata Satyanarayana, Green and Sustainable Chemistry, 4 (2014) 33-37.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Studies on Mangenese (II), Cobalt(II), Nickel(II), Copper(II) and Zn(II) complexes of substituted phenyl-thiazolyl-thiosemicarbazide

N. G. Kolhe[a,b*], J. K. Khedkar[b], and Y. H. Deshpande[a]*
[a]Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra, India
[b]Department of Chemistry, New Arts, Commerce and Science College, Shevgaon, Maharashtra, India

ABSTRACT

Thiazolyl thiosemicarbazide consists of a thiazole moiety in the structure. The compounds belonging to the thiazole ring systems have shown considerable activity in various fields including medicinal chemistry. Vitamin B1, sulphatiazole, promizole, nitridazole, aminitrazole, and thiabendazole, all contain thiazole ring in one form or other. Thiosemicarbazide containing –NCS group are known to possess pronounced biological activities. Thiosemicarbazide along with thiosemicarbazones have been used in various life saving drugs and drug action of these compounds was found to have been increased when administered in the form of their metal complexes. However a survey of literature reveals that no work has been done with substituted thiazolyl thiosemicarbazides. In the present work we investigate the complex formation process between some substituted thiazolyl thiosemicarbazides synthesised in our laboratory for the first time and various metal ions belonging to transition and inner transition series. The stability of different complexes follows the order: Mn < Co < Ni < Cu > Zn.

Keywords : Thiazolyl Thiosemicarbazide, Metal Ions, Metal-Ligand Complexes, Stability, Thermodynamics

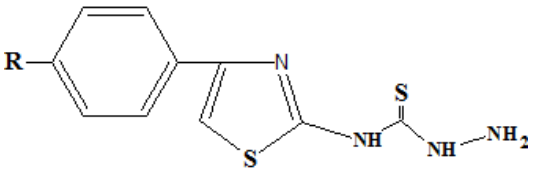
I. INTRODUCTION

Thiosemicarbazides are known to possess antiviral[1], fungicidal[2], and antitubercular[3] activities. They are known to act as inhibitors in the corrosion of Aluminium and Zinc[4]. The metal complexes of thiosemicarbazides have been known for pharmacological applications.[5] Crim *et al*[6] have shown the importance of metal chealets against cancer. They have been used in various life saving drugs.[7,8] The drug action of these compounds was found to have been increased when administered in the form of their metal complexes.[9,10]

It was therefore decided to investigate the complex formation process between certain metal ions, commonly occurring in the physiological systems and various substituted thiosemicarbazides and to see the effect of substituents (if any) in the organic compound part of the complexes. The investigation was carried out by using Calvin-Bjerrum potentiometric titration technique. (Ionic strength 0.1M, 30^0 C, Medium – dioxane)

II. EXPERIMENTAL

All the chemicals used were of Analytical grade. The metal ions were used in the form of their nitrates and were estimated by EDTA titrations.[11] Dioxane was purified by standard method.[12] The thiosemicarbazides N-[4'-phenylthiazole-2'-yl]thiosemicarbazide(1), N-[4'-(4"-Bromophenyl)thiozole-2'-yl]- thiosemicarbazides (2), N-[4'- (4"-chlorophenyl)thiozole-2'-yl]-thiosemicarbazides (3), N-[4'-(4"-methylphenyl)thiozole-2'-yl]- thiosemicarbazides (4), and N-[4'-(4"-Aceta-amido) thiozole-2'-yl]-thiosemicarbazide were prepared and purified by the methods described earlier.[13]



1; R = -H
2; = -Br
3; = -Cl
4; = $-CH_3$

5; = 

Scheme 1. The basic structure of ligand

The Calvin-Bjerrum titration technique involving the titration of i) 4 X 10^{-3} M $HClO_4$(A); (ii) 4 X 10^{-3} M $HClO_4$ (A)+ 2 X 10^{-3} M ligand (A+L) and (iii) 4 X 10^{-3} M $HClO_4$ + 2 X 10^{-3} M ligand (A+L+M) + 4 X 10^{-4} M metal ion solution against standard (1.833 X 10^{-1} N) carbonate free NaOH solution. An approximate quantity of 1M $NaClO_4$ solution was added to each of the above mixtures to maintain constant ionic strength of 0.1M. The total volume of each of the mixture was made upto 50 ml so that the solution were 50% (v/v) with respect to dioxane. A Elico LI-120 pH meter having an accuracy of ± 0.01 pH unit with combined electrodes,was used to record the pH values. All the measurements were carried out at 30 ± 0.1° C

Calculations of $\overline{nA}$ pk, n, PL and logK were done by point wise method of Irving-Rossotti.

III. RESULTS AND DISCUSSION

A representative graph of A+L (acid +ligand) and A+L+M (acid+ligand+metal) is shown in Fig.1 Since the pK and log K values obtained were practical values, correction factor of Van Uitert and Fernelius[14] was obtained to get the thermodynamic values. The curve of A + L lies above the acid curve (A) this may be due to association process in the ligands in acidic medium. The same type of behaviour was observed for 2-amino-4-(p-methoxy phenyl ethyl)-thiazole[15]. The values of $\bar{n}$ A indicate that though the ligand has 4 basic nitrogen atoms only one proton is taken up by it like phenanthroline and imidazole.[16,17] This was also observed by Banerjee and Basak[18] in their work with unsubstituted 2-amino-thiazole.

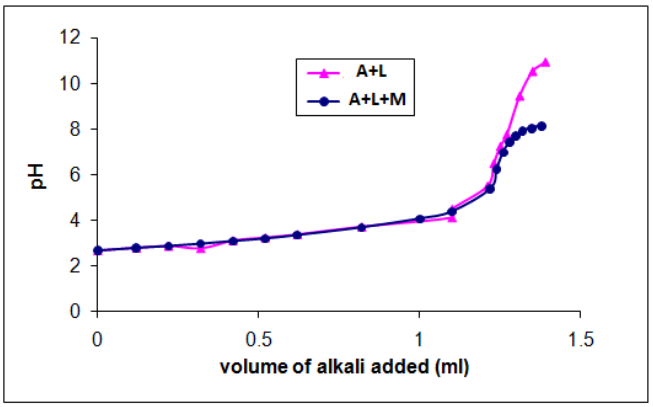


Figure 1. Graph of pH *vs* volume of alkali added

The pH, $\bar{n}$ and PL and log K values for Mn(II) –ligand II system are represented in Table 1.

Table 1. The pH, $\bar{n}$ and PL and log K values for Mn(II) –ligand II

pH	$\bar{n}$	PL	LogK
7.7	0.2272	2.7309	2.1991
8.0	0.2998	2.7377	2.3692
8.2	0.3544	2.7429	2.4825
8.5	0.4815	2.7552	2.7228
8.74	0.7267	2.7797	3.2042

Only the logK values of the metal-ligand complexes could be determined. The $\bar{n}$ values for $logK_2$ were haphazard and in the region of hydrolysis. The stability constants of the meta-ligand complexes are presented in Table 2.

Table 2. Proton-ligand and metal-ligand stability constants of transition metal-thiosemicarbazide complexes in 50% (v/v) aqueous dioxane. Temp -30° C μ = 0.1 M $NaClO_4$

Metal ions	Ligand (I)		Ligand (II)		Ligand (III)		Ligand (IV)		Ligand (V)	
	Log K_1	Log K_2	Log K_1	Log K_2	Log K_1	Log K_2	Log K_1	Log K_2	Log K_1	Log K_2

H+	3.87	-	3.33	-	3.54	-	3.96	-	3.62	-
Mn^{II}	2.546	-	2.60	-	2.72	-	2.64	-	2.66	-
Co^{II}	2.666	-	2.64	-	2.73	-	2.756	-	2.685	-
Ni^{II}	2.706	-	2.69	-	2.75	-	2.777	-	2.76	-
Cu^{II}	2.789	-	2.74	-	2.77	-	2.798	-	2.78	-
Zn^{II}	2.79	-	2.77	-	2.76	-	2.69	-	2.70	-

The stability of the different complexes investigated follow the order, Mn < Co < Ni < Cu > Zn which is in accordance with the Irving and Williams.[19,20] The linear relationship between logK and pK values suggest identical binding sites in all the ligands. The stabilities of Mn(II), Co(II),Ni(II) and Cu(II) complexes were higher than Zn(II) complexes. To confirm the possible correlation, $\log K_1$ values of Co(II) complexes of present series ligands were plotted against $\log K_1$ values of Ni(II) complexes of corresponding ligands (Fig. 2)

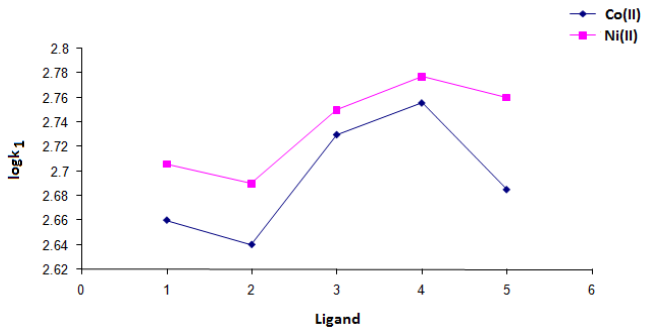


Figure 2. Plot of $\log K_1$ values of Co(II) and Ni(II) complexes of corresponding ligands.

The $\log K_1$ values of Mn(II) complexes were slightly less than those of Co(II), Ni(II), Cu(II) and Zn(II). This was probably due to the bigger size of the thiosemicarbazide molecule which caused steric hindrance in the complex formation.

For determining the Thermodynamic parameters ΔG, ΔS and ΔT, the dissociation constants were determined using the quick titration method developed by Mali and Pethe[21] which utilizes the half neutrilizaion principle. The corresponding values are reported here. The practical proton ligand stability constants of various ligands at different temperatures are represented in Table 3.

Table 3. The proton ligand stability constants of various ligands at various temperatures.

Ligand	Temperature (° C)				
	30	40	50	60	70
1	3.88	3.70	3.56	3.41	3.27
2	3.33	3.15	3.03	2.93	2.83
3	3.54	3.40	3.29	3.20	3.10
4	3.96	3.82	3.70	3.59	3.48
5	3.63	3.49	3.36	3.25	3.14

The ΔG, ΔS and ΔH were calculated using the equations:

i) $\Delta G = 2.303RTpK$ and, ii) $\Delta S = \frac{\Delta H - \Delta G}{T}$

where the ΔH values were evaluated from the temperature coefficient method. The plots of pK against 1/T for various ligands are presented in Fig 3. The thermodynamic parameters are represented in Table 4.

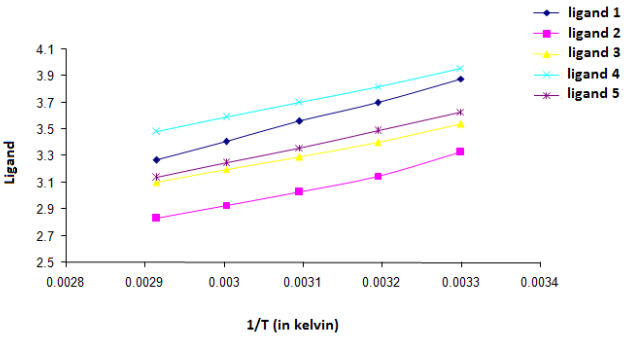
Fig. 3 The plots of pK against 1/T for various ligands.

As expected the pK values decreases with increase in the temperature for all ligands. The ΔG values are positive indicating that dissociation of ligands in to ions is thermodynamically not a favourable process. The ΔS values are negative.

The high ΔH values as compared to ΔS are responsible for complex formation process.

Table 4. Thermodynamic parameters ΔG, ΔS and ΔH

Ligand	Thermodynamic pK	+ ΔH Kcal mol^{-1}	+ΔG Kcal mol^{-1}	ΔS cal deg^{-1} mol^{-1}
1	3.88	3.684	5.3798	-5.594
2	3.33	2.7636	4.6171	-6.117
3	3.54	2.558	4.9083	-7.754
4	3.96	2.3824	5.4907	-10.25
5	3.63	2.878	5.033	-7.11



IV. CONCLUSION

The present work reports the successful synthesis of substituted thiazolyl thiosemicarbazides. The complex formation process between these substituted thiazolyl thiosemicarbazides various metal ions belonging to transition and inner transition series are investigated. These complexes follow the stability order as: Mn < Co < Ni < Cu > Zn. The obtained $logK_1$ values of Mn(II) complexes were slightly less than those of Co(II), Ni(II), Cu(II) and Zn(II); probably due to the bigger size of the thiosemicarbazide molecule causing steric hindrance in the complex formation. The experimentally calculated thermodynamic parameters explain the complex formation process.

V. ACKNOWLEDGMENTS

The principle investigator Dr N. G. Kolhe is very thankful to Dr. Y. H. Deshpande, Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad for valuable and inspiring guidance. NGK is also thankful to Prof. D. B. Ingale, Head, Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University for providing all the necessary facilities. NGK offers his sincere thanks to principal Dr. L. S. Matkar, former principal Dr. S. A. Devadhe, New Arts, Commerece and Science college, Shevgaon and the management of Ahmednagar Jilha Maratha Vidya Prasark Samaj, Ahmednagar for giving the permission to carry out this work.

VI. REFERENCES

[1]. Pandey, V. K. and Agarwal A. K. Acta Cienc Indica Chem 1980, 6, 166
[2]. Srivastava, U.; Pathak, R. B.; Bahel, B. C. J. Indian Chem Soc 1981,58, 822
[3]. Dogmagk, G;. Behnisch, R.; Mietzsch, F.; Schmidt, H., Naturwissenschaflen, 1946, 33, 315
[4]. El-Khair, A.; Mostafa, B.; Kamel, Kh. M.; Abdel-Hamid, I. A. Indian J. Chem 1977, 1010
[5]. Orlova, N. N.; Akasevova, V. A.; Seliolovkin, D. A.; Bogdanova, N. B.; Pershin, G. N. Russ. Pharm. Toxicol, 1968, 348
[6]. Crim, J.A.; Petering, H. G. Cancer Rev 1967, 27, 1278
[7]. Bauer, D. J. ; Vincent, L. S.; Kempe, C. H.; Downie, A. W. Lancent, 1969, 20, 494
[8]. Dwyer, F. P.; Mathew, E.; Roe, E.M.F.; Shulman, A. Br. J. Cancer , 1965, 19, 195
[9]. Mashima, M. Bull. Chem. Soc. Jpn. 1964, 37, 974
[10]. Pradhan, B. and Ramana Rao, D. V. J. Indian Chem. Soc. 1977, 54, 136
[11]. Flaschka, H. R. "EDTA Titrations" Pergamon press, New York (1959)
[12]. Vogel, A. I. "A Text Book of Practical Organic Chemistry" 3rd ed; Longmans London, 1959, p177
[13]. Ahluwalia, V. K.; Dutta, U.; Sharma, H. R. Indian J. Chem. 1987, 26B, 88
[14]. Van Uitert, Le-G. G.; Fernelius, W. C.; Douglas, B. E. J. Am. Chem. Soc. 1953, 75, 2736-2738
[15]. Dasgupta, H. C. And Singh, V. V. Pd. J. Indian Chem. Soc. 1979, 954
[16]. Lee, T. S.; Kolthoff, I. M.; Lessing, D. L. J. Am. Chem. Soc. 1948, 70, 2348
[17]. Tanford, C.; Wagner, M. L. J. Am. Chem. Soc. 1953, 75, 434
[18]. Basak. A.K.and Banerjee, D. J. Indian Chem. 1978, 55, 853
[19]. Irving, H. M. and Rossoti, H. S. J. Chem. Soc. 1954, 2904-2910,
[20]. Irving, H. M. and Williams, R. J. P. Nature, 1948, 162, 746
[21]. Mali B. D. PhD thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Synthesis, Characterization and Antimicrobial Activity of Mn-Fe Tartarate Composites

N. S. Dhavale[1], C. S. Patil[2], S.M. Vhankate[1], V. B. Tadke[1], R.P. Pawar[2] and S.S. Pawar[1*]

[1]Department of Chemistry, Fergusson College (Autonomous), Pune, Maharashtra, India
[2]Department of Chemistry, Deogiri College, Aurangabad, Maharashtra, India

ABSTRACT

The synthesis of Mn-Fe mixed metal tratarate composites of six different proportions is done by co-precipitation method stoichiometrically. The composites of Mn-Fe tartarates formed are characterized by analytical techniques like AAS, IR study, XRD patterns, thermal and elemental analysis. Characterization data of all six complexes reveals that the composites synthesized have polycrystalline nature and bidentate ligand. These composites have antimicrobial activity against micro-organisms like *E.coli, Bacillus subtilis, Staphylococcus aureus, C. albieans, A. niger, P. chrysogenum* ect.

Keywords: Mn-Fe Tartarates Composites, Antimicrobial Activity

I. INTRODUCTION

Dicarboxylates of metals are often exists in natural systems in various conversions and in the process food stuff manufactured [1, 2, 3]. Dicarboxylates of transition and non-transition metals finds important applications in petroleum, paints, cement, PVC and vegetable fat industries [4]. The synthesis and characterization of some polynuclear complexes (i.e. Oxalates) containing Fe, Mn and Zn are useful as precursors by forced hydrolysis [5-9].

This work includes synthesis of Mn-Fe mixed metal tartarates composites using co-precipitation method using various proportions (Sample MFT-1 to MFT-6). The composites of Mn-Fe tartarates are further characterized using analytical methods. The antimicrobial activity of these composites is tested against many micro-organisms such as *E.coli, Bacillus subtilis, Staphylococcus aureus, C. albieans, A. niger and P. chrysogenum.*

II. METHODS AND MATERIAL

A) Synthesis of Mn-Fe tartarates:

The Mn-Fe tartarate composites with six different composites such as $[M_xM^1_{(1-x)}(C_4H_4O_6)]\cdot H_2O$, Where M and M^1 are Mn and X =0.2, 0.4, 0.6, 0.8 and 1.0, are prepared by co-precipitation method by taking analytical grade $MnSo_4\cdot 2H_2O$ and $FeSO_4\cdot 7H_2O$ in distilled water.

The mixture of metal sulphate solution is prepared with respect to molar ratio of Mn and Fe and placed in a beaker. pH less than 6 is adjusted, so that metal hydroxide does not precipitate. The solution is stirred vigorously and sodium tartarate (10%) solution is added slowly with stirring till a permanent precipitate is obtained. Acetone is added to ensure a high yield of product. The solution is stirred for 30 minutes and the filtered. The product is washed with cold distilled water and then with acetone. The product is dried at ambient temperature.

Such type of six samples of Mn-Fe tartararte composites (MFT-1 to MFT-6) are synthesized [10-13].

B) Characterization of synthesized Mn-Fe tartarates composites:

The CHN analysis of six synthesized composites (MFT-1 to MFT-6) is carried out using C.E. instrument using K factor calibration method. The metal contents present were estimated by atomic absorption spectroscopy. The Mn-Fe tartarate composites of six different proportions

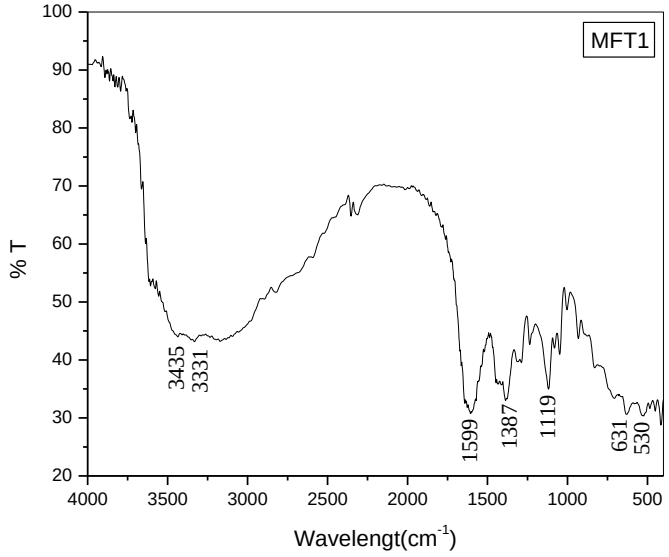
are further characterized using IR study and XRD pattern study of the composites. Thermal decomposition of all Mn-Fe tartarate composites is studied by thermo gravimetric analysis with temperature range 30^0 to 750^0C.

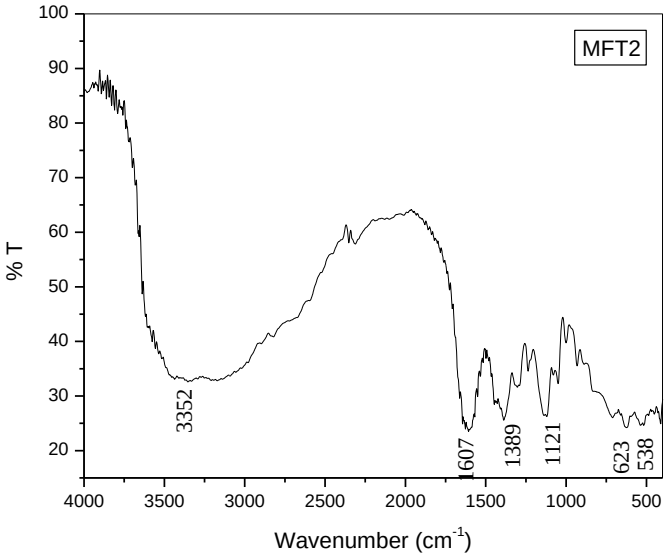
C) The study of antimicrobial activity of synthesized Mn-Fe tartarate composites:

Initially 1% solution of six composites is prepared in distilled water. Agar-plates were used and labeled for bacterial culture. Antimicrobial activity of synthesized composites is studied using organisms such as. *i) E.coli, ii) Bacillus subtilis, iii) Staphylococcus aureus, iv) C. albieans, v) A. niger, vi) P. chrysogenum* 0.5 ml of bacterial cultures were spread, inoculated and incubated at 37^0C for 30 minutes. A well was bored at the center of medium in each plate aseptically. 0.1 ml of each tartarate complex solution is poured aseptically in each respective well and incubated for diffusion at 40^0C for 1 hr. All those plates were incubated at 37^0C for 48 hrs and the results are studied.

Table I : Elemental Analysis

Complex	Formula weight (gm)	C wt. %		H wt. %		Mn wt. %		Fe wt. %	
		Obs	Cal	Obs	Cal	Obs	Cal	Obs	Cal
MFT-1 $Mn_{0.2}Fe_{0.8}(C_4H_4O_6)_3.\ 2H_2O$	535.66	24.92	26.88	2.79	2.99	1.85	2.051	8.12	8.34
MFT-2 $Mn_{0.4}Fe_{0.6}\,C_4H_4O_6)_3.\ 2H_2O$	557.456	24.68	25.83	2.68	2.87	3.75	3.853	9.81	9.95
MFT-3 $Mn_{0.6}Fe_{0.4}\,(C_4H_4O_6)_3.\ 2H_2O$	535.3	26.77	26.90	2.94	2.99	5.98	6.158	4.014	4.173
MFT-4 $Mn_{0.8}Fe_{0.2}(\,C_4H_4O_6)_3.2\ H_2O$	535.048	26.84	26.91	2.74	2.99	8.068	8.215	1.99	2.087
MFT-5 $Mn(C_4H_4O_6)_3.\ 2H_2O$	5534.94	26.84	26.92	2.81	2.7082	10.066	10.27	0.00	0.00
MFT-6 $Fe(C_4H_4O_6)_3.\ 2H_2O$	535.84	26.76	26.87	2.94	2.986	0.00	0.00	10.31	1o.42





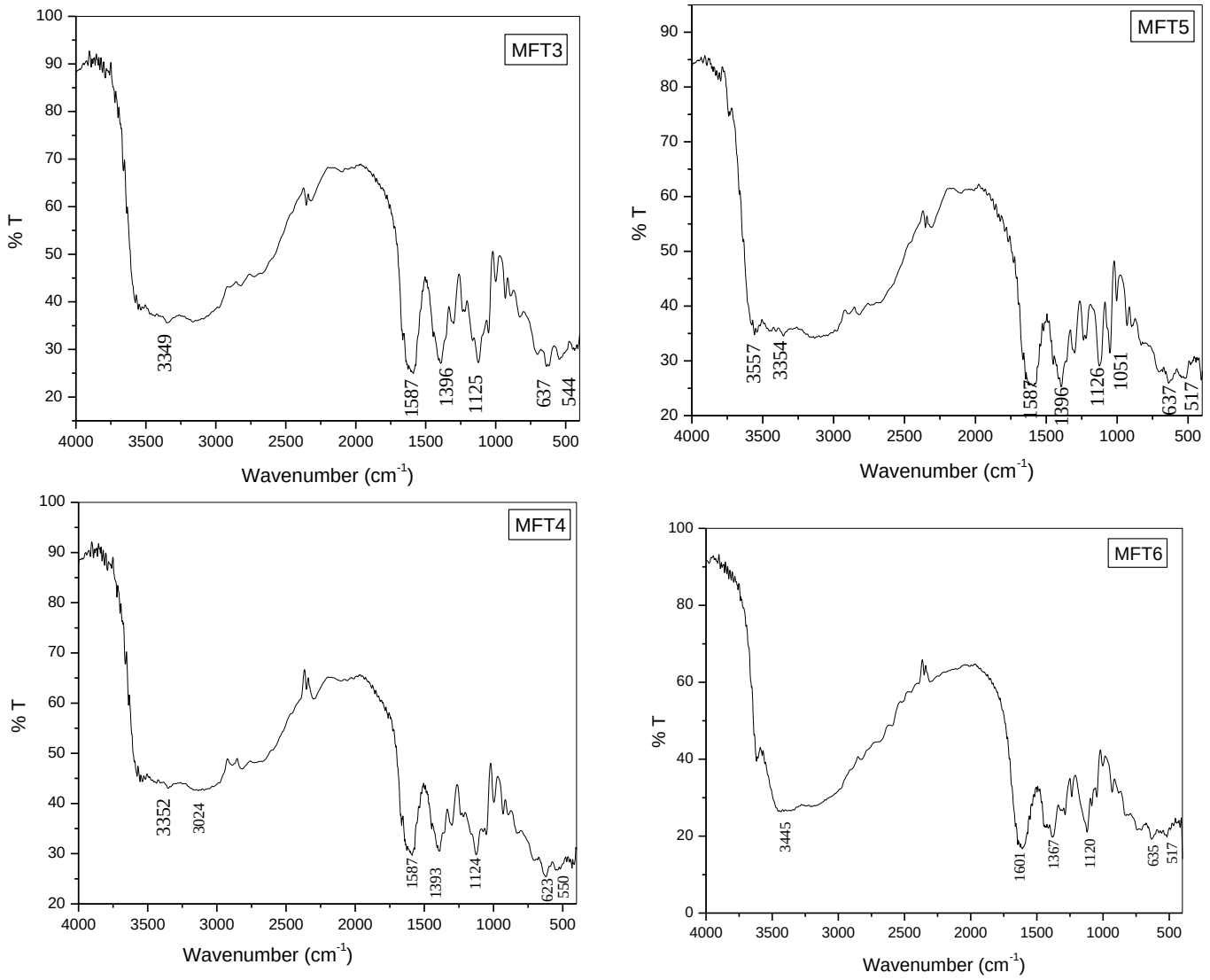


Figure 1: IR Spectra of tartarate complexes

Table II : IR Spectral Data of Mn-Fe tartarate composites

MFT-1 $Mn_{0.2}Fe_{0.8}(C_4H_4O_6)_3 \cdot 2H_2O$	MFT-2 $Mn_{0.4}Fe_{0.6}(C_4H_4O_6)_3 \cdot 2H_2O$	MFT-3 $Mn_{0.6}Fe_{0.4}(C_4H_4O_6)_3 \cdot 2H_2O$	MFT-4 $Mn_{0.8}Fe_{0.2}(C_4H_4O_6)_3 \cdot 2H_2O$	MFT-5 $Mn(C_4H_4O_6)_3 \cdot 2H_2O$	MFT-6 $Fe(C_4H_4O_6)_3 \cdot 2H_2O$
3435	3352	3349	3352	3557	3445
3331	-	-	3024	3354	1601
1599	1607	1587	1587	1587	1367
1387	1389	1396	1393	1396	1120
1119	1121	1125	1124	1126	635
631	623	637	623	1051	517
530	538	544	550	637	
				517	

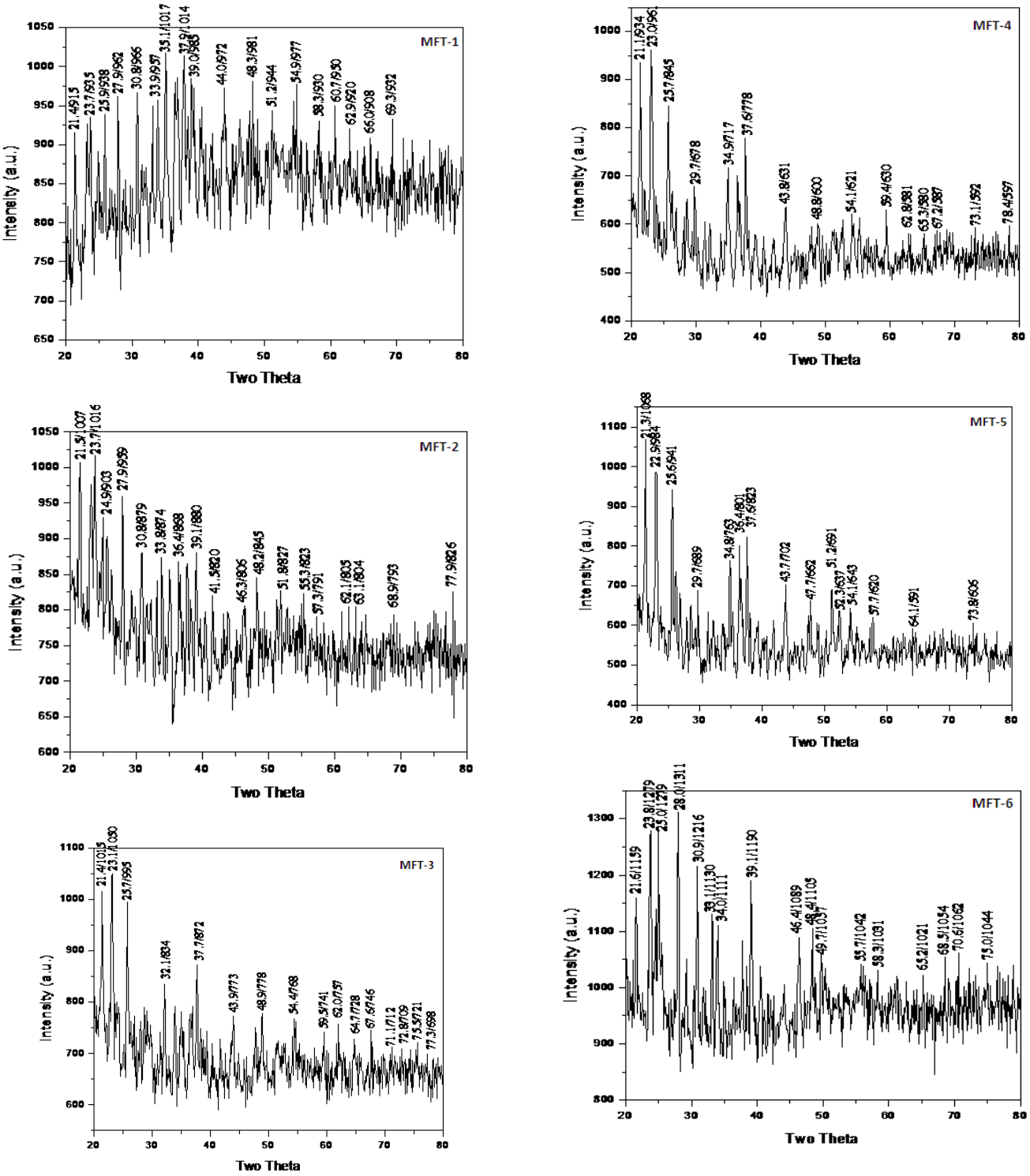
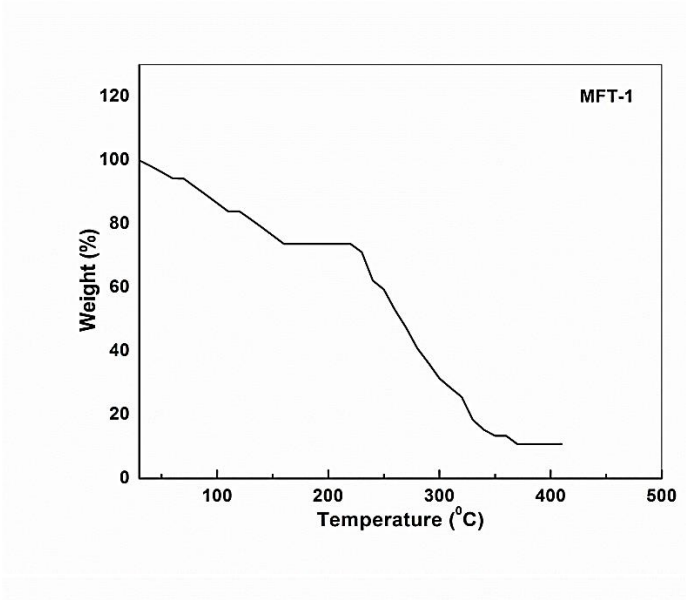


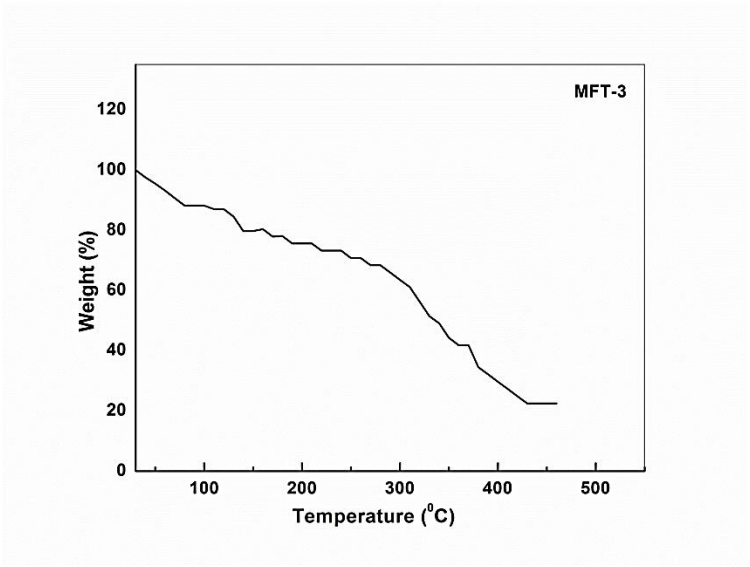
Figure 2 : XRD patterns of Mn-Fe tartarate comosites

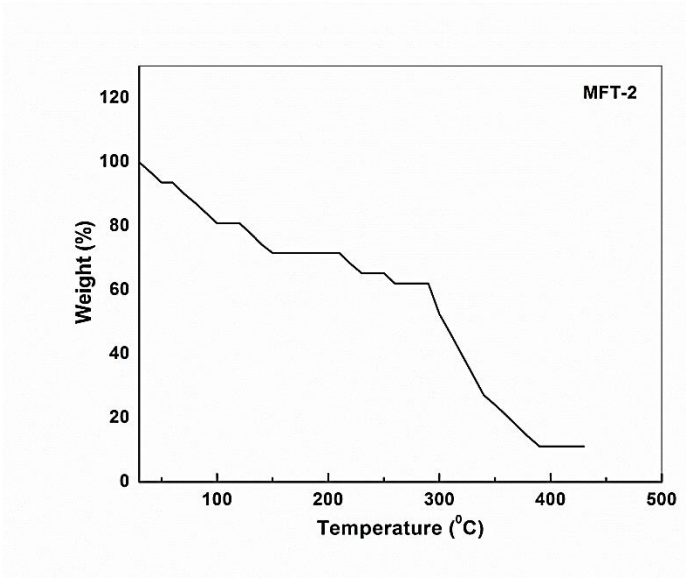
Table III : Observed d-Spacing Values (A^O) of Mn-Fe tartarate composites

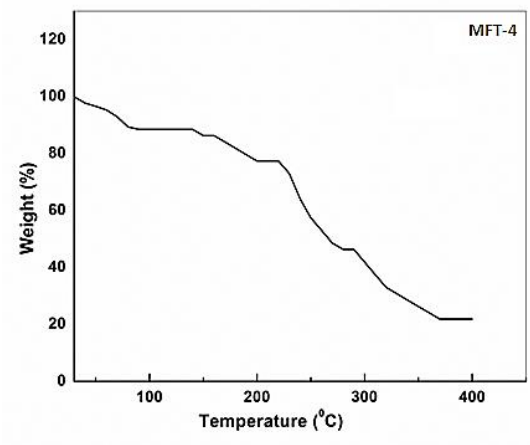
MFT-1 $Mn_{0.2}Fe_{0.8}$ $(C_4H_4O_6)_3.2H_2O$	MFT-2 $Mn_{0.4}Fe_{0.6}$ $C_4H_4O_6)_3.2H_2O$	MFT-3 $Mn_{0.6}Fe_{0.4}$ $C_4H_4O_6)_3.2H_2O$	MFT-4 $Mn_{0.8}Fe_{0.2}$ $C_4H_4O_6)_3.2H_2O$	MFT-5 Mn $(C_4H_4O_6)_3$ $2H_2O$	MFT-6 $Fe(C_4H_4O_6)_3$ $2H_2O$
4.1325	4.1281	4.1481	4.1887	4.1660	4.1083
3.7375	3.7502	3.8457	3.8496	3.8650	3.7339

3.4251	3.5613	3.4512	3.4527	3.4651	3.5580
3.1857	3.1857	2.7799	2.9996	2.9996	3.1831
2.8926	2.8937	2.3797	2.5642	2.5711	2.8904
2.6299	2.6434	2.0574	2.3863	2.4610	2.7038
2.5540	2.4610	1.8588	2.0808	2.3856	2.6344
2.3665	2.2980	1.6833	1.8624	2.0668	2.3015
2.3028	2.1705	1.5508	1.6922	1.9029	1.9551
2.0525	1.9561	1.4940	1.5533	1.7810	1.8788
1.8797	1.8834	1.4382	1.4774	1.7459	1.8327
1.7798	1.7611	1.3834	1.4267	1.6922	1.6488
1.6684	1.6576	1.3238	1.3912	1.5948	1.5811
1.5791	1.6048	1.2970	1.2927	1.4507	1.4297
1.5226	1.4917	1.2572	1.2181	1.2821	1.3684
1.4745	1.4706	1.2327			1.3329
1.4126	1.3605				1.2653









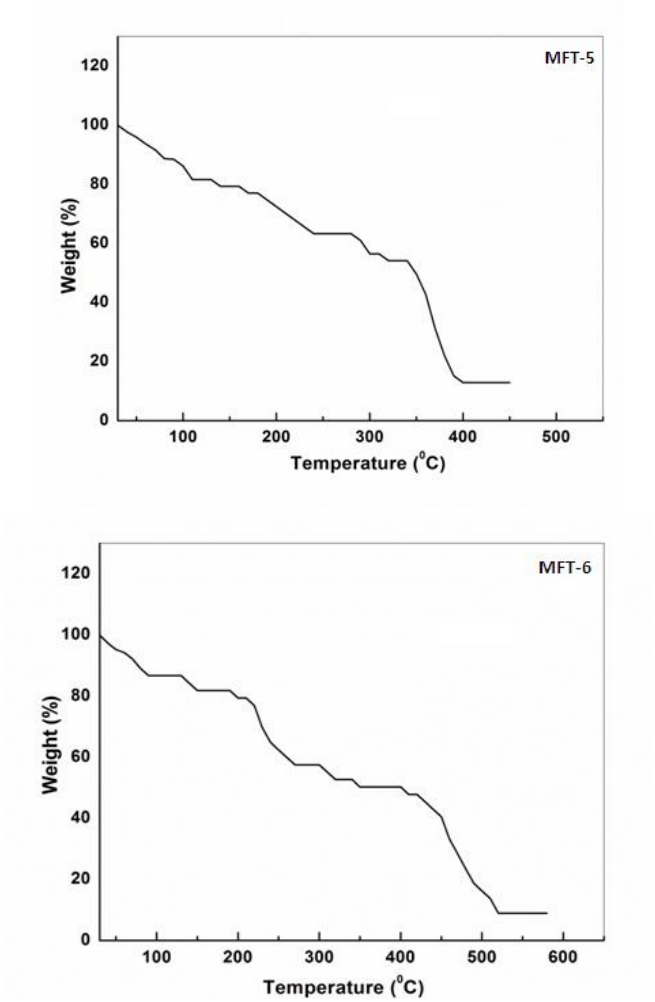


Figure 3 : TGA curves of Mn-Fe tartarate composites

Table IV : TGA Results of Mn-Fe tartarate complexes

Complex	**Observed % Mass loss**	**Temp Range ^{o}C**
MFT-1 $Mn_{0.2}Fe_{0.8}(C_4H_4O_6)_3.2H_2O$	15.82	109
	89.30	380
MFT-2 $Mn_{0.4}Fe_{0.6}C_4H_4O_6)_3.2H_2O$	18.67	105
	88.69	400
MFT-3 $Mn_{0.6}Fe_{0.4}C_4H_4O_6)_3.2H_2O$	11.59	90
	77.33	435
MFT-4 $Mn_{0.8}Fe_{0.2}C_4H_4O_6)_3.2H_2O$	11.45	90
	78.13	370
MFT-5 $MnC_4H_4O_6)_3.2H_2O$	13.26	115
	90.59	525
MFT-6 $FeC_4H_4O_6)_3.2H_2O$	12.96	112
	90.59	530

Table VI : Antibacterial Activity (zone of inhibition in mm) of Mn-Fe tartarate Composites Zones of Inhibition [in mm]

No.	Chemical	Escherichia coli	Bacillus subtilis	Staphylococcus aureus	C. albieans	A. niger	P. chrysogenum
1	MFT-1 $Mn_{0.2}Fe_{0.8}(C_4H_4O_6)_3.2H_2O$	04	02	06	11	07	05
2	MFT-2 $Mn_{0.4}Fe_{0.6}C_4H_4O_6)_3.2H_2O$	08	04	14	03	02	05
3	MFT-3 $Mn_{0.6}Fe_{0.4}C_4H_4O_6)_3.2H_2O$	13	07	09	07	06	02
4	MFT-4 $Mn_{0.8}Fe_{0.2}C_4H_4O_6)_3.2H_2O$	12	11	02	02	05	01
5	MFT-5 $MnC_4H_4O_6)_3.2H_2O$	01	03	04	04	07	11
6	MFT-6 $Fe(C_4H_4O_6)_3.2H_2O$	11	08	09	11	10	01
7	Control [Sterile distilled water]	00	00	00	00	00	00

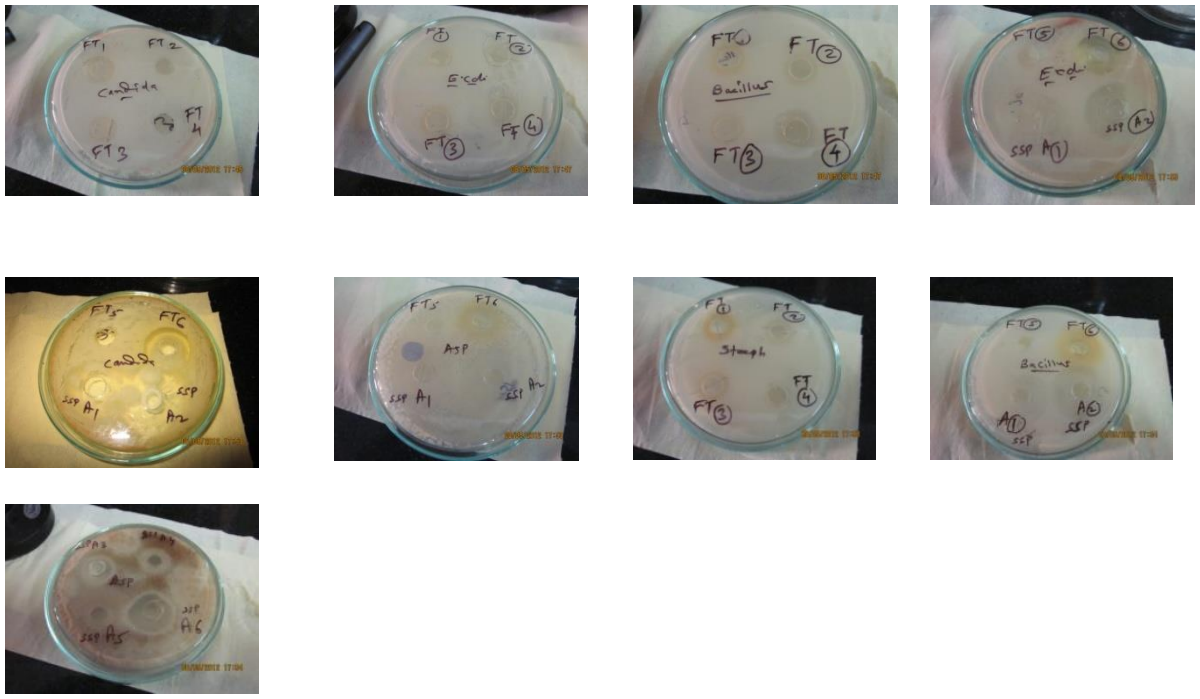


Figure 4 : Antibacterial Activity Plates of synthesized metal composites

III. RESULT AND DISCUSSION

The Mn-Fe tartarate composites of six different proportions (MFT-1 to MFT-6) are synthesized by co-precipitation method and their elemental analysis reveals that the observed weight % of element is in good agreement with calculated values (Table 1).

The study of IR spectra of these six samples (MFT-1 to MFT-6) showed characteristic frequencies corresponding to many groups like carbon-oxygen, metal-oxygen, carbon-hydrogen, -OH etc. on the basis of symmetric and antisymmetric starching frequencies observed confirms the tetradentate linkage of tartarate group attached to Mn and Fe metal atoms (Table 2). The presence of bands such as v_{asy}(OCO) suggests the co-ordination of both COO^- groups present in the tartaric acid molecule to metal ion. The infrared suggests that the probable structure of Mn-Fe tartarate complexes is octahedral.

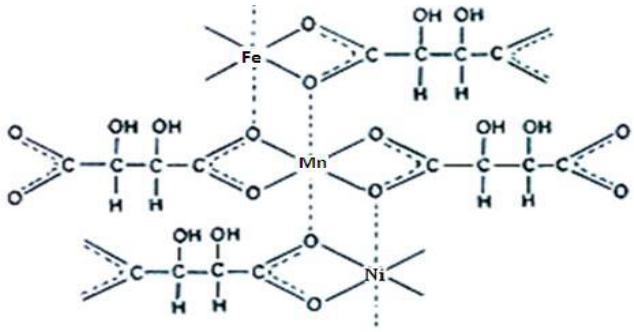
The XRD patterns of Mn-Fe tartarate composites showed certain sharp lines with many broad lines (fig. 2). Therefore the composites synthesized are polycrystalline. The d-spacing values are given in table 3.

The thermo gravimetric analysis indicates the loss of water molecules at about 100 to 110 ^{0}C. The % loss for water molecule is matched with theoretical loss. There is a loss of CO, CO_2 and C_2H_4 molecules within 180^{0}C to 350^{0}C. Thermal study suggests probable reactions.

1) $Mn.Fe(C_4H_4O_6).2H_2O$ -------→ $Mn.Fe(C_4H_4O_6)$ + $2H_2O$

2)| $Mn.Fe(C_4H_4O_6)$ ------→ $Mn.Fe.O_2$ + $2CO_2$ + C_2H_4

The characterization of all six Mn-Fe tartarate composites using techniques like CHNS analysis, IR study, XRD study, AAS analysis and TGA suggest the following type of structure.



These synthesized Mn-Fe tartarate composites show antimicrobial activity against micro-organisms such as *E.coli, Bacillus subtilis, Staphylococcus aureus, C. albieans, A. niger and P. chrysogenum.* Sample MFT-2 shows highest activity against *Staphylococcus aureus,*

and sample MFT-3 is more active against *E.coli.*(fig. 3). All these complexes (A1 to A6) possess potential to inhibit the growth of gram positive as well as gram negative bacteria selected indicating their possible to use as bacterial agent.

IV. CONCLUSION

Six newly mixed metal composites of Mn-Fe tartarates (MFT-1 to MFT-6) were synthesized and characterized by different techniques. By thermogravimetric analysis percentage of water of crystallization in the complexes were confirmed. Elemental compositions of complexes are in good agreement to the calculated one. From XRD patterns polycrystalline nature of the complexes were revealed. Antimicrobial activity of the complexes was carried c These complexes have shown significant antimicrobial activity against studied micro-organisms. Sample MFT-2 showed highest activity against bacteria *Staphylococcus aureus*. Sample MFT-4 is moderately active against bacteria *P. chrysogenum.*

V. REFERENCES

[1]. The Calender of food Chemistry, WPL is , Warszawa (1954)
[2]. Z. Inzuk, The progress of Microbiology, Part- IV, PWN Warszawg (1996).
[3]. J. Janicek, J. Pokorny and J.Dawidek, Food Chemistry, (WNT, Warszawa,(1977).
[4]. S.B. Elliott " The alkaline earth and heavy Metal Soaps" Reinhold, New York (1946).
[5]. S.Hamada, S. Nuseki and Y. Kudo, Bull. Chem. Soc. Japan
[6]. 59 (1986) 3443.
[7]. S.Hamada and E. Matijevic, J. Colloid. Interface Sci., 84 (1981) 274.
[8]. E.Motijevic, Acc. Chem. Res., 14 (1981) 22.
[9]. L. Bo and Z. Leyi, IEEE Trans. Mag., MAG-17 (1981) 3144.
[10]. M.Brezeanu, L.Patron, E. Cristurean, D. Marinescu, A. Antoniu M. Andruh, O. Carp, M. Andruh, A. Gheorghe and N. Stanica, Rev. Roumaine Chim. 38 (1993) 1291.
[11]. S. S. Pawar, C. S. Patil , V. B. Tadke, S. M. Vhankate, S. A. Dhanmane, G. R. Pathade and R. P. Pawar, Int.Journal of Pharm. Study and Res., 5(4) (2014), 1557 – 1565.
[12]. S. M. Vhankate, S. S. Pawar S, S. A. Dhanmane, N. S. Dhawale, K. Fulzele, C. S. Patil, R. P. Pawar and V. B. Tadke, Shri Ramanand Tirth Marath. Univ. Nanded, Res. J. Sci., 2(1) (2013), 88 -100.
[13]. A. K. Nikumbh, A.V. Nagawade, V. B. Tadke, P. P. Bakare, J. Mater. Sci. 36(2001)1.
[14]. A. K. Nikumbh and V. B. Tadke, `Thermochim Acta., (2001).

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

A Glycerol Mediated Green Approach Towards the Synthesis of 1-H Indazole

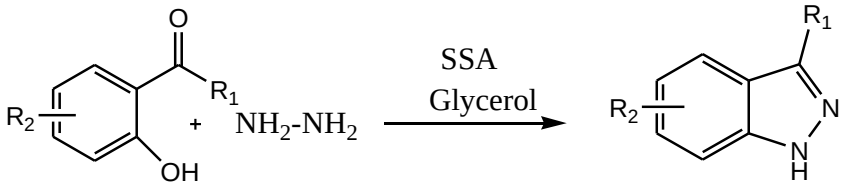
A. J. Dhole*, T. S. Thopate, D. R. Thube, B.B.Jambe, J. S. Tikone

Department of Chemistry, New Arts, Commerce and Science College, Parner Ahmednagar, Maharashtra, India

ABSTRACT

An efficient green approach for the synthesis of Indazole using Glycerol as solvent has been reported. Silica supported sulphuric acid is reusable green catalyst and glycerol is found to be non-toxic and green solvent.No further purification is required.Substituted Compound 1 on stirring with hydrazine 2in presence of Glycerol gavecompound 3 with excellent yield. The structures of all the synthesized compounds have been confirmed by spectroscopic techniques.

Keywords : o-hydroxyl Aldehyde/Ketone,SSA,Glycerol



1 **2** **3**

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Zeolite as Solid Acid Catalyst for Organic Transformations

Dr. M. K. Lande

Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra, India

ABSTRACT

Last few years chemists are developing new approaches for synthesis of materials for human needs, such as food, medicines and consumer products and also plays crucial role in building up strong economy, environmental awareness. This can be achieved by increasing product selectivity, 100% atom economy, reaction time economy and replacing stoichiometric reagents with heterogeneous and reusable catalysts such as zeolites, metal oxides, mixed metal oxides, heteropoly acids, nano-composite materials and biocatalyst.

Zeolites are complex hydrated crystalline inorganic polymers based on an infinitely extending three dimensional network of $[AlO_4]^{5-}$ and $[SiO_4]^{4-}$ units, theses are linked via Si-O-Al bridges to form porous material. The framework structure contains pores, cavities and channels that are occupied by exchangeable cations from either alkali or alkaline earth metal ions or water molecules. This material shows good thermal and chemical stability, nontoxic in nature, also possesses Lewis and Bronsted acidic sites. Therefore, It has been used in the field of petrochemical & fine chemical industries, detergents, purification of water, purification solvents, and separation of gases, drug delivery and catalyst supports. Catalytic potential of these materials depends on the structural morphology, compositions, particle size, acidity, surface area, pore size, nature of active sites in the composite matrix. Tuning of these properties could be depends on synthetic methodologies and other physical and compositional parameters.

Recent advances of characterization techniques and their applications help us to understand, Why zeolite material acts as catalyst? Where is the location of active sites in materials? What are the acid strength of catalytic materials? However, In view of green chemistry approach, zeolites and modified zeolites are an excellent alternative source over conventional acid catalysts, as they can be inexpensive, nontoxic, non-corrosive simple to recover and reuse. Considering this views, I have planned to discuss the fundamental aspects of natural & synthetic zeolites, methods of modification, characterizations and utilization as solid acid in some organic chemical reactions.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Synergistic Effect of Aluminium Oxide / Poly (acrylamide-co-acrylic acid) Hybrid Composite

Nandkishor B. Shirsath[1], Vikas V. Gite[1] and Jyotsna S. Meshram[1,2*]

[1]School of Chemical Sciences, North Maharashtra University, Jalgaon, Maharashtra, India
[2]Department of Chemistry, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra, India

ABSTRACT

The progress in the synthesis and technology of hydrogels makes these materials attractive structures with possible applications. In the present work, In-situ polymerization technique synthesized alumina hydrogel composite with water as a green solvent. The inclusion/incorporation of metal oxide particles in three-dimensional polymeric structures is an innovative means for obtaining multicomponent systems with diverse functionality within a hybrid hydrogel network. Polymer compositions with aluminium oxide, can improve their thermal properties and self-sustaining ability under working environmental conditions. The composite of poly(acrylamide-co-acrylic acid) [P(AM-co-AA)] with aluminium oxide as a composite was created as a result of their intermolecular interactions. The creation of a composite was confirmed by FT-IR spectroscopy, DSC, TGA, and FE-SEM analysis. The aluminium oxide particles were homogeneously distributed in the P(AM-co-AA). The incorporation of aluminium oxide particles gives rise to the enhancement of thermal stability due to the strong interactions between aluminium oxide and poly(acrylamide-co-acrylic acid) polymer. Hence, the synthesized materials were biodegradable, environment friendly and biocompatible which touches the green chemistry route.

Keywords :- Aluminium oxide, Hydrogel, Composite, Interactions, Green Chemistry

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Synthesis, Characterization of Mesostructured Al-SBA-15 Zeolite : Efficient & Heterogeneous Catalyst for One Pot Synthesis of tetrahydrobenzo [c] Acridine Derivatives

G. T. Pawar, M. K. Lande*
Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University,Aurangabad, Maharashtra, India

ABSTRACT

Mesostructured Al-SBA-15 zeolite was synthesized by direct hydrothermal method under autogenous pressure. The prepared Al-SBA-15 zeolite was characterized by Powder-X ray diffraction, Scanning electron microscopy, Energy dispersive spectroscopy, Fourier transform infrared spectroscopy. Brunauer-Emmer-Teller surface area analysis. The catalytic activity of Al-SBA-15 zeolite was tested for one pot synthesis of tetrahydrobenzo[c]acridine derivatives. Present method offers significant advantages over the reported methods like easy separation of catalyst, simple work-up procedure, non chromatographic isolation and purification of desired product and excellent yield. Furthermore catalyst could be reused without loose in activity.

National Conference on New Horizons in Material Science
© 2018 IJSRSET | Volume 4 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Synthesis, Characterization and Antimicrobial Properties of New Thiosemicarbazones and their Metal Complexes

Sanjay AnnaRao[1], S. D. Angadi[2]
[1]University College Mangalore, Mangalore University Mangalore. Karnataka, India
[2]Department of Chemistry, Gulbarga University Gulbarga. Karnataka, India

ABSTRACT

The study of thiosemicarbazones has been the focus of numerous investigations for a variety of reasons which range from their promising biological and pharmacological applications as anti-tumor, anti-bacterial, anti-fungal and anti-viral agents to the chemical and analytical applications as potential chelating agents and ion sensing materials. In view of this, two new heterocyclic thiosemicarbazones containing 2-phenylindole and 3-acetylcoumarine nuclei have been synthesized by reacting 2-phenylindole-3-carboxaldehyde and 3-acetylcoumarine with thiosemicarbazide in ethanolic medium. These compounds have been used as ligands for the synthesis of metal complexes. The complexes were prepared by reacting equimolar amounts of ligands with the metal ions Cu(II), Ni(II), Co(II), Zn(II), Cd(II) and Hg(II) in ethanolic medium. Both the ligands as well as metal complexes have been characterized by various physico-chemical techniques such as elemental analysis, UV-Vis, magnetic susceptibility, conductance measurements, IR, NMR, mass, FAB mass, and ESR data. Further, thiosemicarbazones are known for their interesting mesomeric behaviour attributed to the restricted rotation C-N bond and hence the terminal $-NH_2$ protons are non-equivalent and give two sets of signals. This property of both the ligands has been studied by 1D and 2D NMR analysis using **^{1}H-^{1}H DQF-COSY** and **TOCSY** experiments. The ligands as well as their complexes have been tested for their antibacterial and antifungal properties. Both the ligands and their complexes have shown good antifungal and moderate/less antibacterial properties. The results will be discussed.

Organised by

Department of Chemistry,
New Arts, Commerce and Science College, Shevgaon,
Dist. Ahmednagar - 414 502, Maharashtra, India

Publisher

Technoscience Academy

Website : www.technoscienceacademy.com
Email: info@technoscienceacademy.com