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ARTS, SCIENCE AND COMMERCE COLLEGE, RAHATA

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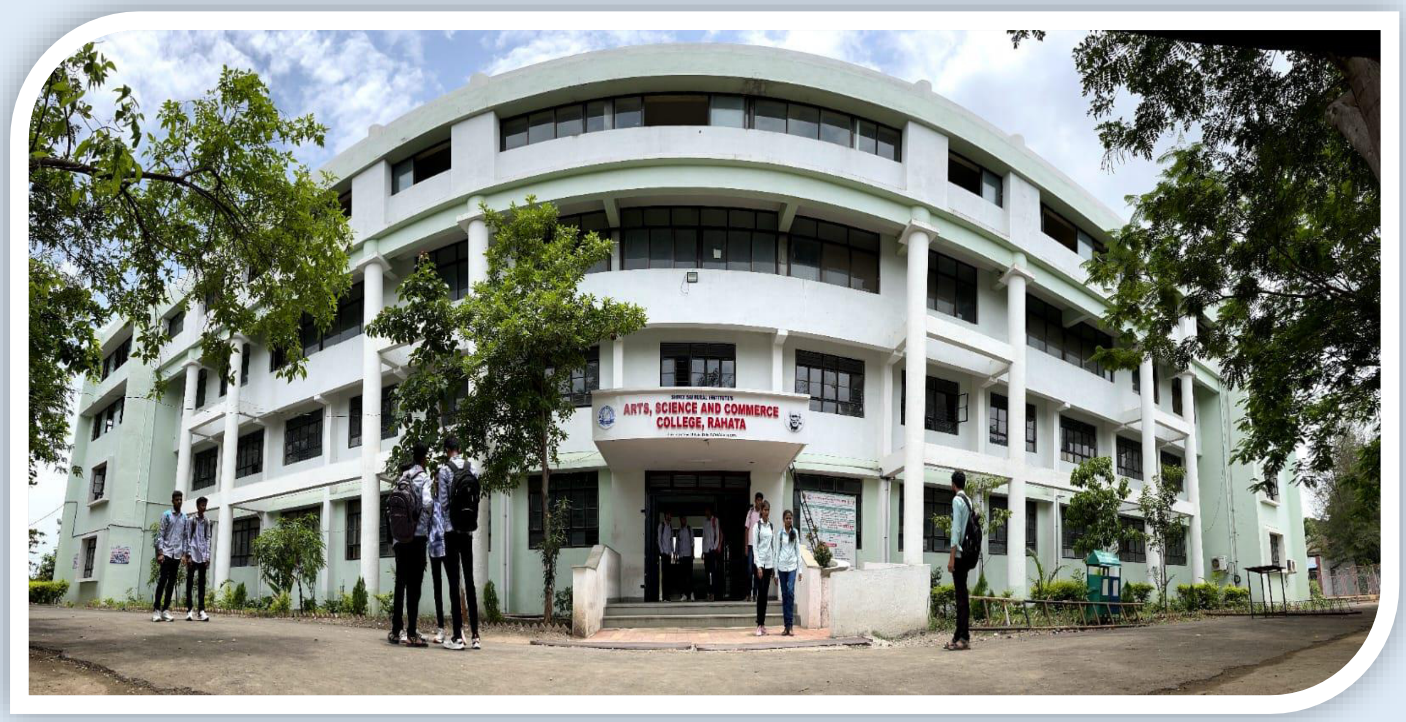

SELF STUDY REPORT-CYCLE 3rd

2018-2023

Criterion: III

Research, Innovations and Extension

Key Indicator: 3.3

Research Publication and Awards

Metric: 3.3.1 (Q$_n$M)

Number of research papers published per teacher in the Journals as notified on UGC CARE list during the last five years

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Arts, Science and Commerce College, Rahata
Tal- Rahata, Dist-Ahmednagar, Pin - 423107 (MS)
(University of Pune Affiliated ID No. PU/AN/ASC/052/1997)
NAAC RE-ACCREDITED "B++" GRADE COLLEGE

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DECLARATION

We the undersigned, hereby declare that all information, reports, true copies of the supporting documents, and numerical data submitted by our institution for the purpose of NAAC accreditation have been thoroughly verified by the Internal Quality Assurance Cell (IQAC). We affirm that these submissions are accurate and correct as per our records.

This declaration pertains specifically to the accreditation process for the third cycle of the institution, covering the period from 2018-19 to 2022-23.

Thank you.

Sincerely,

Dr. Vikram P. Bhalekar
IQAC Coordinator
Coordinator
Internal Quality Assurance Cell
Arts,Science and Commerce College, Rahata

Prof.(Dr.) Somnath S. Gholap
Principal
Principal
Arts,Science and Commerce College
Rahata,Tel-Rahata,Dist-Ahmednagar

Date-**30/07/2024**

Place- **Rahata**

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Sr NO.	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Calendar Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal /Digital Object Identifier (doi) number		
	Academic Year 2018-2019						**Link to website of the Journal**	**Link to article / paper / abstract of the article**	**Is it listed in UGC Care list**
1	Design, synthesis, and pharmacological evaluation of fluorinated azoles as anti-tubercular agents	Prof.Dr.S.S.Gholap	Chemistry	Archiv der Pharmazie	2018	Online ISSN:1521-4184	LINK	LINK	YES
2	Design, synthesis and biological screening of novel 1, 3, 4-oxadiazoles as antitubercular agents	Prof.Dr.S.S.Gholap	Chemistry	Chemistry Select	2018	Online ISSN:2365-6549	LINK	LINK	YES
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4	Synthesis of carbonates from chloromethyl chloroformates and its some applications	Prof.Dr.S.S.Gholap	Chemistry	International Journal of Advance and Innovative Research	2019	ISSN 2394 - 7780	LINK	LINK	YES
5	Co-operatives and Workers in the Informal Economy:	Prof. Dr. Rajaram Nathaji Wachaure	Commerce	Journal of Emerging Technolog	2018	ISSN-2349-5162	LINK	LINK	UGC Approved

	Possibilities and Challenges			ies and Innovative					Journal No 63975
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8	CSR and Gender Equality: The Indian Scenario	Prof. Dr. Rajaram nathaji Wachaure	Commerce	International Multilingural Refereed Research Journal (Vidya Warta)	2018	ISSN-2319-9318	LINK	Printed	UGC Approved Journal No 62759
9	Impact of Goods & Service Tax on Foreign Direct Investment in India.	Prof. Dr. Rajaram nathaji Wachaure	Commerce	International Multilingural Refereed Research Journal	2018	ISSN-2319-9318	LINK	printed	UGC Approved Journal No 62759

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10	Women Entrepreneurship I Rural Area (Special Reference of Maharashtra)	Prof. Dr. Rajaram nathaji Wachaure	Commerce	International Peer Reviewed & Referred Scholarly Research Journal for Interdisciplinary Studies	2018	ISSN-22788808	NA	Printed	UGC Approved
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									Journal No 40776
15	Role of agriculture in Indian Economy	Dr Anupama Gandhi	Economics	Printing Area	2018	ISSN-2394-5303	LINK	Printed	UGC Approved
16	Use of digital libraries and information and communication technologies in research	Dr Anupama Gandhi	Economics	Online International Interdisciplinary Research Journal	2019	ISSN-2249-9598(Online)	LINK	LINK	UGC Approved Journal No 46564
17	Effects of cashless transaction to customer	Dr Anupama Gandhi	Economics	Ajanta	2019	ISSN 2277-5730	LINK	Printed	UGC Approved Journal No 40776
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				Journal (Vidya Warta)					
21	Jansanchar Madhyam aur Hindi	Dr R.D.Kasar	English	Current Global Reviewer	2019	ISSN-2319-8648	NA	Printed	Peer Reviewed & indexed Journal
22	Text- based Films: an Effective Tool for Teaching and Learning of English Literature	Dr R.D.Kasar	English	Ajanta	2019	ISSN 2277-5730	LINK	Printed	UGC Approved Journal No 40776
23	Anuvad Samadahan aur Samasyaye	Dr.Ainur S Shaikh	Hindi	Research Journey	2019	E-ISSN: 2348-7143	LINK	Printed	UGC Approved Journal No 40705
24	Jansanchar madhyamome durdarshan aur Hindi ki Upadheyata	Dr.Ainur S Shaikh	Hindi	Research Journey	2019	E-ISSN: 2348-7143	LINK	Printed	UGC Approved Journal No 40705
25	Jansanchar madhyamome Hindi ki Bhumika	Dr.Ainur S Shaikh	Hindi	Current Global Reviewer	2019	ISSN-2319-8648	NA	Printed	Peer Reviewed & indexed Journal

26	Hindi Ke Vikas Me Internet Ka Yogdan	Dr.Ainur S Shaikh	Hindi	International Multilingural Refereed Research Journal (Vidya Warta)	2018	ISSN-2319-9318	LINK	Printed	UGC Approved Journal No 62759
27	Samkalin Hindi Natkome Dharmic Mulya	Dr.Ainur S Shaikh	Hindi	Research Journey	2018	E-ISSN: 2348-7143	LINK	Printed	UGC Approved Journal No 40705
28	Upnyas Sahitya me Jivan Muly	Dr.Ainur S Shaikh	Hindi	International Multilingural Refereed Research Journal (Vidya Warta)	2018	ISSN-2319-9318	LINK	Printed	UGC Approved Journal No 62759
29	The Roll of Tourism in Sustainable Development	Mr C M Bansode	Geography	Ajanta	2019	ISSN 2277-5730	LINK	Printed	UGC Approved Journal No 40776
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31	PbS sensetized TiO2 based quantum dots	Dr V P Bhalekar	Physics	Engineered Science	2019	ISSN: 2576-	LINK	LINK	YES

	solar cell with efficiency greater than 5% under artificial light: Effect of compact layer and surface passivation					9898 (Online Version)			
32	Impact of composition of polysulphide electrolyte on the photovoltaic performance in quantum dot sensitized solar cells	Dr V P Bhalekar	Physics	Material Research Express	2018	ISSN-2053-1591	LINK	LINK	YES
33	Strong Quantum Confined Lead Sulphide Quantum Dots using Ionic Reaction and Their Properties	Dr V P Bhalekar	Physics	ES material and Manufacturing	2019	ISSN-2578-0611	LINK	LINK	YES
34	Green Synthesis of Novel substituted 2-(1, 3-diphenyl-1H-pyrazol-3-yl) benzo [d] thiazole and using Ionic Liquid under Ultrasound and Microwave Condition	Dr G D Shirole	Chemistry	International Journal of Scientific Research in Science and Technology		ISSN-2395-602X	LINK	LINK	YES
35	Synthesis and antimicrobial activity of novel substituted 2-(9-ethyl-9H-carbazol-3-yl)-4H-chromen-4-one derivatives	Dr G D Shirole	Chemistry	Iranian Journal of Organic Chemistry	2018	ISSN-0975-0983	LINK	Printed	YES
36	N-Butylpyridinium heptachlorodialuminate: An convenient	Dr G D Shirole	Chemistry	Indian Journal of chemistry	2018	ISSN-0975-0983	LINK	LINK	YES

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38	Green Synthesis of Novel substituted 2-(1, 3-diphenyl-1H-pyrazol-3-yl) benzo [d] thiazole and using Ionic Liquid under Ultrasound and Microwave Condition	A. S. Tambe	Chemistry	International Journal of Scientific Research in Science and Technology		ISSN-2395-602X	LINK	LINK	YES
39	Green Synthesis of Novel substituted 2-(1, 3-diphenyl-1H-pyrazol-3-yl) benzo [d] thiazole and using Ionic Liquid under Ultrasound and Microwave Condition	B.K Salalkar	Chemistry	International Journal of Scientific Research in Science and Technology		ISSN-2395-602X	LINK	LINK	YES
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42	Vishnu Prabhakar ke Natako me Samajik Samsyao ka chitran	Dr D.N.Dange	Hindi	Ajanta	2018	ISSN 2277-5730	LINK	Printed	UGC Approved Journal No 40776
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49	Algal Diversity of Fresh Water Farm Pond	Dr A A Aher	Botany	International Interdisciplinary Research Journal	2020	ISSN 2249-9598	LINK	Printed	UGC Approved

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Results in Chemistry 3 (2021) 100129

Contents lists available at ScienceDirect

Results in Chemistry

journal homepage: www.elsevier.com/locate/rechem

Synthesis, cytotoxic, anticancer and antimicrobial activities of some metal complexes of a novel tetradentate Schiff base ligand, (E)-3-((2-((E)-(1-(2-hydroxyphenyl)ethylidene)amino)ethyl)imino)-N-phenylbutanamide

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ARTICLE INFO

Keywords:
Schiff base ligand
Transition metal complexes
Cytotoxic studies
Antitumour studies
Dalton's Lymphoma and Ehrlich's Ascites
Carcinoma cells
Solid tumour

ABSTRACT

A novel tetradentate Schiff base ligand, (E)-3-((2-((E)-(1-(2-hydroxyphenyl)ethylidene)amino)ethyl)imino)-N-phenylbutanamide (**HEAc**) and its VO(IV), Cr(III), Mn(II), Fe(III), Co(II), Ni(II) and Cu(II) complexes have been synthesized. Ligand, **HEAc** was characterized analytically and spectroscopically. Physico-chemical methods like elemental analysis, molar conductance, magnetic susceptibility measurement and IR- and UV–vis spectral measurements were employed for the characterization of the complexes. The cytotoxic activities of ligand and its Cr(III), Mn(II), Fe(III), Co(II), Ni(II) and Cu(II) complexes have been evaluated. *In-vitro* cytotoxicity studies on ligand and its metal complexes showed potential cytotoxicity against Dalton's Lymphoma Ascites (DLA) cell lines. Antitumour activities of this Cu(II) complex was studied using Daltons Lymphoma Ascites cell-induced solid tumour model and Ehrlich's Ascites Carcinoma cell-induced ascites tumour model. Treatment with the Cu(II) complex at three different concentrations (15, 10 and 5 mg/kg body weight) subdued the solid tumour growth in experimental mice and increased the mean survival rate and the life span of Ascites tumour bearing mice in a concentration dependent manner. The copper complex showed highest antitumor activity and cytotoxicity with an IC_{50} value of 47 μg/ml. It was observed that all the metal complexes were more potent bactericides and fungicides than the free ligand, **HEAc** and copper complex showed high antimicrobial activity than the others.

1. Introduction

Schiff bases derived from the condensation of diamines with carbonyl compounds represent an important class of chelating agents. They can be obtained by condensing diamines with carbonyl compounds in 1:2 M ratio [1–5]. Several such symmetrical Schiff bases of 1,2- and 1,3- diamines, where one and the same type of simple aldehydes or ketones are condensed on both nitrogen atoms and their complexes are reported [6–15]. However, unsymmetrical Schiff bases of diamines where two different carbonyl compounds are conducted on the nitrogen atoms are very rare [16,17]. There is a possibility for the formation of bridged bimetallic or even polymeric complexes in the case of these Schiff bases [18,19]. These metal complexes exhibit interesting structures and geometries. Therefore, these complexes have numerous applications in biological- [20–25], analytical- [26] and industrial fields [27–31].

In the present study, we synthesized a novel tetradentate Schiff base ligand, (E)-3-((2-((E)-(1-(2-hydroxyphenyl)ethylidene)amino)ethyl)imino)-N-phenylbutanamide and its VO(IV), Cr(III), Mn(II), Fe(III), Co(II), Ni(II) and Cu(II) complexes. The ligand was characterized analytically and spectroscopically by elemental analysis, IR-, ^{1}H NMR- and UV–Vis spectral techniques. The physico-chemical methods like elemental analysis, molar conductance, magnetic susceptibility measurement and IR- and UV–vis spectral measurements were employed for the characterization of the complexes. The ligand and its Cr(III), Mn(II), Fe(III), Co(II), Ni(II) and Cu(II) complexes have been tested for their cytotoxic activities and anticancer activity. The ligand, **HEAc** and its metal complexes were screened for antibacterial activity against three gram positive bacteria, *Bacillus, Staphylococcus, Streptococcus* and three gram negative bacteria, *Escherichia coli, Klebsiella and Pseudomonas* respectively and antifungal activity against the fungal cultures, *Pencillium, Fusarium* and *Aspergillus* species.

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https://doi.org/10.1016/j.rechem.2021.100129
Received 20 January 2021; Accepted 1 April 2021

2. Results and discussions

2.1. Characterization of the ligand

The novel Schiff base ligand, (E)-3-((2-((E)-(1-(2-hydroxyphenyl)ethylidene)amino)ethyl)imino)-N-phenylbutanamide, **HEAc** (Fig. 1) derived from *o*-hydroxyacetophenone, acetoacetanilide and 1, 2-ethylenediamine, was yellow colored crystals, soluble in polar aprotic solvents like DMSO and non polar organic solvent, benzene, etc. The homogeneity and purity of the ligand was tested by TLC technique. Melting point (185 °C) of ligand was determined using a Fisher-Johns apparatus [32].

2.1.1. ^{1}H NMR spectrum

The ^{1}H NMR spectrum of the novel ligand, **HEAc** was recorded in DMSO d_6. The spectrum showed a number of peaks that were characteristic of the compound [33,34]. A sharp singlet at 9.20 ppm may be assigned to the –NH proton of acetoacetanilide moiety. The signals observed in the range, 7.18–7.60 ppm may be assigned to the different aromatic protons of acetoacetanilide moiety. A singlet at 3.20 ppm may be attributed to the active methylene protons of acetoacetanilide. The signals observed in the range, 6.88–7.49 ppm may be assigned to aromatic protons of *o*-hydroxyacetophenone moiety. A singlet appeared at 4.65 ppm may be attributed to the –OH proton of the *o*-hydroxyacetophenone. The triplet peak appeared at 2.68 ppm was assigned to the methylinic proton of the ethylenediimine moiety. The inductive effect of the nitrogen atoms might be responsible for the higher value. A singlet appeared at 1.95 ppm may be assigned to the protons of the –CH_3 group on either sides of the imine group.

2.1.2. IR spectrum

IR spectrum of ligand showed a medium intensity band at 3160 and a strong one at 1655 cm^{-1}, characteristic of $\nu_{\text{-NH-}}$ and $\boldsymbol{\nu}_{\text{-C=O}}$ of amide group (-CO-NH-), respectively. The bands present at 1633 and 1231 cm^{-1} were assigned to $\boldsymbol{\nu}_{\text{-C=N}}$ and $\boldsymbol{\nu}_{\text{=N-C-}}$, respectively. A band at 3063 cm^{-1} may be assigned to the aromatic $\nu_{\text{=CH}}$ and another one at 2905 cm^{-1} to the $\boldsymbol{\nu}_{\text{-CH}}$ of methylene group. The bands at 2967 and 2939 cm^{-1} may be due to symmetric-and asymmetric stretching vibrations of CH_2 group. A broad band at 3445 cm^{-1} may be assigned to phenolic $\boldsymbol{\nu}_{\text{-OH}}$ of o-hydroxyacetophenone moiety. The characteristic bands due to the stretching of >C═O in the acetoacetanilide and *o*-hydroxyacetophenone, in the range, 1648–1660 cm^{-1} were not present in the spectrum of the ligand, which indicated the complete condensation of the carbonyl compounds with 1,2-ethylinediamine. A sharp band at 1215 cm^{-1} may be assigned to the $\boldsymbol{\nu}_{\text{-OCH3}}$ of ethoxy group.

2.1.3. UV–visible spectrum

The UV–visible spectrum of the ligand, **HEAc** was recorded in DMSO at room temperature. The peak at 238 nm may be due to $\pi \rightarrow \pi^*$ transition of aromatic part of the ligand. Another peak at 344 nm may be due to $n \rightarrow \pi^*$ transition of the non-bonding electrons present on the oxygen of the keto (>C═O) group and nitrogen of the azomethine (>C═N) groups in the ligand [35]. Based on the above data, the following structure was assigned to **HEAc** (Fig. 1).

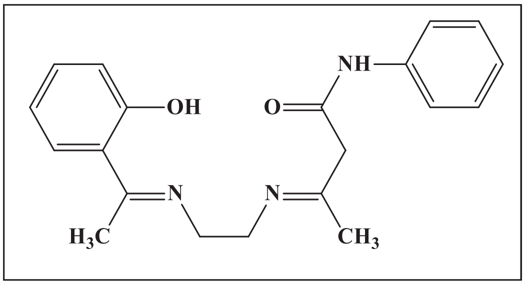


Fig. 1. Structure of the ligand, HEAc.

2.2. Characterization of metal complexes

All the complexes were found to be colored. They were non-hygroscopic and photo-stable. They were soluble in DMF and DMSO but only sparingly soluble in other common organic solvents. The data obtained from analytical and molar conductance studies in DMSO showed that the complexes have the formulae as shown given below. Aqua complexes were obtained for Cr(III), Mn(II) and Fe(III). The magnetic- and various spectral data also confirmed the suggested molecular formulae.

2.2.1. Molar conductance data

The molar conductances at room temperature were determined using 10^{-3} M solutions of the complexes in DMSO and are given in the Table 1. The values were in the low range, 13–40 Ω^{-1} mol^{-1} cm^2 indicating its weak electrolytic nature of the complexes and accordingly, they were assigned formulae. Analytical data and spectral studies also supported the suggested molecular formulae (Table 1).

2.2.2. Magnetic moment

The magnetic susceptibilities of the complexes were measured using the Gouy balance at room temperature. Hg[Co(NCS)$_4$] was used as the celebrant. Diamagnetic corrections were applied using Pascal constants for atoms and structural units of the complexes [36]. The magnetic susceptibilities, diamagnetic corrections and the effective magnetic moment values were calculated. The magnetic moment values are given in the Table 2.

In the present investigation, the VO(IV) complex of **HEAc** showed a magnetic moment 1.71B.M. The Cr(III) complex showed a magnetic moment value of 3.89 B.M., which indicated its octahedral geometry. In the present case, the Mn(II) complex exhibited a magnetic moment value of 5.90 B.M. indicating its octahedral geometry [37]. Fe(III) complex showed a magnetic moment value at 5.89 B.M, which may be due to its to its high-spin octahedral geometry. The present case Co(II) complex showed a magnetic moment value of 4.79 B.M which may be attributed its tetrahedral structure. The Ni(II) complex exhibited a magnetic moment of 3.39B.M indicating its tetrahedral geometry [38]. The observed magnetic moment of Cu(II) complex was 2.00 B.M. indicating its tetrahedral geometry (Table 2).

2.2.3. IR spectra

As a versatile technique for structural chemical studies, the IR spectroscopy is extremely helpful for the identification and characterization of compounds and in assigning geometries to them. The significant vibrational bands of novel **HEAc,** its metal complexes and the assignments are given in Table 3.

Table 1
Molar conductance of complexes in DMSO.

Si. No	Complexes	Λ_m (Ω^{-1} mol^{-1} cm^2)
1.	[(VO)L]	39
2.	[CrL(H_2O)Cl]	35
3.	[MnL(H_2O)$_2$]	20
4.	[FeL(H_2O)Cl]	40
5.	[CoL]	34
6.	[NiL]	28
7.	[CuL]	23

L = $C_{20}H_{23}N_3O_2$.

Table 2
Magnetic moment data of complexes.

Si No:	Complexes	μ_{eff}* (B.M)
1.	[(VOL]	1.71
2.	[CrL(H_2O)Cl]	3.89
3.	[MnL(H_2O)$_2$]	5.90
4.	[FeL(H_2O)Cl]	5.89
5.	[CoL]	4.79
6.	[NiL]	3.39
7.	[CuL]	2.00

* Effective magnetic moment, B.M = Bohr Magneton.

The IR spectrum of the ligand showed a medium intensity band at 3100 and a strong one at 1655 cm^{-1}, respectively, due to $\boldsymbol{\nu}_{\text{–NH–}}$ and $\boldsymbol{\nu}_{\text{–C=O}}$ of amide group (–CO-NH–). The band at 1655 cm^{-1} was absent in the spectra of all the complexes [39]. This indicated that –NH-CO-CH_2– (amide group) of acetoacetanilide moiety has undergone enolisation to –CH═C-OH and coordinated to the metal ion after deprotonation. This was supported by the appearance of new bands around 1115 cm^{-1} due to $\nu_{\text{-C-O}}$ in the spectra of the complexes.

Band of medium intensity at 1633 cm^{-1} in the spectrum of ligand may be assigned to $\boldsymbol{\nu}_{\text{-C=N}}$. However, in the spectra of all the complexes this band shifted to a lower frequency region by 5 to 10 cm^{-1}, indicating the participation of azomethine nitrogen atoms in coordination. [40,41]

A band at 3063 cm^{-1} in the ligand spectrum may be assigned to the aromatic $\boldsymbol{\nu}_{\text{–CH}}$ and another one at 2905 cm^{-1} to the $\boldsymbol{\nu}_{\text{–CH}}$ of the methylene group [42]. A characteristic non-ligand sharp band in the spectrum of VO(IV) complex at 961 cm^{-1} has been assigned to $\boldsymbol{\nu}_{\text{V=O}}$ [43]. Broad bands at ~3500–3460 cm^{-1} in the spectra of the complexes of Cr(III), Mn(II) and Fe(III) were attributed to the hydroxyl stretching modes of water molecules. In addition, strong bands ~870–980 and ~ 650 cm^{-1} suggested that the water molecules were coordinated [44] Medium bands around 510–540 cm^{-1} and 415–450 cm^{-1} in the spectra all the complexes may be assigned [45] to $\boldsymbol{\nu}_{\text{M-N}}$ and $\boldsymbol{\nu}_{\text{M-O}}$, respectively. Bands at 400 and 410 cm^{-1} in the spectra of Cr(III) and Fe(III) complex indicated the presence of M – Cl bonds in these complexes. (Table 3.)

2.2.4. Electronic spectra

The electronic spectrum of [VOL] exhibited bands at 13,350, 19,400 and 24,200 cm^{-1}, which were assignable to transitions, $^2B_2 \rightarrow {}^2E$ (ν_1), $^2B_2 \rightarrow {}^2B_1$ (ν_2), and $^2B_2 \rightarrow {}^2A_1$ (ν_3), respectively. The geometry of this complex can be assigned as tetragonal pyramidal [51]. The value of the magnetic moment for this complex was 1.71 B.M, which indicated the presence of one unpaired electron in it [36].

In the spectrum of the Cr(III) complex investigated here two bands observed at 16,800 and 22,300 cm^{-1} were assigned, respectively, to $^4A_{2g} \rightarrow {}^4T_1$ and the $^4A_{2g} \rightarrow {}^4T_{2g}$ transitions characteristics of an octahedral Cr(III) complex. A third band corresponding $^4A_{2g} \rightarrow {}^4T_{1g}$ (P) transition was also observed above 30400 cm^{-1} [37]. Magnetic moment data also supported its octahedral geometry.

The brown coloured [MnL(H_2O)$_2$] exhibited bands at 14,100 cm^{-1}, 20,400 cm^{-1} and 24,200 cm^{-1}. They may be assigned to $^6A_{1g} \rightarrow {}^4T_{1g}$, $^6A_{1g} \rightarrow {}^4T_{2g}$ and $^6A_{1g} \rightarrow {}^4E_g$ transitions of an octahedral Mn(II) complex.

The Fe(III) complex obtained here was found to be red and it registered two bands, one at 25,000 and another broad one at 20,000 cm^{-1} and were assigned to d-d transitions in an octahedral field [38]. Its magnetic moment value of 5.89B.M supported the octahedral geometry.

The spectrum of Co(II) **HEAc** complex showed bands at 7640, 8750 and 15900 cm^{-1} and were assigned, respectively to the $^4A_2 \rightarrow {}^4T_2$ (ν_1), $^4A_2 \rightarrow {}^4T_1$ (ν_2) and $^4A_2 \rightarrow {}^4T_1$ (P) (ν_3)^{42} transitions of a tetrahedral Co (II) complex. The deep blue color of the complex and its magnetic moment data supported this structure.

The Ni(II) complex investigated here exhibited three transitions characteristic of tetrahedral geometry. Bands were identified at 7,340, 8,100 and 14,300 cm^{-1} and were assigned to $^3T_1 \rightarrow {}^3T_2$, $^3T_1 \rightarrow {}^3A_2$ and $^3T_1 \rightarrow {}^3T_1$(P), respectively.

The 4- coordinate Cu(II) belongs to the d^9 system. The spectrum of Cu(II) **HEAc** complex showed an intense transition at 23,700 cm^{-1} and was assigned to the $^2T_2 \rightarrow {}^2E$ transition, which indicated its tetrahedral geometry [39]. (Table 4).

2.3. Anticancer studies

2.3.1. Short-term in vitro cytotoxic analysis

Daltons lymphoma are extensively used as interesting model for cancer research, especially antitumor study, because of its usefulness in pre-clinical system for evaluating new or known drugs in the treatment of a variety of cancers. Dalton's lymphoma is a transplantable T-cell lymphoma of impulsive origin in thymus of mice host. During the late tumour bearing stages, DL growth has been shown to be associated with a concomitant inhibition of humoral and cell mediated immune responses concerning the abrogated functions of macrophages, B and T cells [40].

The novel Schiff base ligand, **HEAc** and its Cr(III), Fe(III), Co(II), Ni (II) and Cu(II) complexes exhibited striking cytotoxic activity against Dalton Lymphoma Ascites cell line. The copper complex showed highest activity and the concentration required for 50% death (IC_{50}) was found to be 47 µg/ml (Table 5 & Fig. 2).

2.3.2. In vivo toxicity studies of the copper complex in mice

The results of toxicity studies of the Cu(II) complex on 24 Swiss albino mice, 4 groups, at four concentrations (20, 15, 10 and 5 mg/kg) showed that 20 mg/kg was slightly toxic to the animals. Therefore, 20 mg/kg dose was avoided and 15, 10 and 5 mg/kg dose of copper complex were selected for the treatment of *in vivo* ascites tumor, as they were nontoxic to the animals.

Table 3
Significant bands in the IR spectra and their assignments.

Compounds	Assignments and band frequencies (cm^{-1})						
	$\nu_{\text{-C=N}}$	ν-amide	$\nu_{\text{-OH}}$ (H_2O)	$\nu_{\text{N=C-O}}$ (enolised)	$\nu_{\text{-M-N}}$	$\nu_{\text{-M-O}}$	$\nu_{\text{-M-Cl}}$
HEAc (LH_2)	1633	3015, 1655	3445	——	——	—	——
[(VOL]	1620	3012, —	——	1130, 1044	515	480	——
[CrL(H_2O)Cl]	1618	3017, —	3405	1120, 1030	520	470	414
[MnL(H_2O)$_2$]	1620	3018, —	3410	1120, 1019	523	474	—
[FeL(H_2O)Cl]	1615	3014, —	3595	1140, 1030	515	469	410
[CoL]	1619	3014, ——	——	1124, 1071	519	480	——
[NiL]	1621	3016, ——	——	1115, 1080	515	484	—
[CuL]	1620	3014, ——	——	1120, 1038	523	470	——

Table 4
Electronic spectra of complexes and their assignments.

Si. No:	Complexes	Bands (cm^{-1})	Assignments	Geometry
1.	[(VO)L]	13,350	$^2B_2 \rightarrow {}^2E$	Tetragonal Pyramid
		19,400	$^2B_2 \rightarrow {}^2B_1$	
		24,200	$^2B_2 \rightarrow {}^2A_1$	
2.	[CrL(H$_2$O)Cl]	16,800	$^4A_{2g} \rightarrow {}^4T_1$	Octahedral
		22,300	$^4A_{2g} \rightarrow {}^4T_{2g}$	
3.	[MnL(H$_2$O)$_2$]	14,100	$^6A_{1g} \rightarrow {}^4T_{1g}$	Octahedral
		20,400	$^6A_{1g} \rightarrow {}^4T_{2g}$	
		24,200	$^6A_{1g} \rightarrow {}^4E_g$	
4.	[FeL(H$_2$O)Cl]	20,870	$^6A_{1g} \rightarrow {}^4T_{2g}$	Octahedral
		24,200	CT	
		7,640	$^4A_2 \rightarrow {}^4T_2$	
5.	[CoL]	8,750	$^4A_2 \rightarrow {}^4T_1$	Tetrahedral
		15,900	$^4A_2 \rightarrow {}^4T_1(P)$	
		7,340	$^3T_1 \rightarrow {}^3T_2$	
6.	[NiL]	8,100	$^3T_1 \rightarrow {}^3T_2$	Tetrahedral
		14,300	$^3T_1 \rightarrow {}^3T_1(P)$	
7.	[CuL]	23,700	$^2T_2 \rightarrow {}^2E$	Tetrahedral

Table 5
Percentage of cytotoxicity of ligand, **HEAc** and its complexes.

Concentration (μg/ml)	Percentage of Cytotoxicity					
	Complexes					
	Cr(III)	Fe(III)	Co(II)	Ni(II)	Cu(II)	**HEAc**
200	51	71	72	58	85	37
100	44	51	52	44	72	25
50	32	42	43	31	57	17
20	21	37	33	24	30	13
10	11	32	26	14	23	7

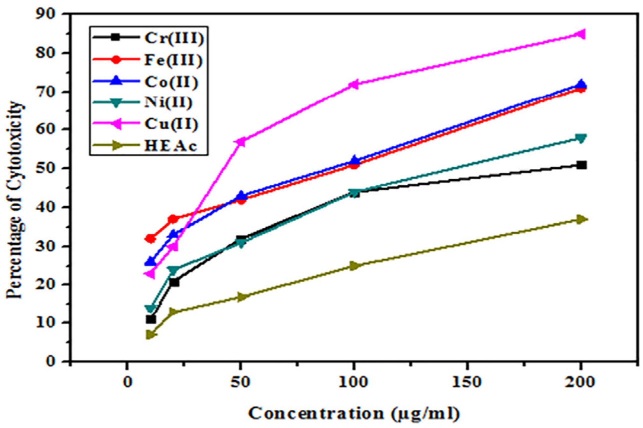


Fig. 2. Cytotoxic action of ligand and its complexes.

2.3.3. Use of Cu(II) complex on reduction of ascites tumour development

Ehrlich ascetic Cell (ESC) tumor is a quickly growing carcinoma with very belligerent behavior. It is capable to grow in almost all strains of mice. The Ehrlich ascetic tumor implantation induces a local inflammatory reaction with rising vascular permeability, which leads to an extreme edema formation, cellular migration and a progressive acetic fluid formation. The ascetic fluid is necessary for tumor growth since it constitutes a direct nutritional source for tumor cells. As stated above, Ehrlich ascites tumour is a hastily growing carcinoma. Mice inoculated with 5 × 10^6 tumour cells have a life span of 25 days. Exponential tumour growth was showed up to 8–10 days after tumour induction and substantial changes in the energy and nitrogen metabolism take place in the host tissues and organs. [41]

The animals in the tumour control group survived for a period of 15.2 days. Those treated with cyclophosphamide survived for 25.8 days. The copper complex at 15, 10 and 5 mg/kg increased the survival rate of the animals by 18.6, 19.6 and 22 days, respectively showed (Table 5). Thus, the copper complex was found to be effective in increasing the average life span of the animals by 44.7, 29 and 22.3%, respectively, at 5, 10 and 15 mg/kg doses. (Tables 6 and 7. and Figs. 3 and 4)

2.3.4. Effect of Cu(II) complex on reduction of solid tumour volume

30 Swiss Albino female mice (6–8 weeks old) weighing 23–28 g were divided into 5 groups containing of 6 animals in each group for the DLA cell induced solid tumor studies. Tumour was induced by injecting DLA cells (0.1 ml of 10^6 cells per mouse) in to the right hind leg of mice (Fig. 5). Group 1 was taken as control. Groups 2, 3 and 4 were treated with Cu(II) complexes. Group 5 was treated with standard drug, cyclophosphamide. The tumor development on animals of each group was assessed by measuring the diameter of tumour growth in two perpendicular planes using a digital Vernier caliper starting from 10th day of tumour induction up to 32th day. The average

Table 6
Effect of Cu(II) complex on survival rate of Ascites tumour enduring mice.

Treatment (mg/kg)	Survival rate (Days)
Control	15.2
15	18.6
10	19.6
05	22.0
Standard*	25.8

*Stndard drug, Cyclophosphamide (10 mg/kg).

Table 7
Effect of copper complex on increasing life span rate of ascites tumour enduring mice.

Treatment (mg/kg)	Increase in Life span (%)
Control	–
15	22.3
10	29
05	44.7
Standard*	69.7

* Cyclophosphamide (10 mg/kg).

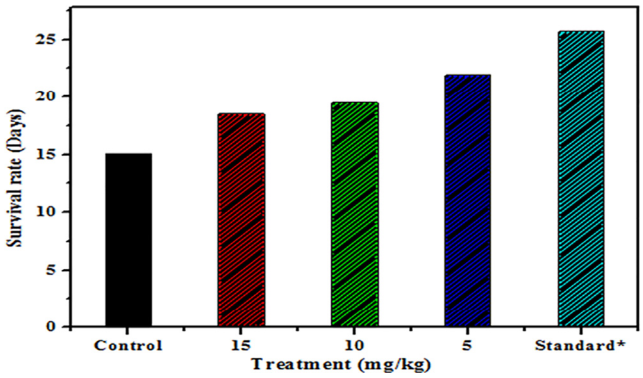


Fig. 3. Effect of Cu(II) complex on survival rate of ascites tumour enduring mice.

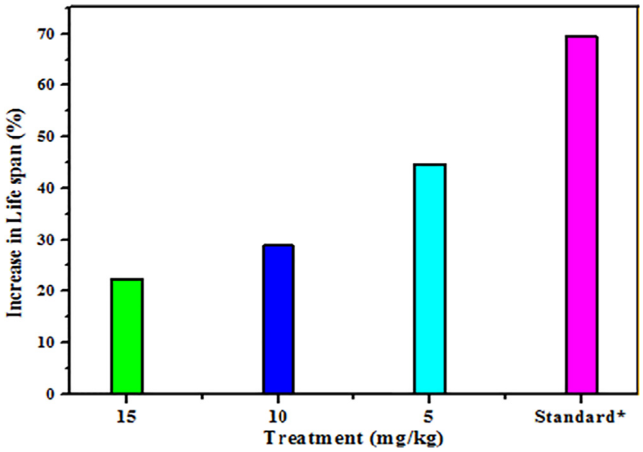


Fig. 4. Effect of Copper complex on increasing life span rate of ascites tumour enduring mice.

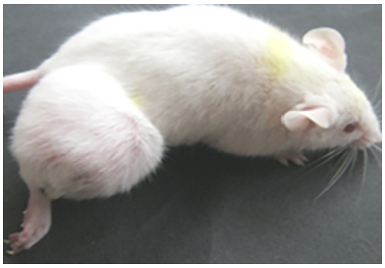


Fig. 5. Tumour was induced by injecting DLA cells in to the right hind leg of mice (22nd day).

tumour volume of each group was estimated using the simple formula, $V = 4/3\pi r_1^2 r_2$, where r_1 is the minor diameter and r_2 is the major diameter.

Tumour volume of the animals in the control group enlarged by 3.001 cm^3 on 32th day, while in the case of animals treated with the Cu(II) complex, there was a significant decrease of tumour volume. In the case of the animals treated with a dose of 5 mg/kg, the volume was 1.429 cm^3, while at higher concentrations (15 and 10 mg/kg) the tumour volumes were found to be 1.844 and 1.742 cm^3, respectively. In the case of the animals treated with standard drug, cyclophosphamide, the reduction in tumour volume was 0.698 cm^3 (Table 8. and Figs. 6–9).

In vitro cytotoxicity studies of **HEAc** and its Cr(III), Fe(III), Co(II), Ni(II) and Cu(II) metal complexes showed potential activity against DLA cell lines. CuCCu(II) complex showed highest activity with an IC_{50} value of 47 μg/ml. *In vivo* EAC induced ascites antitumour and DLA induced solid antitumour studies of Cu(II) complex of HEAc in mice yielded interesting and promising results.

From the present studies, we have concluded that the copper complex of **HEAc** is efficient against EAC-induced ascites tumour. A dose of 5 mg/kg body weight concentration was more effective than the other two concentrations (15 and 10 mg/kg b.wt). The *in vitro* cytotoxic studies of the copper complex suggested its potential use as an anticancer agent.

2.4. Results of antimicrobial activity

2.4.1. Antibacterial screening

The results of antibacterial activity of **HEAc** and its metal complexes indicated (Table 9.) that the Cu(II) complex showed higher inhibition than the other complexes. However, for the different species of bacteria, these complexes exhibited variation in their activities. Thus, the metal complexes were found to have higher antibacterial activities than the free ligand, **HEAc** towards both gram-positive and gram-negative bacteria.

2.4.2. Antifungal screening

The antifungal screening of **HEAc** and its metal complexes (Table 10) indicated that the metal complexes were more potent than the parent ligand. The studies revealed that all the metal complexes were active towards the fungal stains in a concentration dependent manner. From the studies, Cu(II) and Ni(II) complexes were found to have higher activity.

All the metal complexes exhibited good antimicrobial activity against selected bacteria and fungi. Cu(II) complex exhibited better antimicrobial activity than the others. It was observed that all the metal complexes were more potent bactericides and fungicides than the ligand, **HEAc**. The antimicrobial activities of the Schiff base were improved upon coordination with metal ions. This enhancement in the activity can be explained on the basis of overtone- and chelation theory [40].

3. Experimental

3.1. Materials and methods

The solvents used for the synthesis, extraction and recrystalization of the ligand and the complexes were ethanol, methanol, chloroform, DMF, DMSO, petroleum benzene, diethyl ether, etc. Commercially available solvents, like ethanol and methanol were purified by standard methods [32]. Others were E. Merck reagent grade and were used as such. The solvents, such as methanol and dimethyl formamide used for spectral and conductivity measurements were of spectroscopic grade.

Table 8
Effect of copper complex of **HEAc** on the reduction of tumour volume (cm^3).

Dosage (mg/kg)	*Tumour volume (cm^3)								
	Observations (No: of days)								
	Initial	10th	10th	16th	19th	22nd	25th	28th	32nd
Control	0.094	0.701	0.990	1.421	1.982	2.341	2.681	2.994	3.001
15	0.080	0.510	0.591	0.682	0.834	0.884	0.992	1.120	1.844
10	0.079	0.423	0.423	0.794	0.844	0.923	1.024	1.342	1.742
05	0.078	0.484	0.484	0.642	0.714	0.794	0.948	1.012	1.429
Standard	0.080	0.214	0.214	0.248	0.304	0.400	0.490	0.514	0.698

[*] Mean volume in cm^3.

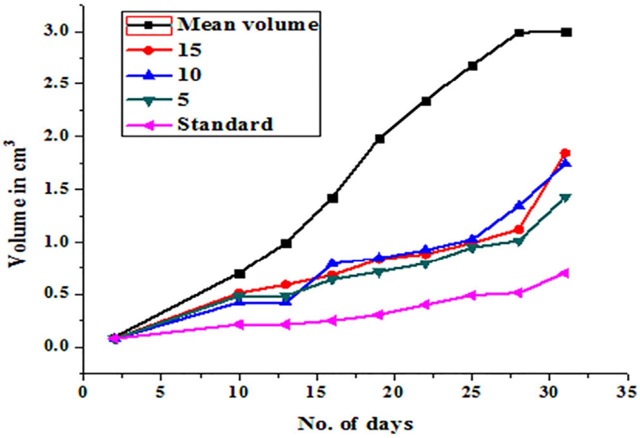


Fig. 6. Effect of copper complex of HEAc on solid tumour.

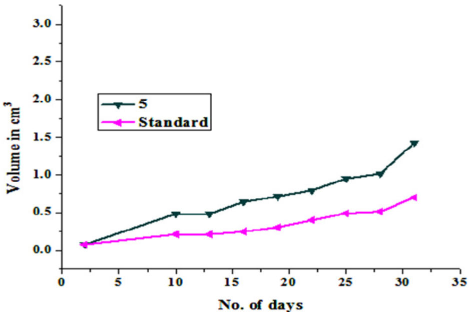


Fig. 7. Effect of copper complex of HEAc on solid tumour, standard and 5 mg/kg.

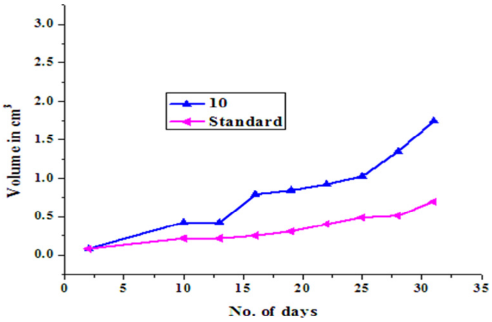


Fig. 8. Effect of copper complex of HEAc on solid tumour, standard and 10 mg/kg.

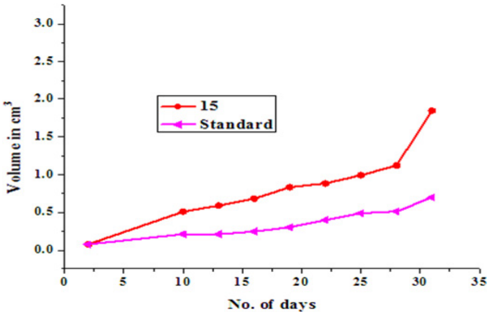


Fig. 9. Effect of copper complex of HEAc on solid tumour, standard and 15 mg/kg.

For the preparation of the ligand, o-hydroxyacetophenone, acetoacetanilide and 1, 2-ethylenedaimene was used. The metal salts used in this study were of BDH AnalaR quality, $VOSO_4 \cdot H_2O$, $CrCl_3 \cdot 2H_2O$, $MnSO_4 \cdot 5H_2O$, $FeCl_3 \cdot 6H_2O$, $CoCl_2 \cdot 5H_2O$, $NiCl_2 \cdot 2H_2O$ and $CuCl_2 \cdot 2H_2O$ were purchased from E. Merck.

Reaction were monitored by thin-layer chromatography (TLC) on pre-coated silica gel F_{254} plates from Merck and the compound were visualized by exposure of UV light and kept in iodine chamber. Chromatographic columns of 70–230 mesh silica gel used for separation. Melting point was determined using a Fisher-Johns apparatus and were uncorrected. C, H, N and S were estimated by making use of Vario EL III CHNS analyzer. The IR spectra were record on a Jasco FTIR-4100 Spectrophotometer by using KBr pellet. The electronic spectra in the range of 200–700 nm were obtained on UV–VIS spectrophotometer. ^{1}H NMR spectrum in dimethyl sulphoxide (DMSO d_6) was recorded on a 500 MHz Brucker AV 500 FT NMR spectrometer.

3.2. Synthesis

3.2.1. (E)-3-((2-((E)-(1-(2-hydroxyphenyl)ethylidene)amino)ethyl)imino)-N-phenylbutanamide (***HEAc***)

o-Hydroxyacetophenone (0.025 mol) and acetoacetanilide (0.025 mol) in minimum amount of methanol were added to 1,2-ethylenediamine (0.025 mol) in methanol in a 250 ml round bottom flask. Added a few drops of mineral acid as dehydrating agent. The mixture was refluxed for 3 hours as mentioned in Scheme 1. After the completion of the reaction, the mixture was cooled in an ice bath till the yellow crystals separated. Completion of the reaction was confirmed by thin-layer chromatographic (TLC) studies on a pre-coated silica gel F_{254} plate from Merck. The product was filtered, washed with ethanol and dried over anhydrous $CaCl_2$. (Yield: 2.01 g, 61%) *Anal.* Calculated for $C_{20}H_{23}N_3O_2$: C, 71.19; H, 6.89; N, 12.49. Found: C, 70.59; H, 7.09; N, 11.98 and m.p; 185 ^{0}C. Color: Pale yellow. UV/vis; λ_{max} (ε): 238 nm, 344 nm. IR spectrum, ν, cm^{-1}: 1493 (Ar-C=C), 3445 (–OH), 3015, 1655 (–NH-CO-), 1231(-C-N), 1665 (C=O), 1250 (N-N), 1633 (N=C), 1644 (N-CH), 3065 (=C–H), 2921

Table 9
Antibacterial activities of **HEAc** and its complexes.*

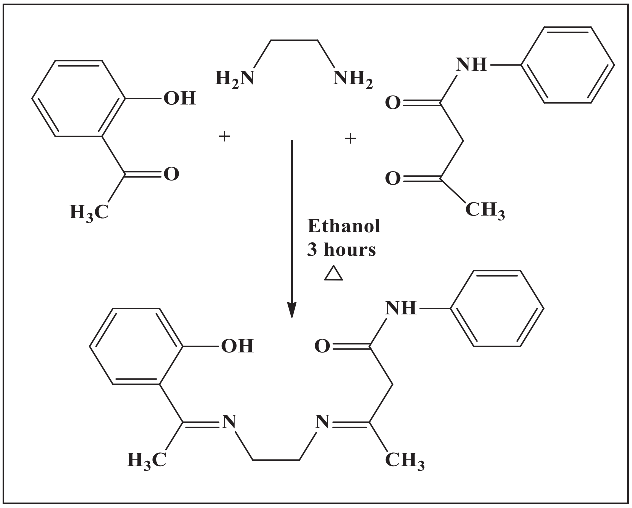
Microorganisms	Zone diameter (mm)							
	HEAc	VO(IV)	Cr(III)	Mn(II)	Fe(III)	Co(II)	Ni(II)	Cu(II)
Stephylococcus	7	19	20	17	14	17	17	41
Streptococcus	–	17	15	13	16	19	21	42
Bacillus	8	11	14	21	17	11	24	40
E. Coli	–	13	21	18	11	14	13	51
Klebsiella	7	10	14	19	15	10	14	23
Psuedomonas	9	8	13	11	10	15	13	16

*Concentration, 5 mg/ml.

Table 10
Antifungal activity of **HEAc** and its complexes.*

Species	Zone diameter (mm)							
	HEAc	VO(IV)	Cr(III)	Mn(II)	Fe(III)	Co(II)	Ni(II)	Cu(II)
Pencillinium	4	14	14	13	14	15	21	30
Fusarium	5	12	11	11	12	17	19	27
Aspergillus	5	13	14	8	11	14	15	26

*Concentration, 5 mg/ml.



Scheme 1. Synthesis of ligand, (E)-3-((2-((E)-(1-(2-hydroxyphenyl)ethylidene)amino)ethyl)imino)-N-phenylbutanamide (HEAc).

(C–H asym.); ^{1}H NMR spectrum, δ ppm (500 MHz, DMSO) 9.20 (1H, s, –NH), 3.20 (2H, s, CH_2), 3.67 (3H, s, CH_3), 4.65 (1H, s, –OH), 2.68 (2H, t, CH_2), 1.95 (3H, s, CH_3), 7.18–7.60 (5H, m, Ar-H), 6.88–7.49 (4H, m, Ar-H)

3.3. Complexes

Ethanolic solution of the metal salt (0.005 mol taken in 20 ml ethanol) was added to a solution of the ligand (0.005 mol of **HEAc** in 20 ml DMSO) and the mixture was refluxed for about 4 h. It was then cooled and evaporated the solvent to reduce approximately half of the total volume. The solid complexes formed were filtered off, washed several times with petroleum benzene and finally with methanol and were dried over anhydrous calcium chloride.

3.3.1. VO(IV) complex

Complex was found to be light green colored, non-hygroscopic, photo-stable and soluble in DMF and DMSO. (Yield: 1.89 g, 59%, *F*. Wt*, 418.10) *Anal.* Calculated for $VOC_{20}H_{23}N_3O_2$: C, 57.42; H, 5.06; N, 10.04, M, 12.18. Found: C, 56.97; H, 5.18; N, 10.21, M, 12.37 and m.p; 285 °C. Color: Yellow. Λ_m: 39 $\Omega^{-1}mol^{-1}cm^2$, μ_{eff}: 1.71 B.M, UV/vis; λ_{max} (ε): 413 nm, 515 nm, 749 nm. IR spectrum, ν, cm^{-1}: 1488 (Ar-C=C), 3012 (–NH), 1231(-C-N), 1660 (=O), 1250 (N-N), 1633 (N=C), 1130, 1044 (-N=CO–), 3065 (=C–H), 2921 (C–H asym.), 515 (M – N), 480 (M – O-).

3.3.2. Cr(III) complex

Complex was found to be green colored, non-hygroscopic, photo-stable and soluble in DMF and DMSO. (Yield: 1.5 g, 58%, *F*.Wt*, 440.08) *Anal.* Calculated for $CrC_{20}H_{25}N_3O_3Cl$: C, 54.49; H, 5.26; N, 9.53, Cl, 8.04, M, 11.79. Found: C, 54.61; H, 5.58; N, 09.71, Cl, 8.35, M, 12.01 and m.p; 270 ^{0}C. Color: Pale green. Λ_m: 35 $\Omega^{-1}mol^{-1}cm^2$, μ_{eff}: 3.89 BM, UV/vis; λ_{max} (ε): 448 nm, 595 nm. IR spectrum, ν, cm^{-1}: 1487 (Ar-C=C), 3405 (–OH), 3017 (–NH), 1231(-C-N), 1651 (C=O), 1250 (N-N), 1618 (N=C), 1120, 1030 (-N=CO–), 3065 (= C–H), 2921 (C–H asym.), 520 (M – N), 470 (M – O-), 414 (M – Cl).

3.3.3. Mn(II) complex

Complex was found to be brownish red colored, non-hygroscopic, photo-stable and soluble in DMF and DMSO. (Yield: 2.01 g, 65%, *F*. Wt*, 438.09) *Anal.* Calculated for $MnC_{20}H_{27}N_3O_4$: C, 54.80; H, 4.83; N, 9.59, M, 12.53. Found: C, 55.00; H, 4.83; N, 9.59, M, 12.77 and m.p; 280 ^{0}C. Color: Pale red. Λ_m: 20 $\Omega^{-1}mol^{-1}cm^2$, μ_{eff}: 5.90 B.M, UV/vis; λ_{max} (ε): 413 nm, 490 nm, 709 nm. IR spectrum, ν, cm^{-1}: 1485 (Ar-C=C), 3410 (–OH), 3018 (–NH), 1231(-C-N), 1660 (C=O), 1250 (N-N), 1620 (N=C), 1120, 1019 (-N=CO–), 3065 (= C–H), 2921 (C–H asym.), 523 (M – N), 474 (M – O-).

3.3.4. Fe(III) complex

Complex was found to be dark brown colored, non-hygroscopic, photo-stable and soluble in DMF and DMSO. (Yield: 1.6 g, 60%, *F*. Wt*, 458.06) *Anal.* Calculated for $FeC_{20}H_{25}N_3O_3Cl$: C, 52.37; H, 4.61; N, 9.16, Cl, 7.73, M, 12.17. Found: C, 52.66; H, 4.81; N, 9.37, Cl, 8.07, M, 12.29 and m.p; 295 ^{0}C. Color: Red. Λ_m: 40 $\Omega^{-1}mol^{-1}cm^2$, μ_{eff}: 5.89 B.M, UV/vis; λ_{max} (ε): 413 nm, 479 nm. IR spectrum, ν, cm^{-1}: 1490 (Ar-C=C), 3595 (–OH), 3014 (–NH), 1231(-C-N), 1665 (C=O), 1250 (N-N), 1615 (N=C), 1140, 1030 (-N=CO–), 3065 (= C–H), 2921 (C–H asym.), 515 (M – N), 469 (M – O-), 410 (M – Cl).

3.3.5. Co(II) complex

Complex was found to be dark blue colored, non-hygroscopic, photo-stable and soluble in DMF and DMSO. (Yield: 1.4 g, 54%, *F*. Wt*, 410.09) *Anal.* Calculated for $CoC_{20}H_{23}N_3O_2$: C, 58.54; H, 5.16; N, 10.24, M, 14.36. Found: C, 58.41; H, 4.91; N, 9.98, M, 14.41 and m.p; 291 ^{0}C. Color: Brown. Λ_m: 34 $\Omega^{-1}mol^{-1}cm^2$, μ_{eff}: 4.79B.M, UV/vis; λ_{max} (ε): 628 nm, 1142 nm, 1308 nm. IR spectrum, ν, cm^{-1}: 1489 (Ar-C=C), 3014 (–NH), 1231(-C-N), 1650 (C=O), 1250 (N-N), 1619 (N=C), 1124, 1071 (-N=CO–), 3065 (=C–H), 2921 (C–H asym.), 519 (M – N), 480 (M – O-).

3.3.6. Ni(II) complex

Complex was found to be dark green colored, non-hygroscopic, photo-stable and soluble in DMF and DMSO. (Yield: 2.11 g, 70%, *F*. Wt*, 409.09) *Anal.* Calculated. for $NiC_{20}H_{23}N_3O_2$: C, 58.58; H, 5.16; N, 10.25, M, 14.31. Found: C, 58.68; H, 4.98; N, 10.51, M, 14.02 and m.p; 295 ^{0}C. Color: Green. Λ_m: 28 $\Omega^{-1}mol^{-1}cm^2$, μ_{eff}: 3.39B.M, UV/vis; λ_{max} (ε): 699 nm, 1234 nm, 1362 nm. IR spectrum, ν, cm^{-1}: 1485 (Ar-C=C), 3016 (–NH), 1231(-C-N), 1655 (C=O), 1250 (N-N), 1621 (N=C), 1115, 1080 (-N=CO–), 3065 (=C–H), 2921 (C–H asym.), 515 (M – N), 484 (M – O-).

3.3.7. Cu(II) complex

Complex was found to be greenish blue colored, non-hygroscopic, photo-stable and soluble in DMF and DMSO. (Yield: 2.5 g, 74%, *F*. Wt*, 414.09) *Anal.* Calculated for $CuC_{20}H_{23}N_3O_2$: C, 57.89; H, 5.10; N, 10.13, M, 15.31. Found: C, 57.95; H, 4.95; N, 10.25, M, 15.51 and m.p; 292 ^{0}C. Color: Greenish blue. Λ_m: 23 $\Omega^{-1}mol^{-1}cm^2$, μ_{eff}: 2.00B.M, UV/vis; λ_{max} (ε): 421 nm. IR spectrum, ν, cm^{-1}: 1487 (Ar-C=C), 3014 (–NH), 1231(-C-N), 1660 (C=O), 1250 (N-N), 1620 (N=C), 1120, 1038 (-N=CO–), 3065 (=C–H), 2921 (C–H asym.), 523 (M – N), 470 (M – O-).

3.4. Anticancer studies

3.4.1. Preparation of the drug and its evaluation of anticancer potential

For *in vitro* studies, 50 mg of the compounds (**HEAc** and its metal complexes) was dissolved in 1 ml of dimethylsulphoxide (DMSO) and was further diluted using distilled water to the desired concentration. Adayar Cancer Institute, Chennai provided essential Ehrlich Ascites Carcinoma (EAC) cell lines and Dalton's Lymphoma Ascites (DLA) cell lines and were propagated as transplantable tumors in the peritoneal cavity of BALB/C mice. L929 (mouse lung fibro blast) cell lines were obtained from National Centre for Cell Sciences, Pune.

The experiments were carried out on laboratory Swiss albino female mice (20–25 g) which were obtained from the Small Animal Breeding Station, Mannuthy, Thrissur, Kerala and they were kept under standard conditions of temperature and humidity in animal house of Amala Cancer Research Centre, Trissur, Kerala. (Fig. 2.) The animals were fed with standard mouse chow (Sai Durga Feeds and Foods, Bangalore, India) and water *ad libitum*. All the animal experiments in this study were carried out with the prior approval of the Institutional Animal Ethics Committee (IAEC) and were conducted strictly according to the guidelines of CPCSEA constituted by the Animal Welfare Division, Government of India. Dalton's Lymphoma Ascites (DLA) and Ehrlich's Ascites Carcinoma (EAC) cells maintained in the intraperitoneal cavity of mouse were used for the study.

Mouse lung fibroblast (L929 cells) were cultured in DMEM medium supplemented with FBS (10% v/v), streptomycin (100 μg/ml) and penicillin (100 U/ml) and kept at 37° in an incubator with 5% CO_2. Dalton's Lymphoma Ascites (DLA) and Ehrlich's Ascites Carcinoma (EAC) cells maintained in the intraperitoneal cavity of mouse were used for the study.

3.4.2. Trypan blue exclusion method (MTT Assay)

The test compounds were studied for short-term *in vitro* cytotoxicity using Dalton's lymphoma ascites cells (DLA). The tumour cells aspirated from the peritoneal cavity of tumour bearing mice were washed thrice with PBS or normal saline. Cell viability was determined by Trypan Blue exclusion method [43,44].

3.4.3. Toxicity studies of Cu(II) complex

24 healthy Swiss albino mice were divided into 4 groups, each group containing 6 animals (group- 1, 2, 3 and 4). 5, 10, 15 and 20 mg/kg of body weight of drug was administrated once daily (Intraperitoneal cavity Injection) to the group 1, 2, 3 and 4, respectively, and continued for 5–6 weeks to determine their mortality rate [45].

3.4.4. Use of Cu(II) complexes for the treatment of mice bearing Ascites tumour

3.4.4.1. On the survival rate of Ascites tumour bearing mice. Based on the toxicity studies of Cu(II) complex, mice (female, 6–8 weeks old) weighing 26–30 g were divided into 5 groups of 6 animals each. Viable EAC cells 106 in 0.1 ml of phosphate buffered saline (PBS) were injected in to the peritoneal cavity of the mice. Group 1 was used as control. Groups 2, 3 and 4 were injected, respectively, with 5, 10 and 15 mg/Kg of the prepared drug [Cu(II) complex]. Gram 5 was administrated with the standard drug (Cyclophosphamide).

Drug and cyclophosphamide were given by intraperitoneal injection from the first day of tumour induction. The death pattern of animals due to tumour burden was noted and the percentage of increase in life span was calculated as, % ILS = (T-C/C) × 100, where T and C are mean survival of treated and control mice, respectively.

3.4.5. On solid tumour development

Swiss albino mice (6–8 weeks old) weighing 23–28 g were splitted into five groups, each group composed of 6 animals. DLA cells (0.1 ml of 106 cells per mouse) were administrated by injection in to the right hind leg of mice to induce tumour growth. Group 1 was used as control animals. Copper complex of **HEAc** was given to the 2nd, 3rd and 4th groups for treatment. Group 5 was taken as standard animals and injected standard drug, cyclophosphamide. The tumour growth on the mice of each group was arbitrated by estimating the diameter of tumour volume in two perpendicular planes using a digital Vernier Calliper, starting from 10th day of tumour growth up to 32st day. The volume of tumour development was calculated using the equation, $V = 4/3\pi r_1^2 r_2$, where r_1 is the minor diameter and r_2 is the major diameter.

3.5. Antimicrobial studies

The ligand, **HEAc** and its metal complexes, VO(IV), Cr(III), Mn(II), Fe(III), Co(II), Ni(II) and Cu(II) were screened for antibacterial activity against three gram positive bacteria, *Bacillus, Staphylococcus, Streptococcus* and three gram negative bacteria, *Escherichia coli, Klebsiella and Pseudomonas* at a concentration of 5 mg/ml in DMF. Antifungal activity of these compounds was evaluated against the fungal cultures, *Pencillium, Fusarium* and *Aspergillus* species at a concentration of 5 mg/ml in DMF. The tests were carried out by disc diffusion or Kirby Bauer method.

4. Conclusions

Novel Schiff base ligand, (E)-3-((2-((E)-(1-(2-hydroxyphenyl)ethylidene)amino)ethyl)imino)-N-phenylbutanamide (**HEAc)** and its VO (IV), Cr(III), Mn(II), Fe(III), Co(II), Ni(II) and Cu(II) complexes were synthesized. The Schiff base synthesized here acted as a tetradentate ONNO donor ligand. The properties and structures of the ligand and its complexes were determined by various physico-chemical and spectroscopic tools. The complexes have the general formulae, [(VO)L], [CrL(H_2O)Cl], [MnL(H_2O)$_2$], [FeL(H_2O)Cl], [CoL], [NiL] and [CuL]. Based on the analytical, magnetic and various spectral studies, geometries have been assigned to these complexes. [(VO)L] complex was found to be tetragonal pyramid, [CrL(H_2O)Cl], [MnL(H_2O)$_2$] and [FeL(H_2O)Cl] complexes were found to be octahedral and [CoL], [NiL] and [CuL] complexes were tetrahedral.

The cytotoxicity of the ligand and its Cr(III), Mn(II), Fe(III), Co(II), Ni(II) and Cu(II) complexes have been evaluated. *In-vitro* cytotoxicity studies showed their potential activity against DLA cell lines with an IC_{50} value of 47 μg/ml. The effect of the Cu(II) complex was studied against EAC-induced ascites tumour and DLA induced solid tumor. A concentration of 5 mg/kg body weight was more effective than the other two concentrations (15 and 10 mg/kg body weight). From the present *in vitro* study, we concluded that the Cu(II) complex was effective against EAC-induced ascites and DLA-induced solid tumour and suggested it's a potential use as an anticancer agent. It was also observed that all the metal complexes were more potent bactericides and fungicides than the free ligand, **HEAc** and Cu(II) complex exhibited better antimicrobial activity than the others.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors express their gratitude to Amala Cancer Research Centre, Trissur, Kerala-India for the help of cytotoxic and anticancer studies of synthesized substances.

Funding information

No funding source available.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rechem.2021.100129.

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DOI: 10.1002/slct.201802227
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Design, Synthesis and Biological Screening of Novel 1,3,4-Oxadiazoles as Antitubercular Agents

Macchindra S. Tambe,[a] Amit Choudhari,[b] Dhiman Sarkar,[b] Jaiprakash Sangshetti,[c] Rajesh Patil,[d] and Somnath S. Gholap*[a]

A series of novel 2,5-disubstitued 1,3,4-oxadiazole derivatives bearing 2,2-dimethyl-2,3-dihydrobenzofuran scaffold has been synthesized and screened for antitubercular activity. All the synthesized compounds were characterized by IR, ^{1}H NMR, ^{13}C-NMR and Mass spectral study. The in vitro antitubercular activity of the synthesized compounds was evaluated against *Mycobacterium tuberculosis* H$_{37}$Ra(ATCC 25177) strain. Among the synthesized compounds, four compound displayed good antitubercular activity IC$_{50}$ values in low micro-gram range ($<$ 10 μg/mL). The antitubercular data suggested that growth inhibition MTB can be imparted by the introduction of a 4-trifluoromethyl phenyl acetylene substituent. Specificity of these compounds was checked by screening them for their anti-bacterial activity against four bacterial strains (Gram-negative strains: *E. coli, S. aureus;* Gram-positive strains: *P. aeruginosa and B. subtilis).* None of the compound displayed antibacterial activity against any of the seleted strain. Molecular docking studies were carried out on InhA (FabI/ENR) which shows that the synthesized compounds bind at the catalytic site in a most favourable manner suggesting their potential as anti-mycobacterial agents. The research presented here was found to be adventitious for the development of new therapeutic agents against *Mycobacterium* infection.

1. Introduction

Nowadays, a threat of infectious diseases is a serious problem in developing and most populated countries due to adoption of modified genotype by parasite to develop resistance against drug candidates. The continuing problem of the multidrug resistance (MDR) diseases can cause great damage to society as well as economical slowdown of the countries.[1,2] Moreover, nosocomial infections are caused by resistance of *Acinetobacter baumannii* to drugs like aminoglycoside, cefetime, fluoroquinolone and most of the antibiotics.[3,4] One of this is tuberculosis infection, which continued a measure cause of morbidity and mortality all over the world.[5] The TB-infected person generally develops clinical pulmonary tuberculosis which lead to three million annual death approximately.[6,7] Although, there is extreme rise in the use of enormous therapeutic agents as driving force against tuberculosis, the first line drugs such as isoniazid, streptomycin ethambutol, rifampicin, pyrazilnamid etc. have become insensitive against *Mycobacterium tuberculosis* strain.[8-11] The most of the available anti-tubercular drugs are ineffective to treat mutant strains like MDR,[12-14] XDR,[15,16] and TDR.[17] In addition, the available treatment of tuberculosis requires long term treatment (6-9 months of DOTS strategy), adverse drug reactions and cases of Drug-Drug interactions. It has been found that the multidrug-resistant TB (MDR-TB) and extremely drug-resistant tuberculosis (XDR-TB) does not respond to the standard treatments available. Hence, there is dire need to recognize new chemical entity with appreciable mode of action against *Mycobacterium tuberculosis* infection.

The derivatives of 1,3,4-oxadiazole are known to possesses broad spectrum of bioactivities and good bioisosters of amide and ester functionalities.[18] It displayed interesting H-bond acceptor properties and improved lipophilicity profile as well as favorable ADME properties.[19] The 1,3,4-oxadiazole derivatives such as **A**, **B** are good anti-TB agents (MIC: 0.78 and 0.68 μg/mL),[20,21] Raltegravir (**C**) was used to be antiretroviral drug[22] and zibotentan (**D**) was found to be potent anticancer agent[23] (Figure 1).

Furthermore, 1,3,4-oxadiazole derivatives exhibits diverse biological profile such as anti-HIV,[24] antimalarial,[25] analgesic,[26] anti-inflammatory[27] anticonvulsant,[28a] antitubercular,[28(b-c)] and as lipid per oxidation inhibition properties.[29] Interestingly, the constrained analogue of isopropyl phenyl ether such as 2,2-dimethyl-2,3-dihydrobenzofuran has been found as core of 5-HT3 antagonist zatosetron (**E**)[30] and serotonin 2C agonist (**G**)[31] (Figure 2).

By knowing the biocompatibility of 1,3,4-oxadiazole and 2,2-di-methyl-2,3-dihydrobenzofuran core, herein we have

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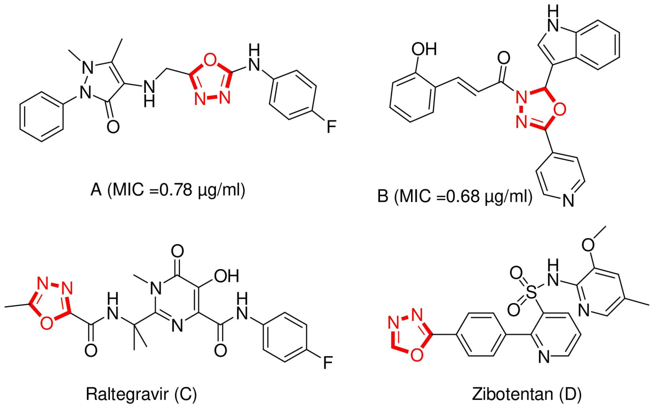
Supporting information for this article is available on the WWW under https://doi.org/10.1002/slct.201802227



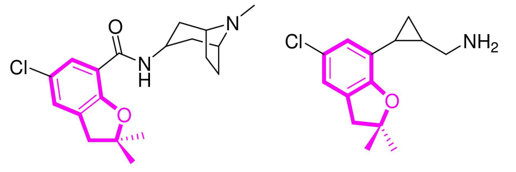
A (MIC =0.78 µg/ml)

B (MIC =0.68 µg/ml)

Raltegravir (C)

Zibotentan (D)

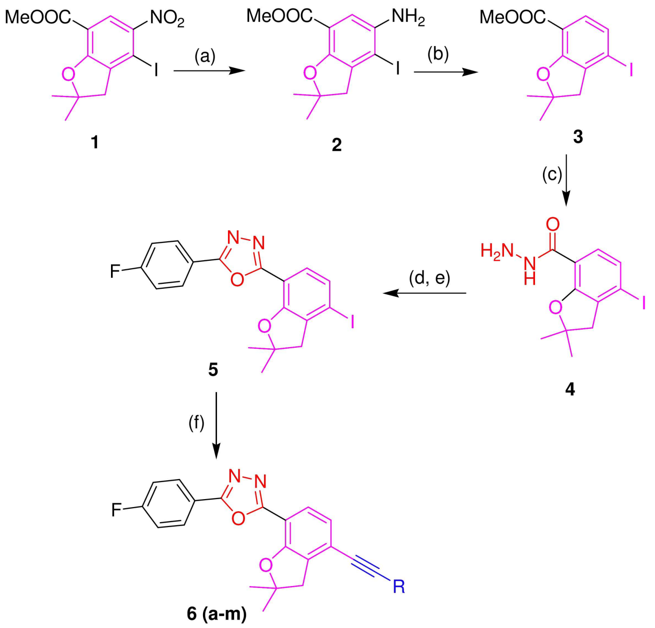
Figure 1. Potentially active 1, 3, 4-oxadiazole derivatives.



Zatosetron (F)

Serotonin 2C agonist (G)

Figure 2. Bioactive 2,2-dimethyl-2,3-dihydrobenzofuran derivatives.



Scheme 1. Reagents and conditions: (a) Fe powder, methanol, Conc. HCl, 1hr, 80.30% (b) Conc. HCl, NaNO$_2$, 0°C, methanol, reflux, 2hr, 70.69% (c) hydrazine monohydrate, methanol, reflux, 10 hrs, 90.50% (d) 4-fluoro benzoyl chloride, TEA, THF, 0°C (e) POCl$_3$, reflux, 10 hr, 73.98% (f) R-C$\equiv$C-H, PdCl$_2$(PPh$_3$)$_2$, TBAF, 70°C, 3hr, 80-96%.

reported the synthesis of a series of 1,3,4-oxadiazole derivatives encored 2,3-dihydro-benzofuran and studied their anti-tubercular potential. In our earlier studies,[32] the potential of 1,3,4-oxadiazole derivatives tethered with 2,2-dimethyl-2,3-dihydrobenzofuran as mycobacterial enoyl-ACP reductase (InhA (FabI/ENR)) enzyme inhibitors has been well investigated. The present study is augmented with the docking study against this enzyme in order to gain deeper insights of binding modes of the synthesized compounds.

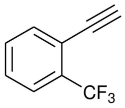
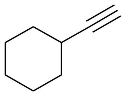
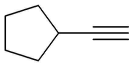
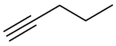
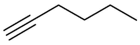
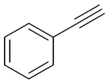
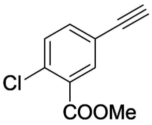
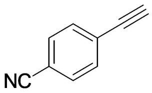
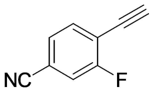
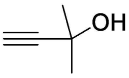
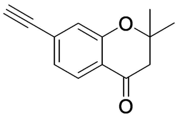
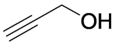
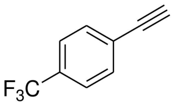
2. Chemistry

The title compounds 6a-m were synthesized was outlined in Scheme 1. The required compound 1 was synthesized as per previous method [32] The compound 1 on reduction with Fe/HCl in MeOH afforded compound 2. The compound 2 on deamination afforded compound 3. The compound 3 on reaction with hydrazine hydrate with methanol furnished compound 4, which on treated with 4-fluoro benzoylchloride to gave *N*-benzoyl hydrazide derivatives, which on cyclisation with POCl$_3$ to gave 1,3,4-oxadiazole derivative 5 with 73.98% yield. The compound 5 on Sonogashira coupling with terminal alkynes using PdCl$_2$(PPh$_3$)$_2$, TBAF, 70°C, 3hr afforded compound 6a-m in a good to excellent yield (70-90 %)(Scheme 1, Table 1). The purification of all synthesized compound was conducted by column chromatography (4% MeOH in CH$_2$Cl$_2$). The structure of the final compounds, 6a-m were confirmed by IR, NMR and MS spectral data.

3. Results and Discussion

In continuation to our ongoing research on the synthesis of biologically active compounds[33] herein we have synthesized novel structurally diverse 1,3,4-oxadiazole derivatives (**6**). All the synthesized compounds were characterized by IR, ^{1}H-NMR, ^{13}C-NMR and Mass spectral analysis. IR spectrum of **6a** showed absorption at 2974, 3065 cm^{-1} due to C-H stretching of alkane, absorption band at 2220 cm-1 due to C$\equiv$C, 1574, 1608 cm^{-1} indicated the presence of aromatic ring (C-C stretching), band at 1492 cm^{-1} confirms the presence of C-F bonding, absorption band at 1315 cm^{-1} due to C=N and 1129, 1110 cm-1 band due to C-O Stretching. The ^{1}H-NMR spectrum of **6a:** ^{1}H-NMR (300 MHz, DMSO-d_6): δ 1.57 (s, 6H, 2x-CH$_3$), 3.24 (s, 2H, -CH$_2$), 7.20 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.52 (t, *J* = 8.7 Hz, 2H, Ar-H), 7.69 (t, *J* = 7.2 Hz, 1H, Ar-H), 7.76 (t, *J* = 7.2 Hz, 1H, Ar-H), 7.86 (d, *J* = 7.8 Hz, 1H, Ar-H), 7.91(d, *J* = 8.4 Hz, 2H, Ar-H), 8.17 (t, *J* = 8.7 Hz, 2H, Ar-H); ^{13}C-NMR(100 MHz, CDCl$_3$): δ 28.4, 42.3, 86.1, 89.5, 95.8, 107.1, 116.2, 116.8, 117.0, 117.1, 119.1, 120.3, 121.9, 123.2, 127.2, 128.0, 129.2, 132.8, 134.1, 156.9, 162.4, 163.2.; Mass m/z (%) = 479.83(M+H)+. Ana. calcd. For $C_{27}H_{18}O_2N_2F_4$ (M.W= 478.44). Similarly, other reactions were conducted with substituted acetylenes to get structurally diverse oxadiazole derivatives. The products were obtained in good to excellent yields. The results obtained were summarized in Table 1. The synthesized products are evaluated for studying anti-tubercular potential.

Table 1. Synthesis of 1,3,4-oxadiazole bearing 2,2-dimethyl-2,3-dihydrobenzofuran derivatives (**6a-m**).

Entry	R	Time [hr]	Yield [%]	M.P.[°C]
6a		2.6	85	174-175
6b		2.8	92	141-142
6c		2.5	88	144-145
6d		2.8	82	92-93
6e		3.0	85	95-96
6f		2.1	96	158-159
6g		3.8	90	182-183
6h		4.0	80	220-221
6i		4.2	82	224-225
6j		3.5	75	105-106
6k		5.0	84	204-205
6l		2.9	80	170-171
6m		2.8	87	162-163

3. Biology

3.1 General

All the chemicals such as sodium salt XTT and MTT, DMSO, ampicillin and rifampicin were purchased from Sigma-Aldrich, USA. Dubos medium was purchased from DIFCO, USA. The stock solutions were prepared in in DMSO (10mg/mL) for further biological testing.

Cultivation of Mycobacterium

Microbial strains such as *Mycobacterium tuberculosis* H37Ra (ATCC 25177) was obtained from AstraZeneca, India. The stock culture was maintained at -80°C and subcultured once in a liquid medium before inoculation into an experimental culture. Cultures were grown in Dubos media (enrichment media). For antimycobacterial assay, *M. pheli* medium (minimal essential medium) was used. It contains 0.5 g KH_2PO_4, 0.25 g trisodium citrate, 60 mg $MgSO_4$, 0.5 g aspargine and 2 mL glycerol in distilled water (100 ml) followed by pH adjustment to 6.6. All bacterial stock cultures were first grown in Dubos media at 37°C at 150 RPM. It takes at least 8-10 days for OD 1 at 620 nm. The antimycobacterial assay was performed in 96-well plates for active as well as dormant stages.

Anti-tubercular activity

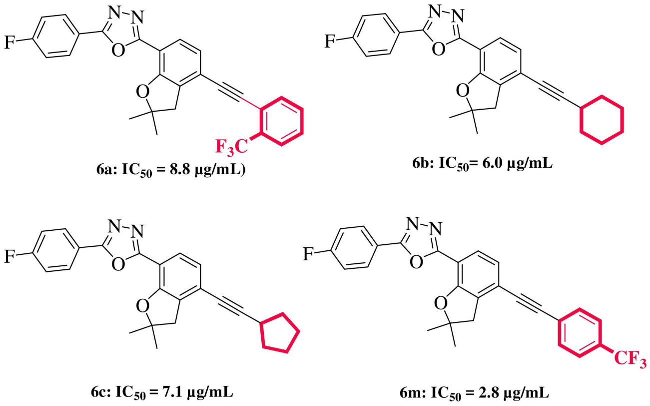
M. tuberculosis H37Ra (ATCC 25177) was obtained from AstraZeneca, India.All the synthetic compounds were screened for their *in vitro* activity against *M. tuberculosis* H37Ra using XTT Reduction Menadione Assay (XRMA) as described earlier. Briefly, 247.5μL of mycobacterial suspension (0.1% of 1O.D) was added to a 96-well plate containing 2.5 μl of test sample. Post-incubation of the plate at 37°C for 12 days, XTT was added followed by addition of menadione. The pink color formed was read on a micro plate reader at 470nm filter against a blank prepared from cell-free wells. Absorbance given by cells treated with the vehicle (DMSO) alone was taken as 100% cell growth. All the experiments were performed in duplicates and the quantitative value was expressed as the average ± standard deviation. MIC and IC_{50} values were calculated from their dose response curves by using Origin 8 software. Percentage inhibition was calculated using the formula: % inhibition = [(control – CMP) / (control – blank)] x 100 where 'control' is the activity of bacilli without compounds, 'CMP' is the activity of *Mycobacterium* in the presence of compounds and 'blank' is the activity of the culture medium without Mycobacterium. The drug in clinical use, rifampicin was used as reference.

In a standard primary screening all the newly synthesized compounds 6a-m were tested for their in vitro antitubercular activity against *M. tuberculosis* $H_{37}Ra$ (ATCC 25177) at three different concentration (30, 10, 3μg/mL) using XTT reduction menadione assay (XRMA).[34] Among the synthesized compounds, **6a**, **6b, 6c 6d, 6e, 6l** and **6m** displayed inhibition greater than 50% towards *M. tuberculosis* $H_{37}Ra$ which exemplifies the antimicrobial nature of the synthesized compound. These compounds were further evaluated in a secondary screening at six different concentrations, i.e., 30, 10, 3, 1, 0.3, and 0.1μg/mL, in order to determine the actual minimum inhibitory concentration (MIC). The results of the screening are tabulated in Table 2. The compound 6m exhibited significant activity with IC_{50} = 2.814μg/mL. The compound 6b possessing cyclohexyl acetylene substituent exhibited strong activity against MTB $H_{37}Ra$ with IC_{50} = 6.0μg/mL. The compounds 6c (R:-cyclopentylacetylene), and **6m** (R: 2- trifluromethyl phenyl acetylene) showed good activity with IC_{50} = 7.1μg/mL and 2.8μg/mL, respectively. The 1,3,4-oxadiazoles derivatives with 2-trifluromethyl phenyl acetylene core (6a) appear to provide moderate activity against MTB $H_{37}Ra$ (IC_{50} = 8.8 μg/mL) (Figure 3).

Table 2. Percent inhibition of Mtb $H_{37}Ra$ growth in presence of compound.

Entry	30[µg/mL]	10[µg/mL]	3[µg/mL]	IC_{50}[a]	MIC[b]
6a	80.66	57.75	8.75	8.8	>30
6b	82.95	72.12	33.26	6.001	>30
6c	89.33	77.83	10.98	7.121	>30
6d	65.06	44.01	10.70	15.595	>30
6e	64.88	35.51	0.25	19.684	>30
6f	-0.14	-7.57	-8.91	ND	ND
6g	20.93	0.09	6.47	ND	ND
6h	10.22	-0.64	-1.61	ND	ND
6i	7.36	0.10	1.75	ND	ND
6j	16.10	14.96	22.54	ND	ND
6k	13.12	-0.66	6.30	ND	ND
6l	54.12	38.23	14.84	24.629	>30
6m	54.78	64.26	54.21	2.814	>30
Rifampicin	-	-	-	0.001	0.04

The active compounds are highlighted in bold. [a] IC_{50}: 50% inhibitory concentration. [b] MIC_{90}: minimum inhibitory concentration. ND: Not determined



6a: IC_{50} = 8.8 µg/mL)
6b: IC_{50}= 6.0 µg/mL
6c: IC_{50} = 7.1 µg/mL
6m: IC_{50} = 2.8 µg/mL

Figure 3. Molecular structures of most potent anti-tubercular 1,3,4-oxadiazoles.

Antibacterial activity

Bacterial strains *E. coli* (NCIM 2688), *P. aeruginosa* (NCIM 2036) as gram-negative and *B. subtilus* (NCIM 2079), *S. aureus* (NCIM 2010) as gram-positive were obtained from NCIM (NCL, Pune) and were grown in Luria Burtony medium from Himedia, India. Once the culture reaches 1 $O.D_{620}$, it was used for anti-bacterial assay. Briefly, 0.1 OD_{620} bacterial culture was treated with synthesized compound at 30, 10 and 3 µg/mL concentration and incubated for 8 h at 37 ◦C. Ampicillin served as positive control for antibacterial activity. The *in vitro* screening values (% inhibition) against microorganisms tested are summarized in supplementary **Table 3**.

A series of compounds (**6**) were further screened against Gram+ve (*B.subtilis* and *S.aureus)* and Gram-ve (*E.coli and P.aeroginosa*) bacteria to asses there selectivity towards MTB. It has been observed that the compound under investigation did not showed significant activity towards any of the screened bacterial strain (Table S1: Supporting Information).

Table 3. Growth inhibition GI_{50} and GI_{90} in panel of cell lines by compounds.

Entry	HeLa		MCF-7		THP-1	
	GI_{50}	GI_{90}	GI_{50}	GI_{90}	GI_{50}	GI_{90}
6a	>30	>30	>30	>30	>30	>30
6b	>30	>30	>30	>30	>30	>30
6c	>30	>30	>30	>30	>30	>30
6m	>30	>30	>30	>30	>30	>30

Cytotoxicity assay

Three human cancer cell lines, HeLa (human cervical cancer), THP-1 (human monocytic leukemia) cell line were used to check the cytotoxicity of compounds. The cell lines were obtained from the National Center for Cell Science (NCCS), Pune and maintained in T25 flasks with 10% (v/v) fetal bovine serum (FBS) containing Dulbecco's Modified Eagle Medium (DMEM). Cell line containing T25 flasks were maintained at 37 °C under 5% CO_2 and 95% air in a humidified atmosphere. Medium were replaced twice a week. All the compounds were tested for their cytotoxicity against the mentioned cell line by using modified MTT assay. Briefly, HeLa and MCF-7 cells were seeded at the density of 1×10^4 cells/mL in a 96 well plate. The plates were incubated overnight into CO_2 incubator (37°C under 5% CO_2 and 95% air in a humidified atmosphere) to adhere the cells. Next day, cells were treated with different concentration of test compounds (30-0µg/mL) and incubated for additional 48h. Post incubation, cell medium was replaced with MTT (0.5mg/mL)-PBS medium and incubated for 2-4h to form the reduced MTT or Formazan crystals. This reduced MTT or Formazan crystals were solubilized by addition of acidified isopropanol. The optical density was read on a micro plate reader (Spectramax plus384 plate reader, Molecular Devices Inc) at 570nm filter against a blank prepared from cell-free wells. Absorbance given by cells treated with the vehicle alone was taken as 100% cell growth. IC_{50} and MIC values were calculated by plotting the graphs, by using Origin Pro software. The viability and growth in the presence of test material is calculated by using the following formula: Percent cytotoxicity = [(average absorbance of control − absorbance of compound)/(absorbance of control – absorbance of blank)] × 100, where control is the culture medium with cells and DMSO and blank is the culture medium without cells.

The cytotoxicity of most potent antitubercular compounds such as **6a, 6b**, **6c** and **6m** were screened against three human cancer cell lines HeLa (epithelial cervical cancer), MCF-7 (mammary epithelial cells) and THP-1 (acute monocytic leukemia) using modified MTT cell viability assay.[35] Notably, none of the compounds exhibited cytotoxicity ($GI_{90} > 30$ µg/mL) (Table 3). Thus indicating the selectivity and specificity of the synthesized compounds towards MTB (Table 3).

The molecular docking study was carried out against InhA (FabI/ENR), an enoyl-ACP reductase, which is a key enzyme of *M. tuberculosis* involved in the biosynthesis of cell wall constituents such as mycolic acids. The X-ray crystal structures of this enoyl-ACP reductase enzyme (InhA) with inhibitor pyrrolidine carboxamide (PDC) for *Mycobacterium* was retrieved from the RCSB protein data bank (http://www.rcsb.org/pdb) (PDB code: 4TZK) and used for the docking study. The molecular docking study was performed using Autodock4.2.[34] In the docking studies Tyr158 residue and water molecules at the catalytic site were kept flexible during entire docking simulations. UCSF Chimera 1.8[35] interface was employed for geometry optimization of structures of ligands. The crystal structure of InhA was refined by removing water except the conserved water residue at the catalytic site. The co-substrate NADH was kept in the catalytic site but other nonstandard residues were removed.This refined InhA structure was further curetted by energy minimization in UCSF Chimera with Amber ff12SB force field to remove the steric clashes and other minor inaccuracies. The optimized structures of ligands and InhA were subsequently used in docking simulation. The docking protocol was validated by measuring spatial similarity between predicted pose and crystallographic pose in terms of RMSD value. The docking protocol is considered to be validated if the RMSD between experimental and predicted pose is below 2 Å [38] and it was found to be 0.5091 Å (Figure S1: Supporting information). Discovery studio visualize and PoseView program [39] was utilized for analysis of the docking results. Furthermore, the docking simulation results were analyzed by comparing the binding free energy in Kcal/mol, estimated Ki values in nanomolar units and interactions of ligands with residues at the active site.

The residue Tyr158 play a crucial role in inhibition of InhA through hydrophobic interaction with the aromatic substituent in PDC and van der Waal's interaction with the halogen substituent.[40] The docking study gives the estimates of the thermodynamic stability of docked poses of the compounds. The estimated free energy of binding in Kcal/mol, estimated inhibition constant values (Ki) in nanomoles and the key interacting residues are presented in Table S2 (Supporting Information). It is clearly evident from the estimated free energy of binding and estimated inhibition constants that compounds **6a,** **6b**, **6c** and **6m**, are having the estimated binding free energies lower than -10 Kcal/mol and estimated inhibition constants lower than 55 nM suggesting their pronounced inhibitory potential of InhA. These theoretically measured binding free energies and inhibition constants are in good agreement with the experimentally determined IC_{50} values against *M. tuberculosis*. The docking study suggests the role of hydrophobic interactions between the non polar substituent in the structures of compound and non polar residues Met161, Met199, Ile202, Leu207, Ala211, Met103, Leu215, Ala157, Met155, Leu218. The hydrophobic van der Waal's interaction with halogen substituent and the residues Met155, Leu218, Ala157, Ile215, Leu207, Ile202 and Met103 was also found playing a key role. The role of π- π stacking interaction between residues Tyr158 and Ile215 and hydrophobic substituent of compound was also established in docking studies. The conserved water molecules HOH737 and HOH743 are also involved in hydrogen bond formation with polar hydrogen of the co-crystallized ligand (Figure 4).

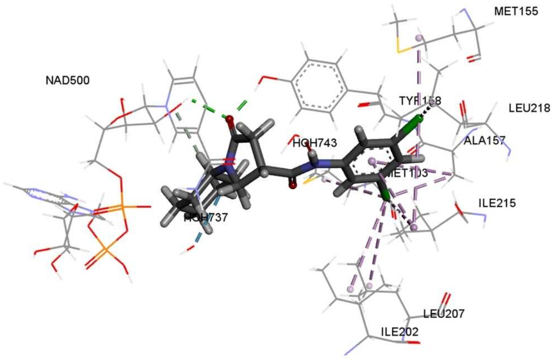


Figure 4. Crystallographic pose of co-crystallized ligand at catalytic site of InhA along with co-substrate NAD and other important residues.

The hydrophobic interaction either with pyridine ring or hydrophobic part of ribose skeleton of co-substrate NADH was also found crucial. The top docked poses of compounds **6f**, **6g**, **6h**, **6i**, **6j** and **6k** were found not producing this hydrophobic interaction which may be responsible for their less thermodynamic stability at the catalytic site and corresponding increase in estimated free energy of binding. The presence of fluoro substituent was also found important in the formation of non-covalent interaction resulting in halogen bond with residues like Gly96, Gln214, Ile202, Met155, Thr162, Pro151 or Gln100. The key interactions for most active compounds **6a**, **6b**, **6c**, **6d**, **6e**, **6l** and **6m** was highlighted in Figure 4. These results of docking studies establish that the substitution of hydrophobic phenyl ring with trifluoromethyl substituent at *ortho* or *para* position has the highest inhibitory potential while other hydrophobic substituents like cyclohexyl, cyclopentyl, propyl and butyl also produce moderate inhibition of InhA enzyme. Polar substituents were found least favorable at the catalytic site and also less active against InhA. These findings could augment further design and enhancement of potency of such inhibitors.

We have synthesized a series of structurally diverse 2,5-disubstitued 1,3,4-oxadiazole derivatives and evaluated their antitubercular activity. The synthesized compound demonstrated significant antimycobacterial activity in $MtbH_{37}Ra$ (**6a**, **6b**, **6c** and **6m**). So, these compounds can be further optimized for drug development which can give promising chemical leads for treatment of TB. Molecular docking studies also support the experimental antimycobacetrial activity and suggest the potential role of these compounds in inhibition of InhA enzyme involved in mycolic acid biosynthesis. Further optimization and design of this scaffold with respect to introduction of non polar functionalities in the molecular structure could lead to potent antimycobacterial agents.

4. Conclusion

We have synthesized a series of structurally diverse 2,5-disubstitued 1,3,4-oxadiazole derivatives and evaluated their antitubercular activity. The synthesized compound demon-

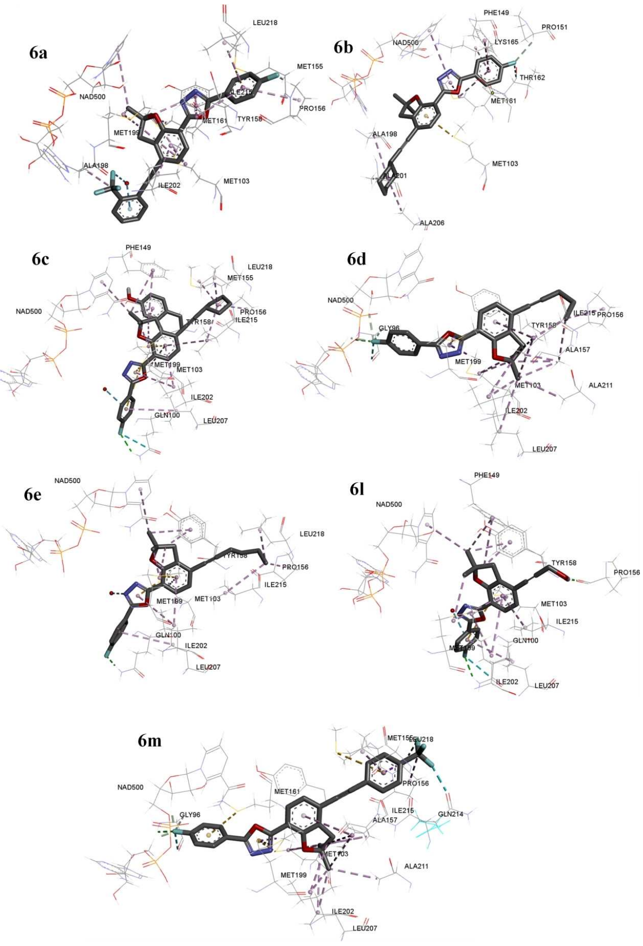


Figure 5. Binding pose and molecular interactions of some representative compound into the active site of InhA .

strated significant antimycobacterial activity in MtbH$_{37}$Ra (**6a**, **6b**, **6c** and **6m**). So, these compounds can be further optimized for drug development which can give promising chemical leads for treatment of TB. Molecular docking studies also support the experimental antimycobacetrial activity and suggest the potential role of these compounds in inhibition of InhA enzyme involved in mycolic acid biosynthesis. Further optimization and design of this scaffold with respect to introduction of non polar functionalities in the molecular structure could lead to potent antimycobacterial agents.

Supporting Information

The spectroscopic data and scanned copies of spectrums (^{1}H-NMR, ^{13}C-NMR, HRMS) for all synthesized compounds are attached as separate supporting Information file.

Acknowledgements

Authors are thankful to Savitribai Phule Pune University, Pune for spectral analysis, SSG thankful to University Grant Commission (UGC) New Delhi for financial assistance, PRES Loni, Principal, Padmashri Vikhe Patil College of Art's Science Commerce, Pravaranagar for providing necessary laboratory facilities and Prof. C. H. Gill, BSR Fellow, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad for constant encouragement.

Conflict of Interest

The authors declare no conflict of interest.

Keywords: Antitubercular agents · 2,2-dimethyl-2,3-dihydrobenzofuran · fluorinated analogues · 1,3,4-oxadiazole · Sonogashira coupling.

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Submitted: July 17, 2018
Accepted: November 22, 2018

SYNTHESIS OF CARBONATES FROM CHLOROMETHYL CHLOROFORMATES AND ITS SOME APPLICATIONS

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ABSTRACT

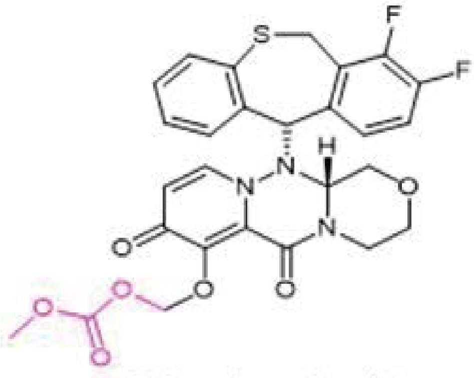
We are developed an efficient, simple and scalable process of various carbonates from chloromethyl chloroformates. This novel methodology procedure offers a very effective and environmentally suitable procedure for carbonates preparation. This conversion offers corresponding carbonates in good to excellent yields. Alkyl carbonates are important role in organic chemistry as well as a biodegradable chemical intermediates because its moderate toxicity.

Keywords: Chloromethyl chloroformate, alcohols, carbonates, 4-dimethylaminopyridine and dimethylformamide

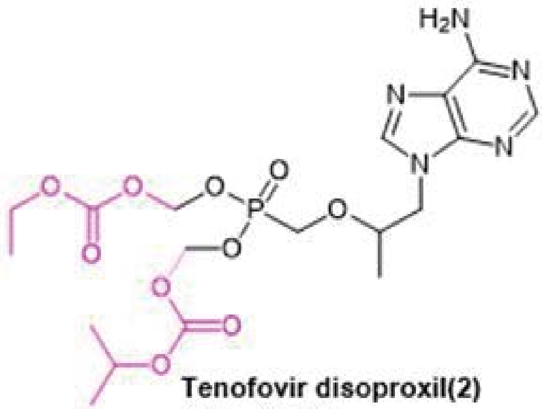
INTRODUCTION

The carbonates are very important role in organic compounds and intermediates due to their unique properties physicochemical as well as versatility chemicals. Organic carbonates are widely used in industrial level as synthesis of plastics, many more pharmaceuticals, herbicides, agrochemicals, additives and as well as lubricants due to its environmentally safe and it easily biodegradability for human health due to their moderate toxicity1. Carbonates are used for the extraction of metals like bismuth, iron, lead, cadmium, gold from acidic solution as salts as well as complexes form2. Many carbonates an excellent polar additives are used for skin cleaners, lipstick, hair conditioners and also in other aromatic products3. The many typical methods of carbonates are using toxic gases like phosgene used, this are used in excess pyridine in anhydrous solvent at different temperatures4. Some methods for carbonate formation using carbon dioxide with alcohol through hemicarbonic acids is also decomposes and unstable to alcohol, it isolated as inorganic salts solids and it high melting inorganic salts5. In direct phosgenation reaction of hydroxyl compounds requires higher temperatures and gets a lower quality as well as yield obtained, also forms a unwanted impurities6. The formation of carbonates from using alcohols and carbon monoxide through metal compounds in particular as mercury, palladium and copper they not get the selective product formation7. Carbonates formation using quaternary ammonium salts, this requires high temperature and yield not satisfactory for scaleble8. Some symmetrical carbonates synthesis of alkyl halides at nucleophilic substitution reactions using TEAC, this results side reactions of alcohol formation so decrease the yield of carbonates9. In the above reported methods have disadvantages are very toxic reagents, unsuitability reaction conditions and it not a biodegradable. It has a unsatisfactory yields, unsuitable for commercial scale up, has no reusability and a limited scope for industrial level. Therefore in last year we are developed new methods for industrial usable and easily commercially produced this products.

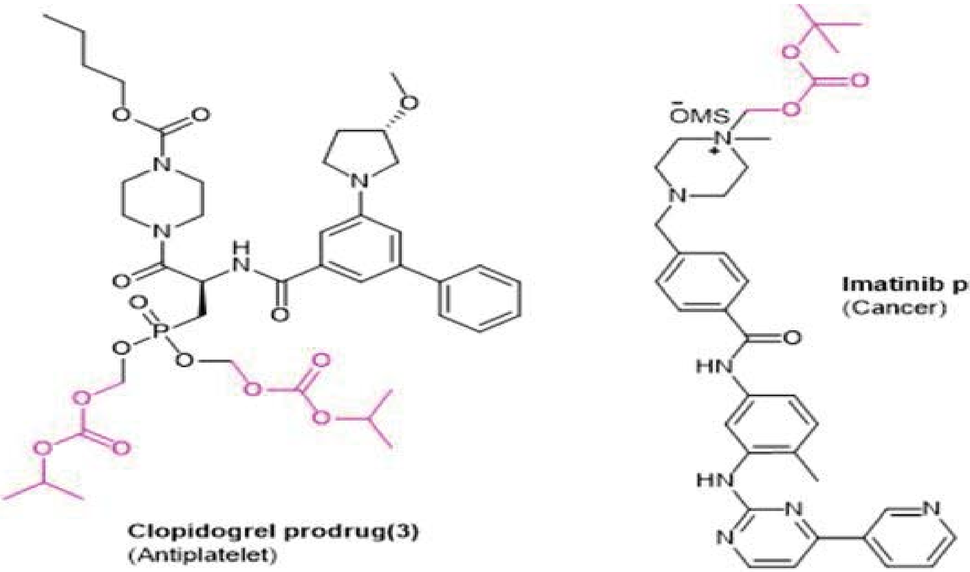
The carbonate compounds as a Baloxavir marboxil(1) is an antiviral medication for treatment of influenza A and influenza B10, Tenofovir disoproxil(2), is a medication used to treat chronic hepatitis B and to prevent and treat HIV/AIDS11, Clopidogrel prodrug(3), is an antiplatelet medication that is used to reduce the risk of heart disease and stroke in those at high risk12, Imatinib prodrug(4), is a medication used to treat cancer, specifically, it is used for chronic myelogenous leukemia (CML) and acute lymphocytic leukemia13 Figure-1.



Baloxavir marboxil(1)
(Antiviral)



Tenofovir disoproxil(2)
(Hepatitis-B)



Clopidogrel prodrug(3)
(Antiplatelet)

Imatinib prodrug(4)
(Cancer)

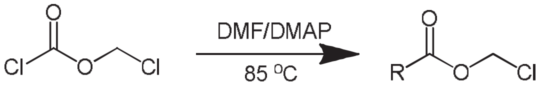
Figure-1: Some biologically active carbonate compounds

In coming days, the carbonate chemistry development is very needful due to its various and wide application in active ingredients, therefore development of carbonate is very numerous and well efforts for development. The chloroformate to carbonate synthesis, many more methods available using pyridine, phosgene intermediates, toxic metals but various drawbacks of this methods like silver carbonate, alkyl halides14, using palladium metals15, antimony trioxide and aluminium trioxide have required higher temperature16, activating agent required such as crown ethers, polyamines17. Considering these reported methods has several drawbacks and several disadvantages for using it drastic condition, hazardous reagents and chemicals, using expensive catalysts, limited scope and environmentally hazardous effluent. So, therefore still need to develop economically valuable and industrial suitable method for carbonate synthesis from chloroformates.

In this development, the chloromethyl chloroformate is synthesis using methyl formate, this process is chlorine gas purged at heating condition to get monochloro derivative of chloroformate it distilled under reduced pressure to get chloromethyl chloroformate23. In this conversion of carbonates synthesis the dimethylformamide and dimethylamino pyridine is easily available in reagent grade. In this method development of protocols easily availability of solvent has much a low toxicity and used in a variety of products24.It has used as a various chemical synthesis as well as a daily routine in pharmaceutical industry, agrochemical and lubricating coating division for various surfaces in aqueous and non-aqueous environments25 .It has been used to for catalytic amount in various synthesis, is a active role in transformation of reaction as good rates26. Therefore in this way, we shows here the one-pot green protocol , catalyst free, yield efficient synthesis of nitriles from aldehydes using polyethylene glycol-200 as a green solvents (Scheme-1).

In conclusion, we have developed a practical, easily scalable, cost efficient with the scope and limitations of catalyst for transformation of chloroformate to carbonates mediated by dimethylamino pyridine and dimethylformamide. Initially we have chosen tert-butanol as a model compound for the desired carbonate formations from chloromethyl chloroformate. We have reacted chloromethyl chloroformate 1 (1.00 mmol) with tert-butanol (5 ml) using dimethylamino pyridine (0.15 mmol) and dimethylformamide(1 ml) as a catalytic solvent and it optimize as a different temperatures for reaction conditions to product forms tert-butyl chloromethyl carbonate 2d(Table 1)

Table-1: Reaction condition optimization.



1

2d

Sr. No	Temperature (^{0}C)	Time(h)	Yield 2d^{b}(%)
1	RT	24	-
2	50	24	42
3	85	9	89

4	85	24	-[c]
5	85	24	23[d]
6	85	24	20[e]
7	100	9	86
8	120	9	89

[a] Reactions are performed using the chloromethyl chloroformate 1 (1.00 mmol), Dimethylamino pyridine (0.15 mmol), Dimethylformamide(1 ml) in tert-butanol (5 ml).

[b] Product isolated yields shows.

[c] Reaction preformed without dimethylamino pyridine.

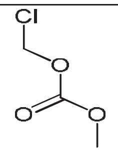
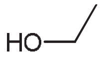
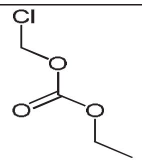
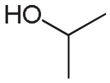
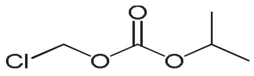
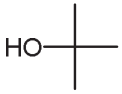
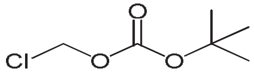
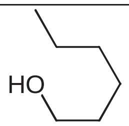
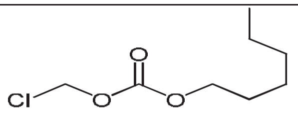
[d] Reaction performed without dimethylformamide.

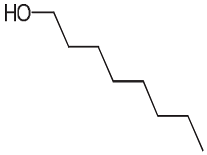
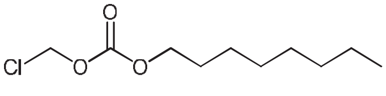
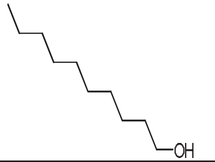
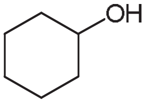
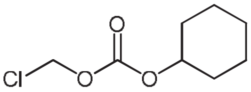
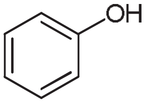
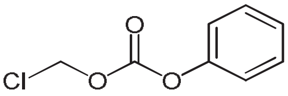
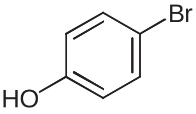
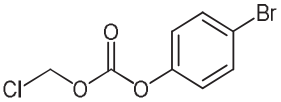
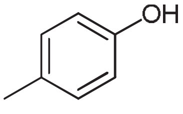
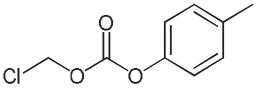
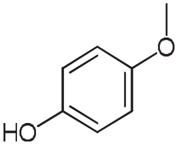
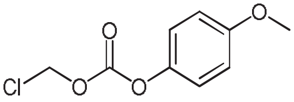
[e] Reaction performed in dimethylamino pyridine and without dimethylformamide.

Table-2: Comparison of yield of 2d with other methods reported in literature

Entry	Catalytic System	Yield (%)	Lit.
1.	Dichloromethane/Pyridine	76	18
2.	Manganese salt with palladium	65	19
3.	Diethyl ether/Pyridine/10	56	20
4.	Pyridine/-10 °C	59	21
5.	Hg(oAc)$_2$/180-200 °C	82	22
6.	Antimony trioxide and aluminum trioxide/195-200 °C	73	16
7.	Present method	89	--

Table-2: Synthesis of Carbonates from chloromethyl chloroformates using various alcohols

Entry	Alcohol	Product(2)	Time (h)	Yield (%)	Boiling Point (^{0}C)/Torr		Ref
					Found	Reported	
1	—OH	 2a	12.5	86	137-139	139-140	27
2		 2b	11	85	133.6-134	135.1	28
3		 2c	14	83	148.5	147.63	28
4		 2d	9	89	156-157.6	160	29
5		 2e	16	89	147.6	145.6-146.1	28

6		 2f	16	85	163.1-164.8	165	29
7		 2g	17	82	165.3	160.5	29
8		 2h	14	65	123.1	128.2-128.7	29
9		 2i	20	70	166	-	29
10		 2j	19	67	136.6	-	30
11		 2k	15	88	173-174.6	174.3-175.1	30
12		 2l	15	86	186.5	-	30

[a] Reactions are performed using the chloromethyl chloroformate 1 (1.00 mmol), Dimethylamino pyridine (0.15 mmol), dimethylformamide(1ml) in alcohols (5 ml).

[b] Product isolated yields shows.

At room temperature product 2d was not formed, chloromethyl chloroformate unreacted as such as shown on Table 1.The reaction was further probed by increasing the temperature at 85°C, the reaction was proceeds smoothly and tert-butyl chloromethyl carbonate 2d was obtained 89 % yield (Table 1,Sr.No.3). Therefore it is observed that the good yield of carbonate was obtained in presence of dimethylamino pyridine and dimethylformamide at 850C (Table 1,Sr.No.3). There is more improvement on reaction time and reaction temperature, but product yield not significant improve as per our expectations (Table 1, Sr.No.7 and Sr.No.8), so 850C was chosen the reaction temperature. When we performed reaction without dimethylamino pyridine no product was formed (Table 1,Sr.No.4). We performed reaction without dimethylformamide, the very less product was formed (Table 1,Sr. No.5). It is also important to mention that when the reaction was performed using dimethylamino pyridine and out dimethylformamide, the 2d product was formed very less (Table 1,Sr.No.6). In an developed reaction condition, chloromethyl chloroformate 1(1.00 mmol), dimethylamino pyridine (0.15 mmol) and dimethylformamide (1 ml) was added in tert-butanol (4 ml) and stir at 850C for 9 h to obtained tert-butyl chloromethyl carbonate 2d in 89 % yield (Table 1,Sr.No.3).

We have optimized that the one-pot transformation of chloromethyl chloroformate to corresponding carbonate using alcohol was maintained to the same extent with structurally diverse alcohols (Table 2). The carbonate formation reaction was almost complete in less than nine hours for all substrates tested by TLC, boiling point were recorded using open capillary and is uncorrected. Carbonates were isolated in good to excellent yields as described in Table 2. The interaction of chloromethyl chloroformate in to dimethylamino pyridine and dimethylformamide to forms C-N- insitu weak bond. Then the C-N- bond easily cleavage through alcohol nucleophilic substitution addition to forms our desired carbonate. Then subsequent expulsion of carbonate to regenerates dimethylamino pyridine and is acting as a catalyst. These reaction process is mechanistically related to oxidation of chloroformate to carbonates. After the reaction condition optimization, a study regarding the reuse of dimethylamino pyridine was not performed due to after reaction completion the reaction mass quenched in water and extracted to dichloromethane. The dimethylamino pyridine was soluble in water and its isolation is shows31 from water.

In day to day life environment pollution is a serious concern to reduced effluent to reduce the pollution, has been an increasing interests to the design of degradable catalyst reactions, a absence of hazardous solvents, low cost, recyclable and environmentally friendly solvents due to reduced effluent to reduce pollution. In mostly all the chemical and pharmaceutical industries observed that the catalysts and hazardous solvents are not always eco-friendly or biodegradable. In this way our development method is superior and promoting environment friendly method due to our method effluent is biodegradable and it minimizes COD and BOD. The dimethylamino pyridine and dimethylformamide has a different combination of chemical and physical properties such as a polarity, no flammability, high boiling point, low toxicity and it easily availability so it promoted to use as good solvent in organic solvents. Therefore we developed here the efficient, one-pot synthesis of carbonates from chloromethyl chloroformate using alcohol as a solvent. The main aspect of dimethylamino pyridine and dimethylformamide in this reaction was established by the fact that in the absence of dimethylamino pyridine and dimethylformamide the formation of carbonates from chloroformates does not takes place. Therefore it conclude that the dimethylamino pyridine and dimethylformamide is an essential component for reaction. In addition optimization, we have performed reaction using tertiary nitrogen base like triethyl amine to gives the less conversion obtained, therefore the role of dimethylamino pyridine and dimethylformamide in this transformation is required.

In conclusion, we have developed here a practical and cost efficient one-pot protocol for the transformation of chloromethyl chloroformate to corresponding carbonates by using corresponding alcohols in presence of dimethylamino pyridine and dimethylformamide as catalyst. These method advantages are wide scope of transformations, it can readily applied to big scale processes at plant level with excellent yield, cost efficient, selectivity, biodegradable effluent for environment secure, and convenient process for preparation of desired product.

ACKNOWLEDGMENTS

The authors are thankful to the DST, New Delhi for financial support and we thanks to Atul Ltd for providing chemicals.

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32. General procedure for synthesis of carbonates from chloromethyl chloroformate: To a single neck round bottom flask chloromethyl chloroformate (1.00 mmol), dimethylamino pyridine (0.15 mmol) and dimethylformamide (1 ml) in respective alcohols (5 ml). The reaction mixture was heated at respective alcohol boiling point to stir at for the time indicated in Table-2. After the completion of reaction was confirmed by TLC (10 % ethyl acetate in hexane) at TLC indicator, then reaction mixture was cooled to room temperature and diluted with water (5 ml). Product (2a to 2l) was extracted in dichloromethane (3 × 3 ml), solvent dried with magnesium sulphate and solvent evaporated under reduced pressure to give the crude residue. The crude residue material was distilled under column packing with respective carbonate boiling point under vacuum. Compounds were characterized and comparison with melting point, 1H NMR, 13C NMR, mass spectra with literatures.

Co-operatives and Workers in the Informal Economy: Possibilities and Challenges

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Abstract:

This paper seeks to overturn these misconceptions by illustrating that co-operatives formed on the basis of self-help can and do assist their members by bringing more benefits to the worker than if the worker remained a sole operator. Co-operatives can also help promote a wider model of socially inclusive development. As a collective representation of often very poor people, co-operatives play wide-reaching roles in the lives of informal workers. Co-operatives can provide income and enhance livelihoods, help workers gain control of and improve their employment conditions, and enhance workers' access to resources, facilities, public institutions, and markets. They can also ensure the inclusion of poor women, empower members to channel concerns in policy circles and influence decisions affecting them, and build strong and sustainable organizations at both local and national levels (Motala 2002).

Key-word:- **co-operative, inclusive development, poor people, livelihoods, resources, public institution, wome empower, Informal Economy.**

Introduction:

The fact that co-operatives can address all these aspects makes them unique. Many of these benefits also characterize other organizational forms seeking to mobilize and help workers in the informal economy – the key difference is that a co-operative is an enterprise. It is through engaging with the market that members organize. It is possible, and it has happened, that workers create another organization first, and then set up a co-operative. In a co-operative, members can be both owners and workers. This enterprise model is as deeply rooted and has as long a history as the investor-owned enterprise model, but it has been relatively little scrutinized in comparison. The paper, seeking to address this gap, begins from the premise that co-operatives are important, if little understood actors in the informal economy.

It aims therefore to map their presence, provide a better understanding of the wider co-operative movement, and explore some of the ways in which co-operatives benefit workers in the informal economy. The paper is based on a literature search, desk research of relevant websites and interviews with key stakeholders.

Overview of the Global Co-operative Movement:

Statistical Shortcomings Up-to-date, accurate information about co-operatives is hampered by the absence of large-scale and comparable data sets for co-operatives. To counter this in recent years, the movement has begun to generate some data on the scale and reach of the co-operative economy, i.e. the top 300 global cooperatives. The challenge now is to ensure data for co-operatives are collected and analyzed by national statistical offices (World Co-operative Monitor 2012). To this end, the International Labour Organization (ILO) is the UN lead agency for co-operatives, and its Department of Statistics provides a comprehensive range of Labour Statistics.

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Impact of E-Banking on Traditional Banking Services

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Abstract - Internet banking is changing the banking industry, having the major effects on banking relationships. Banking is now no longer confined to the branches were one has to approach the branch in person, to withdraw cash or deposit a cheque or request a statement of accounts. In true Internet banking, any inquiry or transaction is processed online without any reference to the branch (anywhere banking) at any time. Providing Internet banking is increasingly becoming a "need to have" than a "nice to have" service. The net banking, thus, now is more of a norm rather than an exception in many developed countries due to the fact that it is the cheapest way of providing banking services.

This research paper will introduce you to e-banking, giving the meaning, functions, types, advantages and limitations of e-banking. It will also show the impact of e-banking on traditional services and finally the result documentation.

Keywords: E-Banking, Functions, Advantages, Limitations, Traditional banking services.

I. INTRODUCTION -

Internet banking (or E-banking)
y user with a personal computer and
can get connected to his banks
perform any of the virtual bankin
internet banking system th

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"CSR and Gender Equality: The Indian Scenario"

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ABSTRACT:

Gender equality, gender equity, women's empowerment, gender non-bias, gender non-discrimination etc. are the buzz words all over the world. In India, supporting to constitutional provisions, to emphasize the need for corporate interventions in the field of equality, the Government of India has included 'Promotion of Gender equality' as a CSR focus area in Schedule VII of New Companies Act-2013 so that the sector can get more funds from companies' CSR budgets. According to Global Gender Gap Index-2016, out of 144 countries, India is ranked 87th on global gender gap, 136th in economic sphere, 113th in educational attainment and only 142nd in health and survival, which reflect the worsened situation of gender disparity in the country. In India, total spending by companies on CSR were Rs. 4701.43 crore in FY 2015, which increased upto Rs. 5521.51 crore in FY 2016, marking 17.44 % overall growth, but the share of the sector reducing inequalities decreased from 04.34 % in 2015 upto 01.08 % in FY-2016 having more than 45% decline. This downturn in CSR spending for the sector is completely paradoxical to the status of gender disparity in India. From the social point of view, the sectors such as slum development and reducing inequalities must be given priority by companies in their CSR programmes because Gender equality is another form of socio-economic equality and equality in development as a whole. CSR initiatives of the companies', addressing the need for gender equity and not just equality, if designed and implemented in proper way should provide the solution for the problem in the long term.

Key words: CSR, Gender equality, women's empowerment, business case for CSR, Schedule VII in Companies Act-2013, CSR spending

"You educate a man; you educate a man; you educate a woman; you educate a generation." - **Brigham Young.**

I - Introduction:

Gender equality, gender equity, women's empowerment, gender non-bias, gender non-discrimination etc. are the buzz words all over the world on various fronts of academicians, policymakers, governments, non-government organizations and contributors in the field. Gender equity focuses on developing support systems for women, whereas the aim of gender equality is to create a level playing field for men and women. In India, the constitutional provisions, which guaranteed all its citizens including women Justice, Liberty and Equality also guaranteed equal political right to both men and women through many provisions. Laws and by-laws have been enacted from time to time by Union and State Governments to protect the women's rights and to provide equal opportunity to them. Article 243 D in the Indian constitution mandates that at least1/3 (33%) out of total seats in all tears of Panchayat must be reserved for women.

Supporting to all these provisions, to emphasize the need for corporate interventions in the field of equality, the Government of India has included 'Promotion of Gender equality' as

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Impact of Goods and Service Tax on Foreign Direct Investment in India

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Abstract :-

With the initiation of globalization, developing countries, particularly those in Asia, have been witnessing a immense surge of FDI inflows during the past two decades. Even though India has been a latecomer to the FDI scene compared to other East Asian countries, its considerable market potential and a liberalized policy regime has sustained its attraction as a favorable destination for foreign investors. This research paper aims to examine the impact of FDI on the Indian economy, particularly after two decades of economic reforms, and analyzes the challenges to position itself favorably in the global competition for FDI. The paper provides the major policy implications from this analysis, besides drawing attention on the complexities in interpreting FDI data in India. This paper will help in analyzing the impact of GST on attracting FDI in India and how it will help in making India's initiative related to FDI a success. The paper will be based on secondary data with relevance to the current economic scenario.

Keywords: Goods and Services Tax, Foreign Direct Investment, Economic Growth, Economic Reforms.

by tertiary sector to agricultural sector.

10)Create Effective Demand :-

The development of agricultural sector would increase the purchasing power of farmers. It will helpful to create demand for non-agricultural sector. In country like India majority of people depend upon agriculture and increase in productivity of cash crops will provide a market for non-agricultural sector.

11) Creation of Infrastructure :-

The agricultural sector requires roads, market yards, storage, railways and many other infrastructural facilities for development. The government provides these infrastructural facilities for development of agriculture. These facilities are also helpful for the development of industrial and commercial sector.

12) Shift of Manpower :-

Agriculture absorbs a large quantity of manpower in India. In India 60% of labour is absorbed by agriculture. In the initial stages agriculture sector shift manpower from agricultural to non-agricultural sector. It is important for economic development as it releases the burden of surplus labour force from agricultural sector to non-agricultural sector. It is necessary for the progress of both agricultural and non-agricultural sector.

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Agriculture Crop Pattern during Post Reform Period and Farm Business

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Abstract:

Post reform period India adopted new economic reforms on regional growth of agricultural sector. For this purpose, it was necessary to analyze cropping pattern for the post reform period. Its progress during last twenty years has been encouraging the strength in production of few cash crops. At the same time, the production of few cereals has been declined in the same period. It has put pressure on food inflation in Maharashtra.To increase the agricultural production of a country is a complex task. The development of agricultural production depends on how effectively people work together as it is on the natural resources with which they begin. According to Gandhian Economic thought to raise the moral as well as the material level of the Indian masses so as to provide a basic standard of life. It aims primarily at improving the economic conditions of over six lakh villages of India and therefore, it lays the great emphasis on scientific development of agricultural.

Introduction:

Maharashtra is one of the developed states in India. It is a place of pride in agricultural development. We can see that cotton, sugarcane, onion, grapes are major cash crops. It is enriched with black soil and better fertility factor.To increase the agricultural taxation. The business must be protected from heavy taxation methods. As SSIs absorb surplus amount of labour in the economy and helps the system in scaling down the extent of unemployment as well as poverty; every measure should be taken in the forthcoming GST to protect it.

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Impact of GST on Tax Structure

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Introduction:

Taxation system is a backbone of any country's economy. To increase GDP, generate employment, build infrastructure etc. Tax system plays a very important role. Every country generates revenue through different tax system. To understand the global scenario of tax system we need to see how different developed countries deploy their tax system. In India, a dual GST is being implemented wherein a Central Goods and Services Tax (CGST) and a State Goods and Services Tax (SGST) is levied on the taxable value of a transaction

Taxation system in India:

Taxes in India are levied by the Central Government and the state governments. Some minor taxes are also levied by the local authorities such as the Municipality and village panchayats. The authority to levy a tax is derived from the Constitution of India which allocates the power to levy various taxes between the Central and the State. An important restriction on this power is Article 265 of the Constitution which states that "No tax shall be levied or collected except by the authority of law". The GST is expected to streamline the indirect tax regime. It contains all indirect taxes levied on goods, including central and state-level taxes

TAXATION SYSTEM IN INDIA (PRIOR TO GST)

The bill, after ratification by the States, received assent from Hon. President Shri. Pranab Mukharjee on 8th September 2016, and was

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Recent Developments and Government Initiative in Indian Economy

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1.1 Introduction

India has arisen as the fastest developing major economy in the world & is expected to be one of the top three economic powers of the world over the next 10-15 years, backed by its strong democracy & partnerships.

1.2 Market size

India's GDP is estimated to have increased 6.6 per cent in 2017-18 & is expected to grow 7.3 per cent in 2018-19. In April-July quarter of 2018-19, the GDP grew by 8.2 per cent.

India has retained its position as the third largest startup base in the world with over 4,750 technology startups, with about 1,400 new start-ups being founded in 2016, according to a report by NASSCOM.

India's labour force is expected to touch 160-170 million by 2020, based on rate of population growth, increased labour force participation, & higher education enrolment, among other factors, according to a study by ASSOCHAM & Thought Arbitrage Research Institute.

India's foreign exchange reserves were US$ 400.49 billion in the week up to September 14, 2018, according to data from the RBI.

1.3 FDI in India

India has been ranked 11th in the Global FDI Confidence Index 2018, making it the 2nd highest ranked emerging market for FDI.

FDI equity inflows to India reached US$ 35.84 billion during 2017-18* while the cumulative FDI equity inflows to the country from April 2000 to December 2017 reached US$ 368.05 billion.

1.4 Recent Developments

With the improvement in the economic scenario, there have been various investments in various sectors of the economy. The M&A activity in India increased 53.3 per cent to US$ 77.6 billion in 2017 while private equity (PE) deals reached US$ 24.4 billion. Some of the important recent developments in Indian economy are as follows:

Around 10.8 million jobs were created in India in 2017.

Companies in India have raised around Rs 21,000 crore (US$ 2.88 billion) through Initial Public Offers (IPO) in 2018 (up to August).

Exports from India increased 20.7 per cent year-on-year to US$ 221.83 billion in April-August 2018.

Income tax collection in the country reached Rs 10.03 lakh crore (US$ 137.75 billion) in 2017-18.

India has improved its ranking in the World Bank's Doing Business Report by 30 spots over its 2017 ranking & is ranked 100 among 190 countries in 2018 edition of the report.

India is expected to have 100,000 startups by 2025, which will create employment for 3.25 million people & US$ 500 billion in value, as per Mr T V Mohan Das Pai, Chairman, Manipal Global Education.

India's Foreign Direct Investment (FDI) equity inflows reached US$ 389.60 billion between April 2000 & June 2018, with maximum contribution from services, computer software & hardware, telecommunications, construction trading & automobiles.

India's Index of Industrial Production (IIF rose 5.4 per cent year-on-year in April-July 2018

India's ranking in the world has improve to 126 in terms of its per capita GDP, based o purchasing power parity (PPP) as it increase

8. A Review of Cashless Policy in India

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Introduction

Our current Prime Minister, Shri Narendra Modi, took the whole world by surprise when he announced on 8 November 2016 that the currency notes of denominations Rs.1,000 & Rs.500 were no longer legal tender.

What was seen as a move towards checking the menace of black money in the country, soon paved the way for India's push to becoming a cashless economy.

"Paperless, Cashless" is one of the goals of Digital India. Numerous benefits have been associated with transforming India into a cashless society. Some of the major advantages include:

- Brings transparency into the system.
- Helps to fight against corruption.
- Will increase the tax base.
- Reduces costs incurred on the minting of coins & printing paper notes.
- Cashless transactions are faster & secure.
- Lower transaction costs.
- A boost to the country's Economic Growth.
- The biggest advantage of cashless India is in the promotion of Financial Inclusion of the people.

If implemented properly, a cashless India can really become a reality rather than just a distant dream. However, it remains to be seen if our country is actually ready to go cashless.

Designating or of financial transactions handled as by means of credit cards, bank transfers, & checks, with no bills or coins handed from person to person: some say we are headed toward a *cashless* society

Example

Credit card processing blink cards is an innovation designed to make **cashless** consumer purchases faster, unique & fun to do while boosting sales for retailers.

- The game is truly coming to grips with our seemingly **cashless** society that we have adapted to.

Conclusion:

PMFMY offer good opportunities for farmers to deal with risk in agriculture. It is observed that the annual growth in farmer insured has increased around 32.8 % in Kharif-2016 compared to Kharif-2015. It also seen that in terms of area insured has increased by about 35.4 % in Kharif 2016 compared to Kharif 2015. It can be seen that number of farmer benefited has reduced 75.5 lakh to 26.97 lakh during Kharif -2015 to Kharif-2016, It can conclude that number of benefited farmer has reduced to -62.28 % from Kharif-2015 to Kharif-2016. Implementation agency should take infinite to more benefit to farmer. It is also suggest that insurance company should transfer claimed amount to farmers account.

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Role of Agriculture in the Indian Economy

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Abstract

From the evolution of human history it is found that agriculture plays important role. In the case of developing countries the share of agriculture sector is higher in the Gross Domestic Product (GDP) compare to developed countries. Agriculture occupies a prominent place in all economic in the world. It contributes in national income, provides raw material, source of foreign exchange, employment, international trade. The development of any country is not possible without the development of its agricultural sector.

Agriculture is largest and most important sector of the Indian Economy. It is backbone of the Indian economy, although the share of agriculture in the total national income has been decreasing on account of development of the industrial and service sector. But still agriculture play important role in the economic development of the country.

The contributions of agriculture may be explain as follows.

1) Share in national income:-

The share of agriculture in national income has fallen with the fastest development of non-agricultural sectors in recent years. Yet India accounts for 7.68 percent of total global agricultural output. Contribution of Agriculture sector in Indian economy is much higher than worlds average (6.1%) Indian agriculture sector accounts for 18 percent of India's gross domestic product (GDP). The contribution of agriculture

Online International Interdisciplinary Research Journal, {Bi-Monthly}, ISSN 2249-9598, Volume-09, Issue-02, Mar-Apr 2019 Issue

Use of Digital Libraries and Information and Communication Technologies in Research

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Abstract

Education plays vital role in economic and social development of any country. In modern world, use of Information and Communication Technologies (ICT) has dramatic effects in carry out their functions of teaching, learning and research. In higher education research is needed for the development of student and teacher. Digital libraries play an important role in research by helping researcher in their work completion and publication. The emergence of modern libraries with ICT facilities has opened new ways of accumulating and regulating scientific and technical information to the researcher. This paper deals with the important of digital libraries in research work.

Introduction :-

ICT in higher education enhances the quality of research work. It also saves time, money and efforts of the researchers in their pursuing research. Use of ICT's in libraries has become great for the researcher as they open up wide variety of information according to their need. E.library, shodhaganga, inflibnet are some resources which help researchers for servery of literature, references regarding their research work.

ICT tools have become backbone of the research activity. Researcher conduct their surveys online and trying to reach their goals using online resources. Academic libraries provide greater service to accomplish the researcher goals. Academic libraries facilitate universal access of scholarly brains and they allow scholarly community to accomplish their goals efficiently.

ICT Application in Academic Libraries.

In this internet era the new technologies have changed the methods of information storage and retrieval in academic library field. Libraries can store huge amount of information using new technologies and transmit it anywhere, anytime without any obstacles. ICT's facilitate for rapid transmission of information globally through its networks which helps researcher to get information regarding his subject. It also helps library professionals to manage their housekeeping and documentation activities like circulation, acquisition, maintenance of catalogue, periodical management etcs. These innovative technology also help researcher in compiling bibliographies, indexing and abstracting.

E-learning in Academic Libraries

ICT's in libraries give more dynamic information to the scholars who need to gain specialized knowledge. ICT tools have changed traditional teaching methods and made distance more effective for its user. ICT provides up-to-date information. The use of ICT in education lends more student centered learning, before that education was associated with strong teachers having high degrees. With the world moving rapidly in to digital media, the role of ICT in education is becoming more and more important and this importance will continue to grow in the 21th century. Being aware

10. Effect of Cashless Transaction to Customer

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Abstract

This paper focuses on types of cashless payment and its impact on customers in India Indian Government accepted cashless policy to reduce cash related robbery, reduce risk of carrying cash, cash related corruption and attract more foreign investors to India. Modernization in payment system will also reduce cost of banking system and banking related corruption.

Electronic banking will made banking transaction easier to its user. Cashless transaction will also reduce the problem of corruption and Black Money.

Introduction

The demonetization in November 2016 led many different consequences and there is much debate regarding its benefits. One of the positive aspect regarding demonization is, that it provided to the progress towards a digital and cashless society. After governments demonetization the Indian people started adopting the modern ways of cashless payment options.

There are many cashless payment options available in Indian economy such as

1) Cheque
2) Demand Draft
3) Online Transfer NEFT /RTGS
4) Gift Card
5) Unstructured Supplementary Service Data (USSD)
6) E Wallets- paytm, free charge etc.
7) UPI- Unified payment interface Apps
8) Plastic Money- Debit / Credit Cards
9) Not Banking – Online fund Transfer
10) Aadhaar Card – Aadhaar unable payment system.

डॉ. बाबासाहेब आंबेडकरांचे आर्थिक विचार

प्रा. डॉ. सौ. अनुपमा गांधी
कला विज्ञान व वाणिज्य महाविद्यालय,राहाता, ता.राहाता. जि.अहमदनगर

डॉ. बाबासाहेब आंबेडकर हे आपल्या देशातील महान व्यक्तीं पैकी एक होते. त्यांचा जन्म 1891 साली झाला.त्यांनी एम.ए. पी.एच.डी. होमसायन्स या पदव्या अर्थशास्त्र विशया संदर्भात मिळवल्या वरील तीन पदव्यांना अनुक्रमे पुढील तीन प्रबंधासाठी मिळाल्या.

1.ईस्ट इंडीया कंपनीचे प्रशासन आणि वित्तप्रणाली

2.ब्रिटीश भारतातील प्रांतिकवित्ताची उत्क्रांती

3.भारतीय रुपयाचा प्रश्न व त्यावर उपाय

•आर्थिक विचारांमधील योगदान

भारतीय अंदाजपत्रके, घटनेवरील भाशणे इंडिपैंडंट लेबर पार्टी आणि शेडयुल कास्ट फेडरेशन यांचे जाहिरनामे यातून प्रामुख्याने त्यांचे आर्थिक विचार व्यक्त झालेले दिसतात.

❖ शोध निबंधातील आर्थिक विचार

अ)ईस्ट इंडिया कंपनी प्रशासन व वित्तप्रणाली

डॉ. आंबेडकरांनी 1915 मध्ये ईस्ट इंडिया कंपनीचे प्रशासन आणि वित यावर एम.ए. या पदवीसाठी शोधनिबंध लिहिला होता. निबंधाच्या अंतिम भागात त्यांनी ब्रिटीश राजवटीचे भारतातील योगदान आणि शोषण या दोन्ही बाजूचा उल्लेख केला. भारतातील कार्याबददल इंग्रजांना समाधान वाटण्यास फार थोडी जागा नक्कीच आहे, त्यांनी भारतीयांना दिलेली महत्व पुर्ण गोष्ट म्हणजे शांती. पाश्चिमात्य शिक्षणाची सुरुवात करुन त्यांनी एकापुरातन राष्ट्राच्या आधुनिक संस्था व जीवनाच्या संपर्कात आणले. त्यांनी दिलेले प्रशासन सशक्त व परिणामकारक आहे. पण भारताने इंग्लंडला जेवढे दिले `त्यामानाने इंग्लंडचे योगदान काहीच नाही. भारतातील सोन्या चांदीच्या साठयात इंग्लंडने कोणतीच भर टाकली नाही.उलट येथील संपत्ती लुटून नेली.

डॉ. बाबासाहेब आंबेडकरांनी ईस्ट इंडिया कंपनीच्या वित प्रणालीचे

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पिकरचना बदल आणि शाश्वत शेती : विशेष अभ्यास पद्मश्री डॉ.वि. विखे पाटील सहकारी साखर कारखाना कार्यक्षेत्र

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१. प्रस्तावना :

प्राचीन काळापासुन भारत कृषी प्रधान अर्थव्यवस्था असलेला देश म्हणून ओळखला जातो. भारतामध्ये भारतीयांनी शेती व्यावसाय उपजिवीकेचे साधन म्हणून स्विकारण्याऐवजी जीवनपद्धती म्हणून स्विकारलो आहे. स्वातंत्र्योत्तर काळात देशात औदयोगिकरणाचे प्रयत्न केले गेले असले तरी भारतीय अर्थव्यवस्थेत शेतीचे स्थान महत्त्वाचे आहे.

कोणत्याही अर्थव्यवस्थेत शेती व्यवसाय प्राथमिक क्षेत्रात सामाविष्ट होतो. जसा जसा अर्थव्यवस्थेचा विकास होत जातो. तस तसे प्राथमिक क्षेत्राचे महत्त्व कमी होते. परंतु भारतीय अर्थव्यवस्थेत भारतीय शेतीच्या वैशिष्टयांमुळे शेती क्षेत्राला महत्त्वाचे स्थान आहे. भारतातील शेती व्यवसाय आजही निसर्गाच्या लहरीवर अवलंबुन आहे. स्वातंत्र्योत्तर काळात भारतीय शेतीचे अनेक चढउतार अनुभवलेले आहेत. असे असुन देखील ढोबळ मानाने भारतीय शेतीची कामगिरी नोंद घेण्याइतपत चांगली झाली आहे. १९७०-७१ पासुन गेल्या तीन दशकात कृषी उत्पादनाचा निर्देशांक कृषी उत्पादनात वाढ झालेली दर्शविते. हा निर्देशांक १९७०-७१ मध्ये ८५.९ तर १९९०-९१ मध्ये १४७.४ तर १९९८-९९ मध्ये १७७.२ होता. अन्नधान्य उत्पादन निर्देशांकाचा विचार करता त्यामध्ये १९७० ते १९९८-९९ या कालावधीत ८७.९ पासुन १६४.८ पयंत वाढ झाली आहे. अन्नधान्याव्यतिरीक्त इतर उत्पादनांनी ठळक प्रगती नोंदविली आहे. या काळात हा निर्देशांक ८२.६ वरून ११८.१ इतका वाढलेला आहे. विशेष ध्यानात घेण्यासारखी बाब म्हणजे विविध डाळींच्या उत्पादनांचा निर्देशांक ११३.६ वरून १४५.० इतका वाढला आहे. म्हणजेच ३० वर्षांत ही प्रगती फारशी समाधानकारक नाही म्हणून अन्नधान्य व इतर पिकांच्या उत्पादनात कसा बदल होत गेला. हे तपासुन पाहणे जरूरीचे ठरते. त्यासाठी पिकांच्या आकृतिबंध आणि त्यातील बदल लक्षात घेणे आवश्यक ठरते.

१९२० नंतर भारताची लोकसंख्या वाढली आहे. वाढत्या लोकसंख्येसाठी अन्नधान्याची वाढती गरज निर्माण झाली. भारताच्या फाळणीमुळे भारताला गव्हाचा प्रदेश (पश्चिम बंगाल), कापूस पकिवणारा प्रदेश (सिंध) व ताग पिकवणारा प्रदेश (पुर्व बंगाल) हे सर्व प्रदेश गमवावे लागले. त्यामुळे अन्नधान्य आणि शेती आधारित उद्योगांना आवश्यक असणारा कच्च्या मालाचा पुरवठा वाढविण्यासठी पहिल्या पंचवार्षिक योजनेच्या काळात (१९५०-५१ ते १९५५-५६) शेती क्षेत्राला अग्रक्रम देण्यात आला. आणि या योजनेत एकूण योजना खर्चापैकी (१९६० कोटी रूपयांपैकी ६०० कोटी) ३१ टक्के रक्कम शेती क्षेत्रावर खर्च करण्यात आली. याच काळात खजगी क्षेत्राने शेती क्षेत्रावर सुमारे १५७ कोटी खर्च केला.

परिणामी १९६० सालाच्या मध्यावर हरितक्रांतीची पंजाब हरियाणा प्रांतात सुरूवात होऊन दशकाच्या शेवटी ती देशातील इतर राज्यात पसरली. हरितक्रांतीतून शेती उत्पादन लक्षणीय वाढ झाली. त्याच बरोबर शेती क्षेत्राची गणिते ही बदलली . शेतकरी जीवन पद्धती म्हणून स्विकारलेल्या शेती व्यवसायाकडे व्यापारी दृष्टिकोनातुन पाहु लागले. कृषी क्षेत्राच्या संशोधनातुन सुधारित बी- बीयाणांचा कार्यक्रम राबविला गेला. सिंचनाच्या सुविधा विकसित झाल्या. परिणामी पिकांचा आकृतिबंध (रचना) बदलला. अलीकडच्या काळात खजगीकरण, उदारीकरण, जागतिकीकरण यामुळे बदल होत आहेत. म्हणून पिक रचनेतील बदलाचा अभ्यास उपयोगी ठरेल.

१.२ शोध प्रबंधाच्या विषयाचे महत्त्व :

पिक रचनेतील विविधता ही संकल्पना फार जुनी असुन भारतीय शेतकरी पुर्वपार त्याचे पालन करत आहेत. शेतकऱ्याकडे उपलब्ध असणाऱ्या क्षेत्रामध्ये विविध पिके घेणे म्हणजे पिक आराखडयातील विविधता होय.

आलिकडच्या काळात सिंचन सुविधा मध्ये झालेला विकास. कृषि क्षेत्रातील तंत्रज्ञानामधील प्रगती, जागतिकीकरण व ग्राहकाच्या बदलत्या आवडीनिवडीमुळे विविष्ट शेतमालाला मिळणाऱ्या चांगल्या किंमती, पोष्टीक आहार संकल्पनेमुळे फळे, भाजीपाला, पिकांना आलेले महत्त्व कृषि प्रक्रिया उद्योगाची वाढ शेती व्यवसायातील वाढता उत्पादन खर्च, शेतमालाला विक्री व्यवस्थेतील बदल, तसेच रासायनिक खते, औषधे यांच्या वापरामुळे उत्पादनात जरी वाढ झाली तरी जमिन व पर्यावरणाचा ऱ्हास होऊन अन्नधान्य पिके, ऊस, आता फायदेशीर न राहिल्याने पीक आराखडयामध्ये बदलाची आवश्यकता निकडीने जाणवू

VOLUME - VIII, ISSUE - I - JANUARY - MARCH - 2019
AJANTA - ISSN 2277 - 5730 - IMPACT FACTOR - 5.5 (www.sjifactor.com)

10. Cashless Policy and Mobile Wallets: A Case Study of Paytm

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Introduction

The recent revolution of technology for financial transactions situations motivating questions for policy makers. The financial institutions regarding the suitability of current institutional arrangements and availability of instruments to promise financial stability, efficiency, effectiveness of monetary policy and achievement of sustainable economic growth in India Over the course of history, different methods of payment systems have been in reality. Initially barter system was common. However, the problems of barter system such as the double coincidence of wants necessitated the introduction of various forms of money. But, analysts have been forecasting the complete demise of study instruments and the emergence of potentially superior substitute for cash or monetary exchanges that is cashless society (Wikipedia 2011).

On 8 November 2016, the Government of India announced the Demonetization of Rs.500 and Rs.1000 banknotes . The push for the digital payments was one of the listed purpose of the demonetization. There was immediate and sharp jump in the digital payments in November – December 2016 owing to shortage of cash. The mobile wallet transaction select by people immediately after the demonetization. They followed by dip in mid 2017 due to facility cash shortage. There was again sharp rise thereafter. By April2018, the volume of the digital payments had doubled. After return of the cash , the growth had been modest.Reserve Bank of India (RBI) data, we shows that demonetization did a large positive impact on digital payments. In fact, based on one metric, the volume of digital payments in India has doubled thanks to demonetization.

Importance of the Study

Cash Less Transactions are referred to the economy where no liquid money is used. All the transactions are carried out using by electronic means. A Cash Less transaction is nothing but electronic transaction of one's money with aid of Internet banking, credit card, debit card,e-wallet etc. Cash Less transaction helps to authenticate financial transactions and maintain proper

Government should promote more credit lending through the co-operative society. Although nationalized banks are available in the villages but still it is not available to each and every village so huge crowd is observed in the bank. Therefore credit co-operative societies can be better option for them.

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महाराष्ट्रातील शेती व्यवसाय आणि पीकरचना बदलाचा अभ्यास

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प्रस्तावना

प्राचीन काळापासून भारत कृषी प्रधान अर्थव्यवस्था असलेला देश म्हणून ओळखला जातो. भारतामध्ये भारतीयांनी शेती व्यावसाय उपजिवीकेचे साधन म्हणून स्विकारण्याऐवजी जीवनपद्धती म्हणून स्विकारली आहे. स्वातंत्र्योत्तर काळात देशात औद्योगिकरणाचे प्रयत्न केले गेले असले तरी भारतीय अर्थव्यवस्थेत शेतीचे स्थान महत्त्वाचे आहे.

कोणत्याही अर्थव्यवस्थेत शेती व्यवसाय प्राथमिक क्षेत्रात सामाविष्ट होतो. जसा जसा अर्थव्यवस्थेचा विकास होत जातो. तस तसे प्राथमिक क्षेत्राचे महत्त्व कमी होते परतु भारतीय अर्थव्यवस्थेत भारतीय शेतीच्या वैशिष्टयांमुळे शेती क्षेत्राला महत्त्वाचे स्थान आहे. भारतातील शेती व्यवसाय आजही निसर्गाच्या लहरीवर अवलंबून आहे स्वातंत्र्योत्तर काळात भारतीय शेतीचे अनेक चढउतार अनुभवलेले आहेत असे असुन देखील ढोबळ मानाने भारतीय शेतीची कामगिरी नोंद घेण्याइतपत चागली झाली आहे १९७०–७१पासुन गेल्या तीन दशकात कृषी उत्पादनाचा निर्देशाक कृषी उत्पादनात वाढझालेली दर्शविते हा निर्देशाक १९७०–७१ मध्ये ८५.९ तर १९९०–९१ मध्ये १४७.४ तर १९९८–९९मध्ये १७७ २ होता. अन्नधान्य उत्पादन निर्देशांकाचा विचार करता त्यामध्ये १९७०ते १९९८–९९ या

जनसंचार माध्यम और हिंदी

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'भाषा मनुष्य को मिला एक उपहार है।
मानव के गले को नवलखा हार है।
सबके दिलों का श्रृंगार है।
सबको संतुष्ट करने का साज है।'

हिंदी भाषा हमारी राष्ट्रभाषा है। सन् २००१ की जनगणना प्रमाण ४१ प्रतिशत भारतियों की मातृभाषा हिंदी है। २१वीं सदी विज्ञान एवं तकनीकी की सदी है। इस सदी में सूचना प्रौद्योगिकी में जनसंचार माध्यम महत्वपुर्ण भूमिका निभा रहें है। ज्यादातर जनसंचार माध्यम, जैसे की दूरदर्शन, रेडिओ, समाचार–पत्र, इंटरनेट, मोबाईल आदि माध्यम हिंदी भाषा का ही प्रयोग करते हैं। स्वतंत्रता मिलने के ७२ साल बाद हिंदी भाषा के प्रचार प्रसार में जनसंचार माध्यमों का योगदान अधिक रहा है। जनसंचार माध्यमों के विस्तार में भी हिंदी भाषा का योगदान सराहनीय है। दोनों का संवंध अटूट है। यहाँ हम कुछ प्रमुख माध्यमों का जिक्र कर रहें हैं।

मुद्रित जनसंचार माध्यम और हिंदी :–

आज की स्थिती में भारत में कुल मिलाकर १००० हिंदी दैनिक समाचार पत्रिकांचे प्रकाशित होते है। हर दिन लगभग ८० मिलियन प्रतियों की खपत होती है। 'दैनिक जागरण' 'दैनिक भास्कर','अमर उजाला','नवभारत टाइम्स','हिंदूस्थान दैनिक', 'राजस्थान पत्रिका' आदि प्रमुख दैनिक समाचार पत्रिकाएँ हैं। हिंदी भाषा का प्रसार अंग्रेजी की तुलना में पाँच गुणा ज्यादा है। इसका प्रत्यक्ष प्रमाण यह है कि, हिंदी दैनिक समाचार पत्रिकाओं के पाठक १८८.६८ मिलियन हैं, जब कि अंग्रेजी के वाचक ३८.७६ मिलियन हैं।

आध्यात्मिक ज्ञान के प्रचार–प्रसार में भी मुद्रित जनसंचार माध्यमों ने अगला स्थान प्राप्त किया है। प्रजापिता ब्रम्हाकुमारी ईश्वरीय विश्व विदयालय, आबु शिखरस्थित आध्यात्मिक ज्ञान को शिक्षा देनेवाली एक अग्रसर संस्था है। विश्व में शांती एवंम सुखमय संसार स्थापन करने हेतू पिछले ८२ सालों से यह संस्था कार्य करती है। 'ज्ञानामृत' 'ओम शांति मीडिया' यह इनके मासिक और पाक्षिक पत्रिकाएँ है जो कि हिंदी भापा में ही है। लाखों जिज्ञासुओं ने यह पत्रिकाएँ है जो कि हिंदी भाषा में ही है। लाखों जिज्ञासुओं ने यह पत्रिकाएँपढकर अपना जीवन सँवारा है। इन पत्रिकाओं में प्रसारीत होने वाले लेख, कविताएँ सरल और सुगम हिंदी में होने के कारण जिज्ञासुओं के दिल को छू जाते हैं। संस्था का पूरा कारोबार भी हिंदी भापा में ही चलता है। हिंदी भापा उपयोग के कारण अहिंदी भाषी राज्यों में भी संस्था का अच्छा विस्तार है।

इलेक्ट्रॉनिक जनसंचार माध्यम और हिंदी:–

विज्ञान तकनिकी इतनी तेजी से विकसीत हो रहा है कि आज बटन दबाते ही हजारो दूरदर्शन चैतल्स उपलब्ध होते है। संपुर्ण जगत में भारतीय लोग ज्यादातर हिंदी चैतन्य देखनाही पसंत करते है। हिंदी की गरिया पुरे जगत में फैलाने एवंम उँचा उठाने में इन चैनल्स की भूमिका अत्यंत महत्वपुर्ण है। दूरदर्शन पर खास सिनेमा, आध्यात्म, मनोरंजन, बच्चों के लिए कार्यक्रम आदि स्वतंत्र चैनल्स है। महिलाओं की रुची और उनके व्यक्तित्व को निखारने हेतू 'खाना खजाना' 'आपकी सहेली' आदि कार्यक्रम प्रसारित किये जाते है। 'आस्था', 'जागरण' 'संस्कार' एवंम 'पीस ऑपफ माइंड', यह दुरदर्शन चैनल्स विशेप आध्यात्मिकता में रुची रखनेवाले प्रेक्षकों को ध्यान में रखते हूए प्रसारित किये जानेवाले चैनल्स है। हिंदी के उपयोग के कारण अनेक शाख जो संस्कृत में ये, वह भक्तों को सहज इन

16. Text-Based Films: An Effective Tool for the Teaching and learning of English Literature

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Today's generation is more exposed to media especially electronic media. Students enjoy studying of literature if it is taught with the help of media. In this era of cut-throat competition and high-scoring, the students do not wish to learn literature- and when it comes to the literature of English in rural India; they are unwilling to opt for these courses. Therefore, it is the need of the time to incorporate films in the curriculum of English literature. A modern teacher of English should use this tool effectively not only in making her teaching of English literature interesting, but also to sustain the interest of the students in the study of English literature.

The students of the present generation need to be handled very tactfully than ever. A vast world of internet and e-learning is open to them on a click/touch. You Tube, various websites and many more things on the social media attract (or distract?) their attention rather than sitting in the class and listening to the teacher. Therefore, they are questioning 'Why to study literature?' The teacher's answer to the question that the literature inculcates human values, gives a wide/global perspective of life do not satisfy them. In this type of situations, the media can be used effectively to fulfill their quest of knowledge. Almost every textbook/text prescribed for the undergraduate classess by our universities have film versions or video clips available. They must be screened before and after the text is taught. The teacher can also motivate the students to make short documentaries/films with the help of advanced electronic gadgets like smart phone, tablet etc. These activities would certainly attract the students towards the departments of English and they find it fruitful to study the literature of English. When they enjoy studying literature thoroughly in this way; they will automatically get good marks and good jobs, too.

Screening of text-based films

It is a wonderful practice to screen text-based films while teaching English literature- especially short stories, one-act plays, drama and novel. The present researcher has been using this tool for many years. To take a few examples, the Savitribai Phule Pune University, Pune has prescribed literature papers for the undergraduate level as 'Appreciating Drama', 'Appreciating

अनुवाद समाधान और समस्याएँ

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प्रस्तावना :

टनुवाद अँग्रेजी भाषा के ज्तंदेसंजपवद शब्द का हिंदी पर्याय है। मूलत: ज्तंदेसंजपवद शब्द लैटिन शब्द से इस प्रकार बना है ज्तंदे (पार) स्ंजपवद (ले जाना) अर्थात एक पार से दूसरी पार लेजाना, इस अर्थ में ज्तंदेसंजपवद शब्द का प्रयोग होता है। भारतीय साहित्य में अनुवाद 'पुनर्कथन' आदि के लिए प्रयुक्त होता रहा है। अनंत प्रकाश खेमाणी–अनुवाद का अर्थ है ''वह प्रक्रिय है, जिस में समानार्थ क शब्दों के माध्यम से एक भाषा में व्यक्तकिए गए विचारों का यथा संभव, यथातथ्य रुप में दूसरी भाषा में स्थानांतरण किया जाए।''[१]

अनुवाद एक कलात्मक प्रक्रिया है– एक भाषा के शब्दों को दूसरी भाषा में संप्रेषित करने का साधन अनुवाद है। किसी स्रोत भाषा के कथन के अर्थ को किसी लक्ष्य भाषा में रुपांतरित करने की प्रक्रिया अनुवाद है। अनुवाद में केवल शाब्दिक स्तर पर ही नहीं अर्थ प्रस्तुति और भाषिक सौंदर्य भी अपेक्षित होता है। अनुवाद प्रक्रिया में विषय की स्पष्टता, भावों की उचितव्याख्या, शब्दो की अर्थ–संकल्पना, सांस्कृतिक पृष्ठभूमि बहुत महत्व रखते हैं। अनुवादक को प्रसंग के अनुसार अर्थ समझकर विशिष्ट अर्थ को विंशिष्ट शब्द में प्रयुक्त करना पडता है। प्रसंग के साथ शब्दार्थ का समन्वय अनुवाद के लिए सबसे जरूरी होता है।

अनुवाद का महत्त्व :

विश्व में अनेक भाषाएँ है। हर पाठक हर रचना का रसास्वादन करना चाहता है। किंतु भाषा की भिन्नता और पाठक की भाष अज्ञानता इसमें बाधक बनते हैं। इस बाधा का निराकरण अनुवाद करता हैं अनुवादही वह माध्यम है, जो एक भाषा में लिखी हुई संस्कृति का रसास्वादन किसी भी भाषा के पाठक को करा सकता है। जैसे उमर खैयाम की रुबाइयों का रस अनुवाद के माध्यम से ही अंग्रेजी के पाठक उठा सके है। रामचरित्रमानस के काव्य सौंदर्य का उद्‍घाटन दूसरी भाषा के पाठकों के समक्ष अनुवाद के माध्यम से ही हुआ है। हमारी गीता, बिहारीसतसई, कामायनी पश्चिमी देशों में अनुवाद के माध्यम से ही सहृदय पाठकों को आहलादित और रससिक्त करती रही है।

विश्व में अनेक संस्कृतियाँ हैं। अनुवाद के माध्यम से सांस्कृतिक आदान–प्रदान बहुत ही सहज हो जाता है। अनुवाद संस्कृतियों के मध्य सेतु का काम करती है। अनुवाद के इसी महत्व को लक्षित करते हुए राजेंद्र द्विवेदी ने लिखा है–''संस्कृति के प्रसार और समृद्ध का महत्वपूर्ण साधक, भाषा की दूर्लध्य दीवारों को तोडनेवाला प्रदेशों को निकट लाने वाला, दुनिया की दूरियों को खत्म करने वाला, सांस्कतिक वैज्ञानिक पुनर्जागरण का अग्रदूत है।''[२]

अनुवाद आर्थिक लाभ और जीविकाओं के अनेक द्वार भी खोलता है। विश्व की श्रेष्ठ कृतियों के अनुवाद द्‍वारा अनुवादकों ने लाखो कमाए हैं। इस प्रसंग में अनुवाद अनुवाद जीविका का एक सशक्त साधन बनता है। पुन: आज सरकारी दप्तरों में अनुवाद को आदि की अनेक नियुक्तियाँ होती हैं। सूचना प्रधान साहित्य

जनसंचार माध्यामों में दूरदर्शन और हिंदी उपादेयता

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संचार की प्रक्रिया मनुष्य के जन्म के साथ ही आरंभ होती है। संचार एक अत्यंत व्यापक अवधारणा है। प्राचीन काल से आज तक मानव संचार के कारण जूडा है। संचार मानव जीवन की आवश्यकता है। संचार माध्यम जनता, समाज, राष्ट्र और विश्व के सजग प्रहरी है। वर्तमान समय में जनसंचार के यह माध्यम मनुष्य जीवन के साथ ऐसे घुलमिल गये है कि उनके बिना मनुष्य का दिनक्रम ही पूरा नहीं होता। मनोरंजन से लेकर देश–विदेश की खबरे, खेल, व्यापार, शिक्षा, राजनीति के साथ सभी क्षेत्रों की जानकारी देने का काम जनसंचार माध्यम कर रहे हैं।

'जनसंचार' में संचार शब्द की उत्पत्ति संस्कृत के 'चर' धातू से हुई है, जिसका अर्थ है 'चलना' अर्थात् हम किसी भाव विचार या जानकारी को दूसरों तक पहुँचाते है और यह प्रक्रिया सामूहिक पैमाने पर होती है, वह जनसंचार कहलाती है। ''संचार का अर्थ सूचना को एक स्थान से दूसरे स्थान तक पहुँचाना है।''१

जनसंचार का अर्थ है जन–जन तक सूचनाओं को संप्रेषण करना। जनसंचार सूचना, संरचना की ऐसी प्रक्रिया है जो 'वसुधैव कुटूंबकम्' की भावना को चरितार्थ करती है।

डेनिस मै कबेल–''संचार को एक व्यक्ति से दूसरे व्यक्ति तक अर्थपूर्ण संदेशों के सम्प्रेषण के रुप में स्विकार किया जा सकता है। कोई भी व्यक्ति संचार के बिना जी नहीं सकती।''२

बुकर–''सम्प्रेषण ऐसा कोई भी व्यवहार है जिसमें किसी अर्थ का आगत–निर्गत किया जाता है। जिसमें एक व्यक्ति से दूसरे व्यक्ति को संदेश दिया जाता है।''३

''शब्दो में किसी भाव, विचार या जानकारी दूसरो तक पहुँचाते है और यह प्रक्रिया सामूहिक पैमानेपर होती है, तो इसे जनसंचार कहते है।''४

जिन माध्यमों के द्वारा किसी सूचना, विचार या मनोरंजन सामग्रियों को लोगों या समाज तक ले जाया जाता है, उन्हें जनसंचार माध्यम कहा जाता हैं। दूनिया के किसी भी कोने में घटित घटना को कुछ ही पल में लोगो के सामने पहुँचाने का काम जनसंचार माध्यम कर रहे है। ''संचार से तात्पर्य है व्यक्ति के भावों, विचारों को दूसरो तक सम्प्रेषण जिन माध्यमों से होता है उन्हें जनसंचार माध्यम कहा जाता है।'' ५

आज का युग सूचना, संचार तथा विचार का युग है। जिस प्रकार साहित्य समाज का दर्पण है। संचार मनुष्य के जीवन की प्रथम आवश्यकता है। संचार के विविध माध्यम है –जैसे मुद्रित माध्यम, इलेक्ट्रॉनिक माध्यम और नवइलेक्ट्रॉनिक माध्यम। परंतु इन सभी माध्यमों में दूरदर्शन इलेक्ट्रॉनिक माध्यम सबसे लोकप्रिय है। दूरदर्शन एक ऐसा जनसंचार माध्यम है जो सारी दुनिया को आकर्षित करता है। दूरदर्शन ने हिंदी भाषा केप्रचार–प्रसार में वैश्विक क्रांति की है। यह एक ऐसा जनसंचार माध्यम है जोहिंदी के विकास में महत्त्वपूर्ण योगदान दे रहा है।

आज दूरदर्शन पर हिंदी मनोरंजक परक कार्यक्रम की भरमार है। दूरदर्शन पर हिंदी के प्रयोग के लिए व्यापक क्षेत्र खुला है। समाचार, धारावाहिक, विज्ञापन, चर्चा, समाचार आदि के लिए हिंदी भाषा का बडी सुगमता से प्रयोग होता गया। सूचना, शिक्षण और मनोरंजन के क्षेत्र में इसका महत्त्वपूर्ण योगदान रहा है दूरदर्शन ने राष्ट्रीय कार्यक्रम और समाचारों के प्रसारण के जरिये हिंदी को जनप्रिय बनाने में काफी योगदान दिया है। दूरदर्शन में मनोरंजन कार्यक्रमों, फिल्मी गितों के प्रसारण में हिंदी भाषा को देश के कोने–कोने तक पहुँचाने का कार्य किया है। दूरदर्शन ने हिंदी के प्रचार–प्रसार में महत्त्वपूर्ण भूमिका निभाई है।

दूरदर्शन आज सबसे प्रभावी दृक–श्राव्य माध्यम है। मनोरंजन, शिक्षा और जनजागृति का महत्त्वपूर्ण कार्य दूरदर्शन करता है। आज दूरदर्शन घर–घर तक पहुँच गया है। रामायण, महाभारत, चंद्रकांता, शक्तिमान, कौन बनेगा करोडपति, पवित्र रिश्ता, छायागित, चित्रहार, रंगोली जैसे कार्यक्रमों ने हिंदी को हर हृदय तक पहुँचाना का काम किया है। आज दूरदर्शन हर कोने–कोने तक पहुँच गया है। लोगों के जीवन में सोचने की शक्ति और जीने के तौर तरीकों में परिवर्तन आ गया है। हिंदी भाषा के प्रचार–प्रसार एवं विकास से दृष्टि से दूरदर्शन की भूमिका अत्यंत महत्त्व की रही है। साहित्य, समाज, संस्कृति, राजनीति, कला, विज्ञान, धर्म, शिक्षा, व्यवसाय आदि कोईभी ऐसा क्षेत्र नहीं बचा है जो दूरदर्शन से अछुता है। सूचनाओं के सम्प्रेषण के साथ–साथ मनोरंजन, ज्ञानवर्धन का महत्त्वपूर्ण साधन दूरदर्शन है।

हिंदी भाषा को राष्ट्रीय स्तर पर, विभिन्न भूप्रदेश तथा विभिन्न जाति–धर्मियों तक ले जाने का महत्त्वपूर्ण कार्य दूरदर्शन करता है। ''देश के कोने–कोने में, दूर दराज तक, खेतों–खलिहानों, नदियों, पर्वतों, रेगिस्तानों, अँचलों, गाँवों, कस्बों तथा नगरों–महानगरों तक जिस माध्यम ने संदेश के लिए हो या समाचार के लिए,

जनसंचार माध्यमों में हिंदी की भूमिका

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वर्तमान जीवन में संचार एक मूलभूत आवश्यकता है। इसके बिना जीवन अर्थहीन एवं उद्देश्यहीन हो जाता है। इसके बिना किसी समुदाय या मानव की प्रगति असंभव है। यही कारण है कि ''जनसंचार वर्तमान जीवन में वायु और प्रकाश की तरह अनिवार्य है।''१

जनसंचार में 'संचार' शब्द की उत्पत्ति संस्कृत के चर धातु से हुई है, जिसका अर्थ है चलना अर्थात् ''जब हम किसी भाव, विचार या जानकारी को दूसरों तक पहुँचाते हैं और प्रक्रिया सामूहिक पैमाने पर होती है, वह जनसंचार कहलाती है।''२

जनसंचार माध्यमों का सरोकार जनता के प्रति है। जनसंचार माध्यम अपनी बात को जन तक पहुँचाने के लिए 'जन' की भाषा को अपनाते हैं तो सामाजिक परिवर्तन की धार तेज बन जाती है। इसलिए सामाजिक परिवर्तन में भी जनसंचार के माध्यम अहं भूमिका निभाते हैं।

समाज में सदा ही जनसंचार माध्यमों का महत्त्व रहा है। डुगडुगी बजाकर सूचना देने से इस यात्रा की शुरुआत हो जाती है। दूत, कबूतर, हरकारा, डाकिया, समाचार पत्र, पत्र–पत्रिकाएँ, आकाशवाणी, दूरदर्शन जैसी कई सीढियाँ चढते–चढते अब यह यात्रा कम्प्यूटर और इंटरनेट तक पहुँच गई है।

वर्तमान में जनसंचार माध्यमों में आकाशवाणी, समचार पत्र, पत्रे–पत्रिकाएँ, दूरदर्शन हिंदी मे अत्यंत सक्षमता से कार्य कर रहे हैं। सामाजिक बदलाओं में जनसचार माध्यम अहंम भूमिका निभाते हैं। जनसंचार माध्यम का धर्म ही परिवर्तन है। सचार माध्यम के रुप में हिंदी पूरे भारत की प्रचलित भाषा दिखाई देती है। सपूर्ण सचार तंत्र ही हिंदी के आधार पर विकसित हो रहा है। आज भारत में हर व्यक्ति तक पहुँचने के लिए विज्ञापन, फिल्म, दूरदर्शन, समाचार पत्र, दूरभाष्य आदि में हिंदी का प्रयोग आवश्यक बन गया है। आज विश्व के अनेक देश के हिंदी को अपना रहे हैं। इन संचार माध्यमों के आधार पर हिंदी अंतर्राष्ट्रीय भाषा बनती जा रही है।

संचार माध्यमों के आधार पर हिंदी का रुप भी बदलता दिखाई देता है। वैश्वीकरण के इस युग में आज हिंदी सबसे प्रभावी भाषा मानी जा रही है। इसलिए अनेक विदेशी कंपनियाँ की संचार के लिए हिंदी का प्रयोग कर रहे हैं। मनुष्य जीवन में हवा, पानी, अन्न की मूलभुत जरूरतों के बाद चौथी आवश्यकता संचार माध्यम ही है। यही कारण है कि संयुक्त राष्ट्र प्रपत्र में हर्षदेव–''सूचना का अधिकार व्यक्ति का मूलभूत अधिकार घोषित किया गया है।''३

संचार मनुष्य की अनिवार्य आवश्यकता है। संचार के बिना मानव जीवन चल नहीं सकता। जनसंचार एक व्यापक और सामूहिक प्रक्रिया है। विभिन्न संचार माध्यमों ने एक ओर हिंदी को न जाने कितने भू–भाग तक फैलाया है। एक तरह से जनसंचार माध्यमों ने हिंदी को विकास एवं विस्तार का सुनहरा अवसर प्रदान किया है। डॉ. पूरनचंद टंडन के शब्दों में ''सूचना एवं सूचना प्राद्योगिकी का एक बहुत बडा लाभ हिंदी को मिला है और वह है अंतर्राराष्ट्रीय मंच पर हिंदी का व्यापक स्तर पर अवतरण हो रहा है।''४

संचार माध्यमों की हिंदी अपने माध्यम विशेष के प्रति ईमानदार विशेष भाषा है। हिंदी के महत्त्व और विस्तार को विश्व मंच पर स्थापित करने की दिशा में नए प्रयोजनों का उदय पिछले सौ वर्षो में हुआ है, उनमें जनसंचार माध्यमों की विशिष्ट भूमिका है। हिंदी सबको जोडनेवाली कडी है। इसे सभी क्षेत्र, धर्म, वर्ग, जाति एवं श्रेणी के लोगों ने अपनाया। हिंदी प्रदेशदृविशेष या संप्रदाय विशेष की भाषा न होकर संपूर्ण राष्ट्र की भाषा है। वस्तुतः हिंदी की जनप्रियता, सक्रियता और जीवंतता का वर्तमान और भविष्य इन्हीं जनसंचार के माध्यमों में भाषिक प्रयुक्ति पर टिका है।

१०. हिन्दवर्ड २०००— अमेरिका के माईक्रोसोफ्ट कार्पोरेशन ने हिन्दी में "हिन्दवर्ड २०००" जैसे सोफ्टवेअर विकसीत किए है । जिनके द्वारा शब्द के विकल्प, वर्तनी की जांच और वाक्यसंरचना को ठीक किया जा सकता है ।

इसके अतिरिक्त कई अन्य लघुपत्रिकाए ओर हिंदी संचार पत्र भीइंटरनेट पे उपलब्ध हे! साथ हि हिन्दी लघु कथा एवं हिन्दी विश्वकविता को भी हम इंटरनेटपरदेख तथा पढ सकते हे ।

निष्कर्ष रूप में हम कह सकते हे कि वैश्वकरण और सूचना प्रोद्योगिकी के इसदौर में इंटरनेट विश्वभाषा हिन्दी तथा हिन्दी साहित्य के विकास के दृष्टीसे से योगदान सिद्ध हुआ है ।

संदर्भ

१. प्रयोजनमूलक हिन्दी — डॉ. अजय प्रकाश, डॉ रमेश वर्मा, योगेंद्र प्रताप सिंह
२. विश्वभाषा हिंदी — संपादक राज केसरवानी
३. कम्पुटर प्रयोग हिन्दी— डॉ अमरसिंह वधान
४. दृश्य–श्रव्य एवं जनसंचार माध्यम डॉ.कृष्णकुमार रत्तू
५. भारतवानी संपादक डॉ. चंदुलाल दुबे

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हिंदी के विकास में इंटरनेट का योगदान

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साहित्य समाज का दर्पण है। समाज में साहित्य का महत्त्वपूर्ण स्थान है। इंटरनेट को हिंदी में अंतरजाल कहते हैं। इंटरनेट माध्यम से हम दुनिया के किसी भी घटना, संस्कृति, वस्तु, मनुष्य स्थान की जानकारी आदि कई विषयों की खोज क्षणों में कर कसते सकते है। इंटरनेट की मदद से मोबाईल में फेसबुक, व्हाटस्अॅप इ. जैसे माध्यम से एक दुनिया की नई जानकारियाँ अब हाथ में आ गई हैं। इंटरनेट के जरीए हम दुनिया के किसी भी कोने की जानकारी पलभर में प्राप्त कर सकते है। अगर कुछ देर के लिए इंटरनेट का बंद हो जाए तो विश्व में हाहाकार मच जाएगा क्योंकि आज के आधुनिक युग में अनेक काम इंटरनेट के जरिए ही किए जा रहे है। आज नोकरी तथा परीक्षा के लिए आवेदन ऑनलाइन करना होते है जिसके लिए इंटरनेट बहुत जरूरी है।

जनसंचार माध्यम से हिंदी विकास तीव्र गति से हो रहा हो। इंटरनेट मे प्रयोग करनेवालों की संख्या लाखों में पहुँच रही है। संपूर्ण विश्व मे एक क्रांति सी आ गई है। हिंदी भाषा के विकास मे इंटरनेट प्रभावशाली माध्यम हो गया है। आज इंटरनेट पर हिंदी के कई पोर्टल और साइट उपलब्ध है, इंटरनेट सूचनाओं को इकट्ठा करने समाचारों से वचने, समाचार पत्र स्थानीय संस्करण निकालने आदि में सहाय्यक बनकर पत्रकारिता की दुनिया में महत्त्वपूर्ण भूमिका निभा रहा है।

सूचना क्रांति को सफलता प्रदान करनेवाले इंटरनेट का आविष्कार लियोनार्ड क्लीन संक ने किया। इंटरनेट के संचालन की आधार भूमि कम्प्यूटर है। आज कम्प्यूटर और इंटरनेट के कारण हिंदी बडी तेज गति से विश्वस्तर की भाषा बन गई।

किताबों की दुनिया से अक्षर के सहारे ज्ञान प्राप्त करने वाले पाठकों के लिए इंटरनेट के द्वारा वीडियो टेक्स और दृश्य पूरक ज्ञान से रूबरू होना नई दुनिया में पहुँचने के समान है। किताबों के अक्षर पाठकों के मन की आँख खोलते हुए विश्व का प्रत्यक्षीकरण

'RESEARCH JOURNEY' *International Multidisciplinary E- Research Journal* ISSN : 2348-7143
Impact Factor - (CIF) - 3.452, (SJIF) - 3.009, (GIF) - 0.676 (2013) January 2018
Special Issue 33 : समकालीन हिंदी नाटक विधा में बदलते जीवनमूल्य
UGC Approved No. 40705 & 44117

समकालीन हिंदी नाटकों में धार्मिक मूल्य

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'नाटक' साहित्य की सर्वाधिक सशक्त एवं प्रभावशाली विद्या है। नाटक दृश्य काव्य है। श्राव्य एवं दृश्य कव्यों में नाटक श्रेष्ठ है। यह पंचमवेदन के नाम से जाना जाता है। रंगमंच इसका प्राणतत्व है। नाटक द्वारा पाठकों एवं दर्शकों को रसानुभूति होती है। रसानुभूति का अर्थ हैं अपना अस्तित्व भूलकर तन्मय हो जाना, आश्रय से सामाजिक अपना तादातमय स्थापित कर लेता है। नाटक की उपादेयता इसी में है कि समाज उसे देखकर अधिक से अधिक आनंद प्राप्त कर सकें। 'नाटशास्त्र' के प्रणेता भरतमुनि ने तो यहाँ तक माना है कि योग, कम, सौरशास्त्र और समस्त शिल्पों का नाटक मे समावेश है। नाटक के द्वारा देश की सांस्कृतिक परंपरा की रक्षा होती है। इतिहास, पूराण, सभ्यता का विकास सभी कुछ नाटक से द्वारा हमारी आँखो के सामने उपस्थित होता है। इसीलिए साहित्य की अन्य विधाओं की अपेक्षा नाटक बहुचर्चित एवं लोकप्रिय विधा है

साहित्य और समाज एक दूसरे के पूरक है। 'नाटक' साहित्य का एक अभिन्न अंग माना जाता है। नाटक और मानव जीवन का शाश्वत सम्बन्ध रहा है। यह संसार का एक रंगमंच है और मानव उसका शाश्वत पात्र है। मानव जीवन के व्यापक संदर्भो और यथांर्थ जीवन के विविध आयामों से विषय चुनकर वह समाज के लिए ही अपने रुप का निर्माण करता है। शब्दों तथा पात्रों तथा पात्रों की वेश-भूषा, आकृति, भाव-भंगिमा, क्रियाओं के अनुकरण और भावों के अभिनय तथा प्रदर्शन द्वारा दर्शक को समाज के यथार्थ जीवन के निकट लाता है। डह. विपिन गुप्त नाट्य को सामज के साथ रसते हुए कहते हैं कि ''साहित्य में नाटक प्रत्यक्ष और सामाजिक विधा है। दर्शक समुदाय नाटक द्वारा प्रायोजित जीवन को मंचपर धटित होते देखता है ।''१

कहने का अर्थ यह है कि नाटक समसामायिक से जोडता है। तभी उसकी प्रासंगिकता कायम रहती है। इब्सन का कहना है कि- '' नाटककार का काम अपने समय और अपनी जाति को उद्वेलित करने वाले सामायिक एवं शाश्वत प्रश्नों को स्वयं समजना और दूसरों को समजाना।''२

नाटक की व्याख्या :- आ. भरतमुनि का 'नाट्यशास्त्र' नाटय विधा का आदि ग्रंथ माना जाता है। उन्होंने नाटक को परिभाषित करते हुए कहा है दृ ''त्रैलोकस्थास्य सर्वस्य नाट्यभावनुकीर्तनम् ।'' अर्थात नाटक तीनों लोकों के भाषों का अनुकरण है । ३

डह. दशरथ ओझा :- ''जब लोगों की क्रियाओं का अनुकरण अनेक भावों और अवस्थाओं से परिपूर्ण होकर किया जाए तो वह नाटक कहलाता है।'' ४

जयशंकर प्रसाद :- 'काव्येपु नाटक रम्यम' लेख में नाटक सम्बन्धी विचार प्रकट करते हुए कहते है कि- 'दृश्यकाव्य कला का विकसित रुप है । .... हृदय को अनुभूति कराने के लिए कला के दो द्वार है - कान और आँख। इधर काव्य की अनुभूति भी दृश्य और श्रव्य दोनों प्रकार की होती है।'' ५

व्यंग्य इस नाटक की बहुत बड़ी शक्ति है। डॉ. माचवे का यह कथन एक सीमा तक सही “व्यंग्य और परिहास कहाँ समाप्त होता है और गम्भीर नाटक कहाँ षुरू हो जाता है, इसका ‘दरिन्दे’ में पता ही नहीं चलता।“ कुछ शब्द, कोई चाहे तो इसे व्यंग्य नाटक कह सका है। प्रतीक नाटक तो यह है ही।

मंचन की दृष्टी से ‘दरिन्दे’ की सफलता असंदिग्धा है। इसे बिना किसी खास तामझाम के बखूबी खेला जा सकता है। १९७३ को नयी दिल्ली के मावलंकर आडिटोरियम में अखिल भारतीय सर्वभाषा नागरिक सेवा नाटक प्रतियोगिता में इस नाटक को सर्वश्रेष्ठ आलेख, प्रदर्शन, निर्देशन और अभिनय के छह प्रथम पुरस्कार प्रदान किये गये थे। नाटककार हमीदुल्ला न केवल आलेख–कार, वरन् अभिनेता और निर्देशक भी है। रंग–सज्जा और आधुनिक मंच–शिल्प का उन्हें खासा ज्ञान है जिसका प्रयोग उन्होंने इस नाटक में किया है। यों ‘दरिन्दे’ निश्चयके पचासों सफल प्रदर्शन इसकी मंच–सार्थकता सिद्ध कर चुके हैं। ‘दरिन्दे’ निश्चय ही एक ऐसी जीवन्त सार्थक रंगानुभूति है जो सामयिक, युग–बोध से जुड़ी होने के कारण प्रत्येक वर्ग के दर्शक में एक गहरा अहसास जगाती है। ध्वनि--प्रभाव और प्रकाश–व्यवस्था का उचित प्रयोग नाट्य–प्रभाव को गहराता है।

निष्कर्श :–

निष्कर्षत: हम कह सकते है की, दरिंदे नाटक में सांस्कृतीक मुल्यों का विघटन हुआ है। निरूक्तिक दृश्टीसे विघटन विषेश संघटनका पर्याय हो सकता है। पर उस स्थिती में यह सांस्कृतीक मुल्यों के जुडाव का बोधक हो सकता है। समकालीन नाटकों में इन मूल्यों के टूटते–दरकते रूपों का बहुआयामी चित्रण किया गया है।

संदर्भ : –

१. स्मकालीन नाट्य विवेचन – डॉ.माधव सोनटक्के प्रकापन –विकास प्रकाशन, संस्करण : प्रथम १९९४
२. समकालीन हिंदी नाटककार – गिरिश रस्तोगी, इंद्रपस्थ प्रकाशन, प्रथम संस्करण : १९८२

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उपन्यास साहित्य मे जीवन मूल्य

प्रा. डॉ. ऐनूर एस. शेख
हिंदी विभागाध्यक्षा,
कला, विज्ञान व वाणिज्य महाविद्यालय, राहाता
ता. राहाता, जि. अहमदनगर

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साहित्य मानव जीवन के गद्यात्मक सौंदर्य की भावात्मक अभिव्यक्ति है। अत: साहित्य और मानव जीवन का घनिष्ठ संबंध रहा है। मावन जीवन की विविध आयामी यात्रा में जीवन–मूल्यों का योगदान सर्वोपरि रहा है। साहित्य और जीवन–मूल्यों का एक–दूसरे के साथ अटूट संबंध है। साहित्य में जीवन मूल्य उसी प्रकार निहित रहे है, जिस प्रकार फूलो में सुगंध ।

आधुनिक गदय साहित्य की एक महत्त्वपूर्ण विधा उपन्यास है उसमें नारी जीवन मूल्यों को व्यंजित करने के लिए बृहत फलक प्राप्त होता है, क्योंकि उपन्यास गद्य का महाकाव्य माना जाता है जिसमें मानव जीवन से संबंधित विविध पक्षों को विस्तृत रुप से उजागर करना साहित्यकार के लिए सहज संभव है ।

वास्तव में परिवर्तन ही जीवन है। और जहाँ परिवर्तन होता है, वहाँ मानव–जीवन मूल्य भी परिवर्तित होते हैं। नारी जीवन मूल्य भी इसके अपवाद नहीं है। नारी जीवन मूल्यों के परिवर्तन की दृष्टि से साठोत्तरी यगु विशेष महत्त्वपूर्ण रहा है। इस युग में स्वतंत्रता आंदोलन के बहाने नारी चार दीवारों को लांघकर खुले प्रागंण में विवरण करने योग्य बनी । नारी के इन सूक्ष्म मनोभावों को हिंदी उपन्यासकारों ने देखा और उसके एक पहलू को अपनी प्रतिभा और कल्पना के बलपर व्यंजित किया। नव–युग और

13. The Role of Tourism in Sustainable Development in India

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Abstract

Tourism is one of the world's largest industries and one of its fastest growing economic activity. For many countries tourism is seen as a main activity for regional development, as it stimulates new economic activities. Tourism have a positive economic impact on the balance of payments, employment, gross income and production, but it may also have negative effects, particularly on the environment. Unplanned tourism growth can result in such a worsening of the environment that tourist growth can be compromised. The environment, being the major source of tourist product, should therefore be protected in order to have further growth of tourism and economic development in near future. This is especially true with regard to tourism based on the natural environment as well as on historical-cultural heritage.

Sustainability and Sustainable Tourism Development

Sustainabie tourism has three interrelated aspects: environmental, socio-cultural, and economic. Sustainability implies permanence, so sustainable tourism includes optimum use of resources, including biological diversity; minimization of ecological, cultural and social impacts; and maximization of benefits for conservation and local communities. It also refers to the management structures that are needed to achieve this.The paper attempts a theoretical framework for sustainable tourism. It comprises two parts. The first part presents general views on tourism and sustainable economic development, and some opinions on the relationship between tourism and the environment. The second part concentrates on strategies and policy instruments.

Sustainability is one of the key-words of the 1990s. Sustainability and sustainable development were given importance and made popular by the Brundtland report [World Commission on Environment and Development, 1987]. It defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Both an equity dimension (intra-generational and inter-generational) and a social/psychological dimension are clearly outlined by this definition. The

Juni Khyat
(UGC Care Group I Listed Journal)

ISSN: 2278-4632
Vol-10 Issue-5 No. 16 May 2020

APPLICATIONS OF GIS TECHNIQUES FOR ANALYZING SPREAD OF COVID- 19 DISEASE IN INDIA

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Abstract:

The outbreak of the 2019 novel coronavirus disease (COVID-19) has caused more than 50,00,000 people infected with the virus and more than 333,000 of deaths as of 24th May, 2020 (World Health Organization (WHO) as of 24th May, 2020) across the world . At present, the number of infections and casualtiesis increasing rapidly throughout the world. COVID-19 seriously hovers human health, social functioning, and international relations. In the fight against COVID-19, Geographic Information Systems (GIS) has played a prominent role in many ways, including the rapid combination of various data, visualization of pandemic information, spatial tracking of infections, prediction of regional transmission, spatial segmentation of the pandemic risk and prevention, management of the supply and demand of material resources, and social-emotional guidance, which provided concrete spatial information support for decision-making, measures formulation, and effectiveness assessment of COVID-19 prevention and control. GIS technology has developed and matured relatively faster and has a complete technological way for data preparation, platform construction, model construction, and map production. However, for the struggle against the widespread pandemic, the main challenge is finding strategies to adjust technical methods and improve the speed and accuracy of information provided for social management. In this article methods like Spatial Interpolation, Quantities etc are used to show spatial distribution of covid-19 cases in the states and union territories of India.

Keywords: GIS, COVID-19, Geospatial, IDW, Interpolation

Introduction

In today's world data no longer come mainly from the government but are collected from more diverse enterprises. As a result, the use of GIS faces difficulties in data acquisition and the integration of heterogeneous data, which requires governments, businesses, and academic institutions to jointly promote the formulation of relevant policies. The development of GIS

Juni Khyat
(UGC Care Group I Listed Journal)
ISSN: 2278-4632
Vol-10 Issue-6 No. 4 June 2020

Detection of Land-use/Land-cover Changesby Using RS and GISTechniques:A Case Study of ShrigondaTahsil, Maharashtra State, India

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Abstract

Land-use/land-cover change detection study plays a key role in a study endeavored for development and planning purposes. With timely satellite data, these studies are carried out with good accuracy. Throughout the world, the emphasis has been given on such studies because of the increasing demand for land as its limited availability. The present study attempts to focus on land use/land cover changes at the tahsil/block level. By using satellite images for the year 2000 and 2015the land-use/ land-cover was extracted in the study area with a supervised classification method. Appropriate training sites were taken for each LULC categories to achieve good accuracy in the classification. Accuracy assessment was performed after classification for finding the accuracy of the classification based on KAPPA analysis. The change detection of these classes for two images was computed. The most dominant category in terms of change was barren land. The study indicates that the study area has undergone substantial changes in land-use and land-cover particularly in the case of barren land and agriculture land use categories.

Keywords

Land-use/Land-cover,RemoteSensing,GIS,Change Detection,Kappa coefficient.

Introduction

The history of mankind has been closely related to natural resources. The land is one of the important components on which physical, economic, and social development depends. Land provides food and a variety of minerals and therefore, it needs judicious use of land. The land resource has very often been left in past entirely applications of traditional and primitive methods resulting in basic resources gradually deteriorated (Siddiqi, 1971). With the growing pressure of population on limited land resources, man has to use optimum usage of every acre of land. This necessitates the determination of the optimum use of every piece of land. There is a consequent need for a system of land utilization (Stamp, 1960). The importance of land classification is on the basis of the quality and intensity of Land-use (Mohammad, 1978).

N3-Sensitized TiO_2/Nb_2O_5: A Novel Bilayer Structure for Dye-Sensitized Solar-Cell Application

Niyamat I. Beedri, Prashant K. Baviskar, Vikram P. Bhalekar, Chaitali V. Jagtap, Inamuddin, Abdullah M. Asiri,* Sandesh R. Jadkar, and Habib M. Pathan*

A simple and cost-effective chemical precipitation method for the synthesis of Nb_2O_5 nanoparticles is reported. The as-synthesized powder is amorphous and after annealing at 500 °C the crystalline phase is observed, which is then used for the preparation of photoelectrode material sensitized with N3 dye toward dye sensitized solar-cell application. The effect of Nb_2O_5 layer over TiO_2 by making a bilayer structure for dye-sensitized solar-cell application is studied. The device performance is studied using the current density–voltage (J–V) curve as well as by external quantum efficiency measurement (EQE). Furthermore, the behavior of electron in the device is studied by electrochemical impedance spectroscopy (EIS) measurement. It is observed that the amount of dye loading increases with optical reflection for the bilayer structure, which leads to the improvement in J_{SC} along with EQE. The maximum power conversion efficiency obtained for the bilayer structure is 5.26%.

1. Introduction

During the last decade the dye-sensitized solar cell (DSSC) is one of the emerging photovoltaic technologies. A great deal of attention of the industry and researchers is focused on DSSCs due to their simple manufacturing process, low cost, nontoxicity, high flexibility, semitransparency, environmental friendliness, and effectiveness even on flexible sheets with transparent and colorful nature. Fabrication of DSSCs consists of four key components, namely photoanodes, dye molecules, redox electrolyte and the counter electrode. Generally, TiO_2 and/or ZnO are used as photoanode material for fabrication of DSSCs.[1,2] However, there is a prevailing need to search for other semiconductor materials toward performance enhancement. Researchers have used Nb_2O_5 directly as the photoanode material along with TiO_2 or ZnO as photoanode to suppress the recombination rates.[3–5] There are few reports available on pristine Nb_2O_5 as photoanode in DSSCs. Viet et al.[6] have used a Nb_2O_5 photoanode in three polymorphic forms sensitized with N3 dye and observed a maximum efficiency of 3.05%. Rani et al.[7] reported highly ordered Nb_2O_5 nanochannel films for DSSCs application having the best efficiency of 4.48% for a 10-μm thick photoanode. Ghosh et al.[8] reported a 2.41% efficiency for N3-sensitized Nb_2O_5 nanocrystals fabricated by pulsed laser deposition. Sayama et al.[9] synthesized Nb_2O_5 powder via a chemical route and the photoelectrochemical properties of a Nb_2O_5 photoanode sensitized with ruthenium-based dye, achieved 2% efficiency. Zhang et al.[10] reported maximum efficiency of 6.03% for Nb_2O_5 photoanode prepared by a hydrothermal method. The DSSCs were fabricated by using N719 dye with single-crystal Nb_2O_5 nanorods. Ou et al.[11] reported a 4.1% efficiency from a nonporous Nb_2O_5 photoanode fabricated by electrochemical anodization of a niobium substrate. Jin et al.[12] achieved a 2.97% efficiency though subsequent annealing. In this method, they were used N719 dye-sensitized mesoporous Nb_2O_5 photoanode having 480-nm microspheres synthesized by a solvothermal method. There are some reports available for the enhancement of efficiency of DSSC instead of using bare Nb_2O_5 as a photoanode were they use a bilayer structure for fabrication of DSSCs in which Nb_2O_5 acts as a blocking layer before or after the surface treatment of TiO_2. A literature survey has concluded that to date there are no reports on the preparation of a Nb_2O_5 layer by using a doctor blade technique over TiO_2. **Table 1** summarizes the literature work including efficiency, remarks and the preparation route for TiO_2 and Nb_2O_5 layer sensitized with different dyes for DSSC applications.[4,13–18]

In the present work, we have synthesized Nb_2O_5 nanoparticles via a simple and low-cost chemical precipitation method. We have fabricated photoanodes by a doctor blade technique using a paste of chemically prepared Nb_2O_5 nanoparticles toward DSSC application. In addition, we have also checked the effect of a Nb_2O_5 layer over nanoporous TiO_2 toward

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The ORCID identification number(s) for the author(s) of this article can be found under https://doi.org/10.1002/pssa.201800236.

DOI: 10.1002/pssa.201800236

IOP Publishing Mater. Res. Express 5 (2018) 066208 https://doi.org/10.1088/2053-1591/aacdb5

Materials Research Express

CrossMark

RECEIVED
3 May 2018

REVISED
12 June 2018

ACCEPTED FOR PUBLICATION
20 June 2018

PUBLISHED
29 June 2018

PAPER

Impact of composition of polysulphide electrolyte on the photovoltaic performance in quantum dot sensitized solar cells

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Keywords: polysulphide, QDSSC, impedance spectra

Abstract

Sustained and efficient photovoltaic action depends on the electrolyte employed in the device like Quantum Dot Sensitized Solar cell (QDSSC). The study here focuses on the comparison of performance of different polysulphide electrolytes in CdS QDSSC by virtue of difference in their composition. Systematic electrochemical analyses were performed to study the effect of electrolyte composition on the overall solar cell performance by employing chronoamperometry, electrochemical impedance spectroscopy and electrical characterization of the fabricated solar cells. Of all the composition of electrolytes considered here, a modified polysulphide electrolyte with combination of ethanol, methanol and water has emerged as the best.

1. Introduction

For the past few decades, an extensive research is carried out to improve the efficiency of the solar cell. In particular, more focus is on third generation of solar cells since they are of low cost and processing of these cells is relatively easy. Dye sensitized solar cell (DSSC) and quantum dot sensitized solar cells (QDSSC) are best examples of this generation. Though the structure and working principle for these are same, QDSSC is a strong candidate for clean energy over DSSC. In case of QDSSC the maximum thermodynamic limit of efficiency is projected to be 44% [1]. The improved performance in these cells is due to the introduction of novel material structures like QDs which have superior properties like high extinction coefficients, ability to generate multiple excitons, optical tunability and stability. Unlike other QD solar cell architectures, these are simpler to assemble, have greater stability and at the same time cost-effective like their dye counter parts besides being highly promising [2]. QDSSC is fabricated with the help of four components (i) a wide band gap (such as ZnO and TiO_2) semiconductor deposited on ITO or FTO coated glass (acts as photo-anode), (ii) QDs are adsorbed on wide band gap semiconductor (act as sensitizers), (iii) an electrolyte and (iv) a counter electrode [3]. In the present work, our focus is on electrolyte since it plays a very important role in the maintenance of a sustained photovoltaic action through a process of regeneration due to the redox species in QDSSC. Developments of new materials for replacing the conventional liquid electrolyte are under way [4–6]. However, liquid electrolyte is still the preferred choice as it assists in giving high open circuit voltage and a stable operation besides greater penetrability into the photo-anode facilitating a better hole evacuation at this interface.

Though polyiodide is used as an electrolyte in DSSC, polysulfide is the most preferred and suitable electrolyte in QDSSC [2, 7]. Use of metal chalcogenides as sensitizers and their stable chemistry with the redox species in this electrolyte system is the main reason for employing polysulfide in QDSSC. There are a number of protocols available in the literature for the preparation of polysulfide, which uses various combinations of constituents like ethanol, water, methanol and some ionic additives in different concentrations [8–14]. However, there are certain optimized protocols employed in quantum dot sensitized solar cells (QDSSC).

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PbS Sensitized TiO_2 Based Quantum Dot Solar Cells with Efficiency Greater Than 5 % Under Artificial Light: Effect of Compact Layer and Surface Passivation

Vikram P. Bhalekar, Prashant K. Baviskar*, Rajendra Prasad M. B., Balasaheb M. Palve, Vishal S. Kadam and Habib M. Pathan*

Now days, quantum dot sensitized solar cells have fascinated a great deal of interest due to its advantages that include high molar extinction coefficient, tunable energy gaps, and multiple exciton generation of quantum dots. In this present work, the linker free approach was used to sensitize TiO_2 photoelectrodes with PbS QDs by successive ionic layer adsorption and reaction at room temperature. The photovoltaic performance was evaluated using J-V characteristics with polysulphide as electrolyte and carbon composite molybdenum oxide as a counter electrode using Keithley Source meter under white light (30 mW/cm^2) supplied from LED source. Electrochemical impedance spectroscopy is also used to measure the electron life time of the devices using Potentiostat/Galvanostat. Maximum efficiency of 5.82 % was recorded under artificial light with addition of TiO_2 compact layer prior to porous TiO_2 followed by surface passivation of PbS using ZnS, which corresponds to ~3 fold enhancement to that of device fabricated using bare TiO_2.

Keywords: TiO_2;; PbS; Quantum dot sensitized solar cells; Effect of compact layer; Surface passivation

Received 5 October 2018, **Accepted** 17 January 2019

DOI: 10.30919/es8d676

Introduction

Quantum dots (QDs) define the scope for the modern world that opens up the new trends in both fundamentals and commercial point of view hence it is being excited to study. Quantum dot solar cells are emerging out as an alternative strategy towards replacement of expensive dye with semiconductor QDs as sensitizers due to its photostability, high molar extinction coefficient, size dependent optical properties and low cost.[1] The electronic affinity and optical band gap of QDs can be tuned by altering the particle size without changing the chemical composition.[2] The various reports are available on quantum dots sensitized solar cells (QDSSCs) sensitized with PbS,[3] CdS,[4,5] CdSe,[6] CdTe,[7] Ag_2Se,[8] Bi_2S_3,[9] etc. Recently, researchers have a discovery about multiple exciton generation (MEG).[10,11] Out of that, lead sulphide (PbS) becomes favorable candidate because of their large Bohr exciton radius of 20 nm.[12,13] PbS is IV-VI direct band gap semiconductor with bulk band gap 0.41 eV,[14] which is tuned to 1.3 eV and allows the panchromatic utilization of the solar spectrum extends to near infra-red region. Hence it becomes an interesting and easy costumer for solar cell applications.[15] Lee *et al*. reported the PCE of 5.6 % for Hg doped PbS sensitized TiO_2 based QDSSC using SILAR technique.[16] The maximum efficiency of 5.73 % was reported by Sung *et al.* for PbS QDs sensitized bilayered TiO_2 nanostructure as a photoanode with aq. polysulfide electrolyte and Au/CuS/FTO as counter electrode.[15] It is also reported that by introducing a compact TiO_2 as a blocking layer prior to porous metal oxide can efficiently prevent the backward transfer of electrons and help towards the enhancement in efficiency.[17,18]The alternate strategy to improve the photovoltaic performance of QDSSC is the surface modification of QDs which is beneficial towards the reduction in charge recombination at internal QDs as well as at QDs/metal oxide/electrolyte interfaces and avoid corrosion due to the polysulfide electrolyte.[19,20] In addition to compact and surface passivation layers, the development of new counter electrodes (CEs) with high electrocatalytic activity, good conductivity, and stability are crucial for performance enhancement of QDSSCs. Therefore, in recent time much attention has been focused on developing a range of CEs for QDSSCs alternative to Pt.[21-24]

We have focused on chemical sensitization of PbS QDs over porous TiO_2 prepared by doctor blade technique on compact TiO_2/FTO substrate towards fabrication of solar cell. Here we have used SILAR technique for the sensitization of PbS over TiO_2 photoelectrode followed by surface passivation of PbS using ZnS layer by SILAR towards the performance enhancement of solar cell.

Experimental section

Materials used

TiO_2 powders (P25) was purchased from Degussa, Ethyl cellulose, Terpanol, Acetyl acetone, Lead nitrate, Sodium sulphide, and Sulphur powder were purchased from SRL Chemicals Ltd., whereas Ethanol and Methanol were purchased from C.H. Fine Chemicals Co. Ltd. and were used as received without any further purification. Fluorine doped tin oxide (FTO) (sheet resistance of ~12 Ω/cm^2 from Sigma Aldrich, India) coated conducting glass substrates were cut into a size of 2 x 2 cm^2. These were initially cleaned by using double distilled water then with a soap solution followed by ultrasonication for 15 min in double distilled water and ethanol and finally, the films were allowed to dry in incubator at 70°C till use.

Deposition of TiO_2 compact layer

Initially, prepare the solution by taking 5 ml $TiCl_4$ in 20 ml double distilled water (hereafter, DDW). Then prepare the 1 M NaOH in DDW

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Strong Quantum Confined Lead Sulphide Quantum Dots using Ionic Reaction and Their Properties

Vikram P. Bhalekar and Habib M. Pathan*

Lead sulfide quantum dots have been synthesized from a cost- effective and facile chemical method namely ionic reaction using lead nitrate and sodium sulphide as precursors in aqueous solutions. The as prepared nanocrystals are characterized for their optical, structural and electrochemical properties using optical absorption spectroscopy, transmission electron microscopy and cyclic voltammetry respectively. The PbS quantum dots have an average size of 6 nm. The strong size quantization is observed from cyclic voltammetry and absorption spectroscopy.

Keywords: Lead sulphide; Quantum dots; Single crystalline; TEM; SAED

Received 23 November 2018, **Accepted** 3 February 2019

DOI: 10.30919/esmm5f205

Introduction

Nanomaterials with their potential applications in various fields have been the most explored functional materials for the past three decades. In view of this, zero-dimensional (0D) semiconductor nanostructures called quantum dots (QDs) have attracted the attention of scientists due to their unique optical and electronic properties from both the fundamental and application perspective. These are nanocrystals that have acquired their class mostly because of their size regime being comparable to that of Bohr excitonic radius[1] of the material.

QDs possesses a size dependent and discrete electronic energy spectra due to quantum confinement effect[2-4] which gives rise to a series of properties in them.[5] Innumerable types of quantum dots like CdS,[6] CdSe,[7,8] InP,[9] PbS,[10,11] PbSe[11] etc.[10-12] are synthesized by researchers and have a wide range of applications. Among metal chalcogenides, lead chalcogenides, especially PbS and PbSe QDs have been interesting nanostructures due to their characteristic property for demonstration of multiple exciton generation[13-15] (MEG), where a single photon can yield three excitons, hence are useful in highly efficient photo voltaic conversion.[16] Also, PbS quantum dot sensitized solar cell gave a very high photocurrent.[17] In view of these, the synthesis and application of PbS has assumed to have a great importance. PbS is a IV- VI semiconductor with Bohr excitonic radius of 18 nm. It has a bulk band gap of 0.41 eV[18] that can be tuned up to 1.5eV at the QD level and hence it shows a strong quantum confinement effect. PbS has its applicability in Sensors,[19] photography,[20] IR detector[21] (due to absorption Near IR region), Solar absorber[22] etc.

Ample techniques have been developed by the researchers to synthesize PbS QDs like hydrothermal,[23-26] sono-chemical,[27] micro emulsion[28] and organometallic methods.[29,30] Out of which organometallic method gives a better size distribution but the formation of PbS nanocrystals involves a hazardous and unstable chemicals like $(TMS)_2S$ trioctylphosphine, so it is significant to find a simple route to synthesize the narrow size distributed of quantum dots. Besides the previous reports, PbS QDs have resulted in either polycrystalline[5,31] or single crystalline synthesized with the help of a coordinating agent.[32,33]

In the present report, we have synthesized PbS QDs by employing a very simple ionic reaction technique, that doesn't require high vacuum, large power supply or hazardous chemicals. It differs from other technique of decompositions of metal complexes due to its slow generation of chalcogenides and allowing them a slow formation of QDs, which was supported by ultrasonication using lead nitrate and sodium sulphide as precursors in aqueous media, without involving any harmful chemicals or by-products. Sonication is significant stage in the synthesis that produces cavitations effect in the solution, which is equivalent to pressures of few hundreds of atmosphere and that has been provided after the addition of precursors in order to avoid the agglomeration of PbS.[14] This is mainly in order to avoid the hazardous chemicals, capping agents and its effect. The synthesized single crystalline PbS QDs has been characterized using Transmission electron Microscopy (TEM), High Resolution TEM (HRTEM), Optical absorption spectroscopy (UV-Vis) and Cyclic Voltammetry (CV).

Experimental

Lead Nitrate $Pb(NO_3)_2$ and Sodium Sulphide Na_2S were purchased from SRL Chemicals Ltd, India and used without further purification. 0.02 M of $Pb(NO_3)_2$ and Na_2S (very well dispersed) solutions were prepared in double distilled water (DDW) at room temperature separately. These solutions were then added drop by drop (0.5 ml lead- Pb^{2+} followed by Sulphur- S^{2-}) to large aqueous flask containing 400 ml DDW, till colour variations were observed under probe sonication. As the concentration of precursor's increases, the deviation in colour of the solutions varies from pale yellow, yellow, brown and shady brown in the aqueous bath. The samples were named as A, B, C and D respectively.

The UV-Vis spectra of liquid samples (A-D) are acquired with

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© 2019 IJSRST | Volume 5 | Issue 4 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section : Science and Technology

Green Synthesis of Novel substituted 2-(1, 3-diphenyl-1*H*-pyrazol-3-yl) benzo [*d*] thiazole and using Ionic Liquid under Ultrasound and Microwave Condition

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ABSTRACT

A green protocol for the synthesis of series of novel substituted 2-(1, 3-diphenyl-1*H*-pyrazol-3-yl) benzo [*d*] thiazole is developed through the condensation of substituted 1, 3-diaryl pyrazole aldehyde and *o*-amino thiophenol in the presence of 1-butyl,3-methyl,1-imidazolium tetrafloroborate [BMIM][BF_4] as a catalyst under the conventional reflux condition, ultrasound and Microwave irradiation. The use of [BMIM][BF_4] under USI and MWI conditions, and with easier isolation of the products in good yields makes this protocol eco-friendly and versatile compared to the conventional reflux conditions. The structures of the products were confirmed by IR, Mass, ^{1}H-NMR, ^{13}C- NMR spectral data.

Keywords: 1, 3-diaryl pyrazole aldehyde, Microwave, Ultrasound, Thiazole, [BMIM][BF_4].

I. INTRODUCTION

Ionic liquids (ILs) offer an excellent and environmentally benign technique for the synthetic chemistry. The application of ionic liquids as reaction media and catalyst can offer a solution to solvent emission and catalyst recycle problems. Ionic liquids possess the important properties like negligible vapor pressure, thermal stability, recyclability, and higher solubility. Nowadays, ionic liquids have been successfully employed as solvents as well as catalyst for a variety of reactions [1-4]. ILs has been successfully used for various organic reactions like diels-alder reaction, electrochemical reaction, esterification, friedal-Craft reaction, hydrogenation, multicomponent reaction, coupling reaction [5-9].

The benzothiazole and their derivatives are an important class of heterocyclic compounds in medicinal, industrial, agricultural and synthetic organic chemistry. They are widely found in bioorganic and medicinal chemistry with applications in drug discovery such as antitumor, anticonvulsant, and antiviral applications [10–16]. They also found applications in industry as antioxidants, vulcanization accelerators, and as a dopant in a light-emitting organic electroluminescent device [17, 18]. Also the benzothiazole is an important nucleus in some rigid-rod polymer possessing high tensile strength, thermal stability and modulus [19, 20].

Many routes have been reported in the literature for the synthesis of benzothiazoles derivatives. However the most commonly used method involves the reaction of o-amino-thiophenols with substituted benzaldehydes in the presence of a catalyst such as animal bone meal, $ZnBr_2$/ABM, $ZnCl_2$/ABM, $CuBr_2$/ABM [21], Pt/Al_2O_3 [22], SiO_2 [23], vanadium

Iranian Journal of Organic Chemistry Vol. 10, No. 2 (2018) 2343-2351

IranJOC
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Organic Chemistry

Synthesis and antimicrobial activity of novel substituted 2-(9-ethyl-9*H*-carbazol-3-yl)-4*H*-chromen-4-one derivatives

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Received: February 2018; Revised: March 2018; Accepted: April 2018

Abstract: A series of novel carbazole tethered chromone derivatives were synthesized from 3-(9-ethyl-9*H*-carbazol-3-yl)-1-(2-hydroxyphenyl)prop-2-en-1-one. The structures of newly synthesized compounds were confirmed by their IR, ^{1}H NMR, ^{13}C NMR and mass spectral data. The synthesized compounds were evaluated for their *in vitro* antimicrobial activity. Notably, compound **5a** with a broad antimicrobial spectrum was the only compound exhibiting activities against all test bacterial and fungal strains as compared to standard drug ampicillin. Most of the newly synthesized compounds (**4**, **5**, and **6**) have moderate to good antimicrobial activities.

Keywords: Carbazole, Chromone, Thiopyrimidine, Iminopyrimidine, Antimicrobial activity.

Introduction

Chromones are oxygen based heterocyclic compounds display a broad spectrum of biological properties such as anticancer [1], antimicrobial [2], antiviral [3] and anti-tobacco mosaic virus [4] activities. They are suitable molecules because their chemical reactivity towards nucleophiles provides a useful route for the preparation of a variety of heterocyclic systems [5, 6]. The use of chromone compounds to synthesize heterocyclic systems via ring opening and ring closure sequences with suitable nucleophiles is well known [7-9]. Chromones possessing heterocyclic substituents at 2 and 3 position possess coronary dilatory [10], muscle relaxant property [11] and antimicrobial activities [12]. Recently an efficient route for the synthesis of derivatives of tetrahydrochromeno [2,3-b] carbazoles has been developed [13], also 3-hydroxy carbazole chromones have been synthesized and displayed an effective antimicrobial activity [14]. On the other hand, carbazole derivatives are an important class of heterocyclic compounds have been created considerable attention to these structures due to their capability to accommodate the substituents around the carbazole frame [15], biological activities and potential application as pharmacological agents [16, 17]. Pyrimidine and thiopyrimidine are one of an important class of heterocyclic compounds for new drug development that fascinated much attention due to their extensive spectrum of biological potential. [18-20], a recent study has shown carbazole pyrimidine derivatives display a new class of anticancer agents [21]. Therefore, the carbazole is shown to be a useful starting material for physiologically or pharmacologically important products. Bioactivity associated with carbazole moiety in association with chromone and pyrimidine nucleus and our contribution in this field [22-25], we report the series of new substituted 2-(9-ethyl-9*H*-carbazol-3-yl)-4*H*-chromen-4-one derivatives (Scheme **1**) and reported their *in*

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Indian Journal of Chemistry
Vol. 57B, November 2018, pp. 1430-1435

N-Butylpyridinium heptachlorodialuminate: A convenient catalyst for the synthesis of acridine 1,8-diones derivatives by microwave assisted Hantzsch reaction

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Received 25 September 2017; accepted (revised) 28 September 2018

Acridine-1,8-dione derivatives have been synthesized conveniently by the multicomponent condensation of dimedone, aldehydes, and ammonium acetate in the presence of a catalytic amount of *N*-butylpyridinium heptachlorodialuminate. This fascinating microwave assisted protocol involving green ionic liquid offers several advantages such as excellent yields, short reaction period, mild reaction conditions and an eco-friendly approach.

Keywords: Microwave irradiation, ionic liquid, multicomponent reaction, Hantzsch reaction, *N*-butylpyridinium heptachlorodialuminate

Ionic liquids (ILs) have been widely employed as green organic solvents which are alternatives to conventional hazardous organic solvent. In recent decades, ILs have also experienced significant growth in the catalytic processes. They have been employed for various organic reactions including hydrogenations, Diels-Alder reactions, Friedel-Crafts reactions, esterifications, multicomponent reactions, coupling reactions, electrochemical reactions, *etc*. either as catalysts or solvents[1-10].

The 1,4-dihydropyridine nucleus containing acridine 1,8-diones are an significant class of heterocycles which has variety of applications such as fluorescence, laser activity, photo-initiators and electrochemical properties[11-18]. They shows a broad range of biological activities such as antibacterial, antimalarial, anticancer, fungicidal properties and DNA binding scaffolds[19-22]. They also have been employed as pigments and dyes[23]. The some important drugs containing of 1,4-dihyropyridine nucleus are given in Figure 1.

The researchers have applied various methods for the synthesis of acridine-1,8-dione derivatives, including catalyst such as $NiFe_2O_4@SiO_2$-FHS[24], indium(III) triflate[25], MFRH[26], nanoporous isopolyoxomolybdate[27], nano-TiO_2[28], SiO_2-Cu(II)[29], nanocrystalline TiO_2[30], $Fe_3O_4@SiO_2$ nanoparticles[31], nano-zirconia[32], silica sulfuric acid[33], $CuSO_4.5H_2O$[34], BNBTS[35], CTAB[36], MCM-41-SO_3H[37], ionic liquid $Mg(BF_4)$ doped in $[BMIm][BF_4]$[38], $[CMIM][CF_3COO]$[39], $[Et_3N][HSO_4]$[40], amberlyst[41], catalyst free[42], *etc*.

The microwave (MW) irradiation technique provides a well established and powerful energy source for the synthesis of heterocycles. It has many advantages over the conventional methods such as an improved reaction rate, increase the yield of the product, selectivity, rapid optimization and environmentally benign approach. The MW technique[43-47] is applicable for various multicomponent reactions as well as cross-coupling reactions such as Sonogashira, Suzuki-Miyaura, *etc*. Therefore, to contribute in green scenario, the acridine 1,8-diones were synthesized by a microwave technique using ionic liquid as a green catalyst.

Results and Discussion

In optimization, we have focused on the catalytic activity of ionic liquid *N*-butylpyridinium heptachlorodialuminate in the synthesis of acridine 1,8-diones (**4a-j**). Initially we have performed the

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Abbreviations: IL-Kit: *N*-butylpyridinium hepta-chlorodialuminate; USI: Ultrasound Irradiation; MWI: Microwave Irradiation.

© 2019 IJSRST | Volume 5 | Issue 4 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section : Science and Technology

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Green Synthesis of Novel substituted 2-(1, 3-diphenyl-1*H*-pyrazol-3-yl) benzo [*d*] thiazole and using Ionic Liquid under Ultrasound and Microwave Condition

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SYNTHESIS & BIOLOGICAL EVALUATION OF OXADIAZOLE TETHERED TETRAHYDROTHIENOPYRIDINES

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Abstract: Oxadiazoles were good bioioster of treasured functional groups in medicinal chemistry such as esters. Considering this, synthesis of oxadiazole at active position of tetrahydrothienopyridine was magnificently accomplished. Novel series of Tetrahydrothienopyridine oxadiazole hybrids were synthesized by condensation of acid and hydrazide followed cyclization using tosyl chloride and *N*-substitutions was achieved by EDC.HCl as a peptide coupling reagent using different types of acids. All analogs have been characterized by ^{1}H NMR, IR and Mass. In-vitro inhibition of % platelet aggregation was screened on human blood and found encouragingly some analogs to be effective.

Keywords: Tetrahydrothienopyridine, Antiplatelet activity, Oxadiazoles

1. Introduction

Thrombosis is a foremost root of 80 % heart attacks (myocardial infarction) and preponderance deaths in theworld.[1] Deep vein thrombosis (DVT) in the frequent population was 0.05% per years and the disorder is infrequent in children but increases with age. Surgery, cancer, immobilization or admission for other reason is also 50% of first-time episodes of deep vein thrombosis are caused by peril factors.[2] With the higher age, use of antithrombotic, antibiotic and antiviral drugs in combination results unpleasant circumstances of internal bleeding outcome in life threatening.[3] Multidrug resistance bacterial and viral infections are more crucial in older age people, in which treatment mode become exigent.[4] These facts necessitate an essential drug design and synthesized a new placid hybrid which targets numerous diseases compatible for higher age peoples. Molecular hybridization perception is extremely admired now a day, to this approach researcher trying to combining two or more bioactive pharmacophore in single potent lead hybrid.[5–8] 1,3,4-oxadiazoles are recognized as an extensive bioioster of amide and ester functionalities.[9] Raltegravir was used to be antiretroviral drug use for the treatment of HIV infections[10](**Figure 1**). In addition, 1,3,4-oxadiazole derivatives exhibits various potency asanti-inflammatory,[11] antitubercular,[12]analgesic,[13]anti-HIV,[14] antibacterial,[15] antimicrobial,[16] and anticoagulant.[17] It is noticeably captured the intention of drug design expert as an unique potent pharmacophore for the variety of medical therapy like infection,[18] diabetes,[19] cancer[20] and obesity[21].

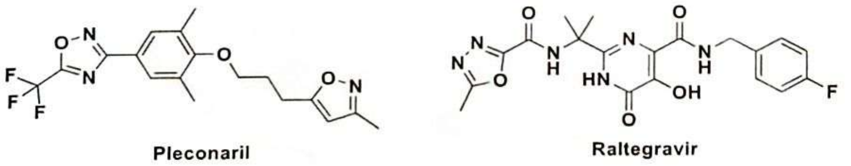
Pleconaril
Raltegravir

Figure 1. Oxadiazoles containing drugs

Thienopyridine clubbed hybrids in research were screened for different types of biological activities like GPIIB/IIIA antagonists,[22] PARP inhibitor,[23] antileishmanial,[24]tumor necrosis factor-α (TNF-α) inhibitors,[25]antibacterial,[26-27]potent smoothened antagonists,[28] antiplatelet agents for deep vein thrombosis.[29-30] Based on the above mentioned investigations various thienopyridine mixed hybrids like tetrazoles, amides, active antibiotics (Ofloxacin) were tethered throughout the N-linking substitutions.[31-32]Moderately bioisosterism in drug design is need for new drug development which is a new aphorism for research group in the class of thienopyridine.[33–35] In this research, tetrahydrothienopyridine is tether with the fluorinated oxadiazoles (**Figure 2**).

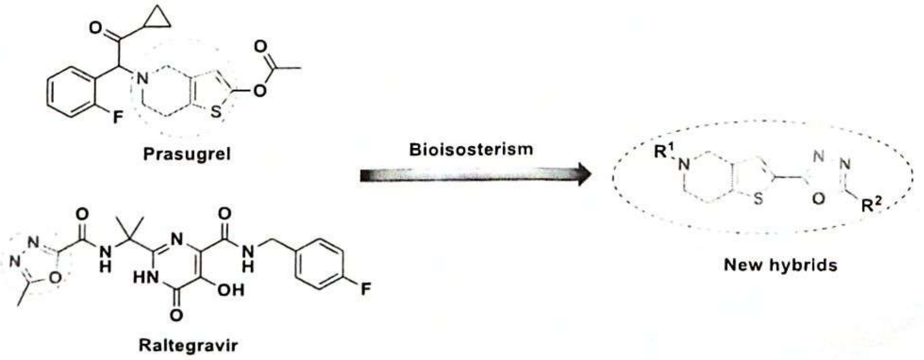

Figure 2. Bioisosterism and molecular hybridization of new molecules

Biochemical Analysis of Farm Pond Fresh Water Algae

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ABSTRACT: *Algae area rich and diverse source of pharmacologically dynamic natural products. Present paper deals with the biochemical analysis of algal members of division Chlorophyta, Bacillariophyta and Cyanophyata.Preliminary phycochemical analysis revealed the presence ofprincipal bioactive compounds- phenols, saponins, tannins, amino acids, coumarins and flavonoids. Currentdrifts in drug study from natural sources have shown that algae are hopeful organisms to afford unique biochemically active compounds. The present analysis defines the main constituent's biosynthesized by algae with nascent profitable influence in food science, therapeutic industry and community health.*

Keywords:*Algae, biochemical analysis, bioactive compounds*

Introduction

Secondary metabolites derived from algae have a broad range of biological activities such as antibiotic, antiviral, antioxidant, antifouling, anti-inflammatory, cytotoxic and antimitotic activities. These secondary metabolites show various applications in pharmaceutical industries. With the increasing apprehension now-a-days microalgae are paid more concentration as nutraceuticals in the markets. Many researchers suggest that biological composition of microalgae such as protein, carbohydrate, minerals and bioactive compounds are of potential medicinal value that influences the nutritional value (Brown and Jeffrey 1992; Fuentes *et al*., 2000). Bioactive compounds: polyphenols, catechin, flavonols, glycosides, and phlorotannins discovered from methanol extract of red, green and brown algae are been reported to have uniqueness in their molecular skeleton and structures contributing to the strong antioxidant activity (Khoddami *et al*., 2013).

Materials and Methods

A) Preparation of algal extract:

Fresh algal materials were collected from the agricultural pond at Wakadi village. After collection, algal materials were immediately washed with distilled water to remove epiphytes and adhering debris, and then dried at room temperature. The dried tissues were grinded to a fine powder. 10 gm of algal powder was completely homogenized and extracted with 100 ml of methanol, acetone, ether, chloroform, alcohol solvent and distilled water for 24hrs. Clarification of algal mixture was carried out by filtration method using Whatman No.1 filter paper. The crude extracts were stored in the dark. Further these extracts were stored for estimating secondary metabolites.

B) Preliminary biochemical studies

The above condensed algal extracts, were preliminarily assessed for the boochemicals such as phenol, flavonoid, saponin, glycosides, alkaloids, tannins and terpenoids as:

C) Qualitative biochemical Analysis

Preliminary biochemical analysis was carried out for the extract as per standard methods described by Brain and Turner (1975) and Evans (1996).

1) Detection of Alkaloids: Extracts were dissolved individually in dilute hydrochloric acid and filtered. The filtrates were used to test the presence of alkaloids by using following reagents

i) **Mayer's test**: Filtrates were treated with Mayer s reagent. Formation of a yellow cream precipitate indicates the presence of alkaloids.
ii) Wagner s test: Filtrates were treated with Wagners reagent. Formation of brown/
reddish brown precipitate indicates the presence of alkaloids.

2) Detection of Flavonoids

i) Lead acetate test: Extracts were treated with few drops of lead acetate solution.
Formation of yellow color precipitate indicates that the presence of flavonoids.
ii) H_2SO_4 test: Extracts were treated with few drops of H2SO4. Formation of orange colour indicates that the presence of flavonoids.

3) Detection of Steroids

Two ml of acetic anhydride was added to 1 ml of the extracts, each with two ml of H_2SO_4. The colour was changed from violet to blue or green in some samples indicate that the presence of steroids.

4) Detection of Terpenoids

Salkowski's Test: 1 ml of the extract was mixed with 2 ml of chloroform and concentrated H_2SO_4 (3 ml) was carefully added to form a layer. An appearance of reddish brown colour in the inner face was indicates that the presence of terpenoids.

5) Detection of Anthroquinones:

Borntrager's Test: About 1 ml of the extract was boiled with 10% HCl for few minutes in a water bath. It was filtered and allowed to cool. Equal volume of $CHCl_3$ was added to the filtrate. Few drops of 10% NH3 were added to the mixture and heated. Formation of pink colour indicates that the presence anthroquinones.

6) Detection of Phenols:

i) Ferric chloride test: 10 mg extracts were treated with few drops of ferric chloride solution. Formation of bluish black colour indicates that the presence of phenol.
ii) Lead acetate test: 10 ml extracts was treated with few drops of lead acetate solution. Formation of yellow colour precipitate indicates that the presence of phenol.

7) Detection of Saponins: About 0.5 ml of the extract was shaken with five ml of distilled water. Formation of frothing (appearance of creamy miss of small bubbles) shows that the presence of saponins.

8) Detection of Tannins: A small quantity of extract was mixed with water and heated on a water bath. The mixture was filtered and ferric chloride was added to the filtrate. A dark green colour was formed. It indicates that the presence of tannins.

9) Detection of Carbohydrates

Benedict's test

To 0.5 ml of filtrate, 0.5 ml of Benedict's reagent is added. The mixture is heated on a boiling water bath for 2 minutes. A characteristic colored precipitate indicates the presence of sugar

10) Detection of Protein & Amino acids

i) Biuret test: To 0.5 ml of extract equal volume of 40% NaoH solution and two drops of one percent copper sulphate solution was added. The appearance of violet colour indicates that the presence of protein.
ii) Ninhydrin test: About 0.5 ml of extract was taken and two drops of freshly prepared 0.2% Ninhydrin reagent was added and heated. The appearance of pink or purple colour indicates that the presence of proteins, peptides or amino acids.

11) Test for Glycosides

For 50 ml of extract is hydrolyzed with concentrated hydrochloric acid for 2 hours on a water bath, filtered and the hydrolysate is subjected to the following tests.
Borntrager's test:To 2 ml of filtered hydrolysate, 3 ml of chloroform is added and shaken, chloroform layer is separated and 10% ammonia solution is added to it. Pink colour indicates presence of glycosides.

12) Cardiac glycoside

Keller-Killani test- To 2 ml of extract, glacial acetic acid, one drop 5 % ferric chloride and concentrated sulphuric acid were added. Appearance of reddish brown colour at the junction of the two liquid layers indicates the presence of cardiac glycosides.

13) Test for Anthocyanins

The presence of anthocyanins has been demonstrated by adding 2 mL of the plant extract with 2 mL of 2 N HCl. The appearance of a pink-red color that turns purplish blue after addition of ammonia indicates the presence anthocyanins.

14) Coumarins: 3 ml of 10% NaOH was added to 2 ml of aqueous extract formation of yellow colour indicates coumarins.

15) Emodins: 2 ml of NH_4OH and 3 ml of benzene was added to extract appearance of red colour indicates presence of emodins

16) Phlobatannins Deposition of red ppt when aqueous extract of each plant sample is boiled with 1% Aqueous HCl was taken as evidence for presence of Phlobatannins

Results and Discussion

The preliminary bicochemical analysis of the fresh water extract revealed the presence of sugar, protein, phenols, alkaloids, flavonoids, tannins, anthocyanins, glycosides, coumarins, phlobatanins, carbohydrates, anthraquinone.

Table 1: Preliminary analysis of biochemicals.

Sr.No.	Phycochemical	Methanol	Alcohol	Ether	Acetone	Chloroform	Aqueous
1	Alkaloids	-	-	-	-	+	-
	i) Wagner's Test ii) Mayer's Test	-	-	-	--	+	-
2	Flavonoids						
	i) Lead Acetate	+	-	-	-	-	-
	ii) H_2SO_4 test	-	-	-	-	-	-
3	Phenols						
	i) Ferric chloride	-	-	-	-	-	-
	ii) Lead acetate	+	+	+	-	-	+
4	Tannins						
	i) Ferric chloride	+	+	-	+	-	-
5	Terpenoids	-	-	-	-	-	-
6	Saponin	-	-	-	-	-	-
7	Steroids	-	-	-	-	-	-
8	Anthocyanins	-	-	-	+	-	-
9	Coumarins	+	+	-	-	-	-
10	Emodins	-	-	-	-	-	-
11	Glycosides	+	+	-	+	-	-
12	Anthraquinone	-	-	-	+	-	-
13	Cardiac glycosides	-	-	-	-	-	-
14	Phlobatanins	-	+	-	-	-	-
15	Proteins	+	+	-	-	-	-
16	Carbohydrates	+	+	-	-	-	-

Conclusion

The algae possess an excellent source of basic primary and secondary metabolites that provides them with an ability to be used as an indigenous folk medicine by traditional healers. This can further be investigated in a wide scale for the purpose of drug development against various diseases. Quantitative phytochemical estimation of algae is very important in identifying new sources of therapeutically, industrially important compounds. Primary and secondary metabolites in a good amount those are adequate enough to fight against infection and major ailments. Phytochemicals are not essential nutrients and are not required by the human body for sustaining life, but have important properties to prevent or to fight some common diseases. The quantitative estimation of the screened phytochemicals may pave a way for the further analysis of the role that they play against any pathological process. And further studies on the isolation and characterization of the bioactive compound.

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Algal Diversity of Fresh Water Farm Pond

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Abstract

Farm ponds are now a day extensively utilized for irrigation purpose. In the present study Farm pond situated within the Wakadi village, Rahata Tahasil of Maharashtra State (India) was selected. In order to identify the biodiversity of this pond, the algal samples were collected at regular intervals. These collected samples were observed, identified and micro photographed. The identification of algae was done with the help of standard books and monographs *viz.* Prescott (1962), Randhawa (1959), Philipose (1967), Ella Gonzalvis. Desikachary 1959. In all, 16 different algal genera were recorded from chlorophycean, Bacillariophyceae, Pennales, Cyanophyceae.

KEYWORDS: Fresh Water Algae, Farm pond, Biodiversity.

Introduction:

The members of green algae are abundantly found in all type of water bodies including, fresh water, brackish water and marine water. The aquatic ecosystem harboring them may be stagnant or continuously flowing. Besides these, algal growth can be supported by moist surface such as wet soil, rocks, tree trunks, walls of old buildings etc. Algae are found growing in a variety of aquatic and terrestrial ecosystems. (Satpatiet.al., 2013). The algal thallus ranges from unicellular mucilaginous colonies to multicellular compact forms which show considerable diversity in form and adaptation to their distinctive environment (Krishnamurthy, 2000).

Algal biomass now a day is drawing huge attention of the scientific and industrial community due to its potential as a raw material in various fields. Algae have good climatic and anthropogenic tolerance which is proving to be effective in its growth (Gupta and Pamposh, 2014).

Algae is not only supporting the food chain and food web but also playing a vital role in biogeochemical cycles of the nature. Algae as a producer in the ecosystem are creating interest in the global community due to its potential in fixing the atmospheric nitrogen. The application of algal bio fertilizers in various agricultural fields has been proved successful and eco-friendly. So the environmentally hazardous chemical fertilizer is now being gradually replaced by eco-friendly bio fertilizers (Gupta and Pamposh, 2014). The algae is also playing important role in the phytoremediation of environmental pollutant.

The agricultural farm pond is now becoming popular method of irrigation among the farming community. The growing interest of the farmers towards farm pond is due to the water crises arised due to reduced rainfall over past few years. The government incentives for construction of farm pond have accelerated the number of farm pond tremendously in last few years. These farm ponds store the water round the year and hence favor the growth of algae.

The study area in the present study is wakadi of Ahmednagar district in Maharashtra state of India. It is a rain shadow area with a little annual rainfall. Hence, farmers generally utilize the water from farm pond during lean period. Due to decreased rainfall, the number of farm ponds are increasing day by day. Therefore, the study was conducted with the objective of identification and classification of algae growing in the farm ponds of wakadi.

Material and Methods:

Study area:

The present study was carried out in the Farm pond in Wakadi village, RahataTahasil of Maharashtra State (India).

Collection of sample:

Algal specimens were collected in sterilized glass containers from selected farm pond. Individual collections were picked in container with detailed field notes like collection number, date, nature of occurrence etc. The collected specimens were carefully cleaned in tap water before being preserved in container. For long term storage and future reference 4% formalin were used as preservative (Glycerin is added to this solution for long time preservation).

Identification of Algae

Permanent slides were prepared and observed under microscope. Photography was done by an Olympus photomicroscope. The identification of phytoplankton was done with the help of standard books and monographs *viz.* Prescott (1962), Randhawa (1959), Philipose (1967), Ella Gonzalvis. Desikachary 1959. Slides were prepared using G.W.F. solution (98% glycerin: distilled water: 42% Formalin = 1:1:1) as mounting medium.

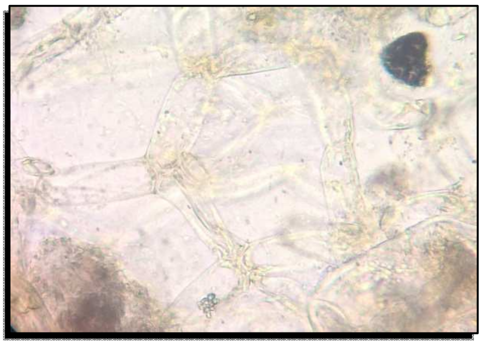
Results:

Sr.No.	Division	Class	Order	Genus
1	Chlorophyta	Chlorophyceae	Chlorococcales	*Hydrodictyon reticulatum* L. *Coelastrum microporum (*Naegeli
			Ulotricales	*Ulothrix tenuissima* (Kuetzing).
			Zynematales	*Mougotia sphaerocarpa* (Wolle)
			Cladophorales	*Cladophora glomerata* (L.) *Rhizocolnium crassipelitum* (West & West). *Pithophora mooreana* (Collins
2	Bacillariophyta	Bacillariophyceae	Pennals	*Navicula cuspidate (*Kuetz . Var. ambigua *)* *Pinnulariaborealis* (Nitzsch.) *Milosira granulate*(Ehr.) Ralfs. *Fragilaria intermedia* (Kuetz.) *Nitzschia palea* (Kuetz.)

				W. Smith
3	Cyanophyta	Cyanophyceae	Ocillatoriales	*Ocillotoria subbrevis*(Schmidle *Lyngbya stagnina* (Kuetzing *Scytonemaocellatum* (Lyngbye ex. Born) *Microcoleus chthonoplastes* (Thuret ex. Gomont)

It was reported that, the fresh water algae collected for the present research were from three major division's viz. Chlorophyta, Cyanophyta and Bacillariophyta divisions. Total 16 genera were reported in the collected algae. It was also found that these algae were responsible for blocking the drip laterals.

It was also decided further to test these algae as bio fertilizers.



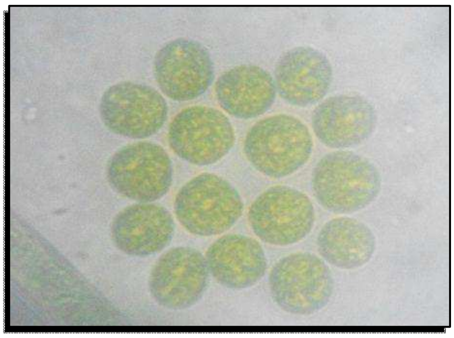


Fig.4.1- *Hydrodictyon reticulatum* (L.)

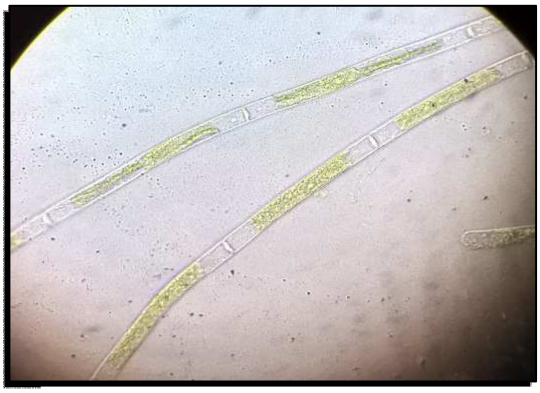


Fig.4.3-*Mougetiasphaerocarpa*

Fig.4.4- *Ulotrix tenuissima* (Kuetzing).

Fig.4.5- *Cladophora glomerata* (L.)

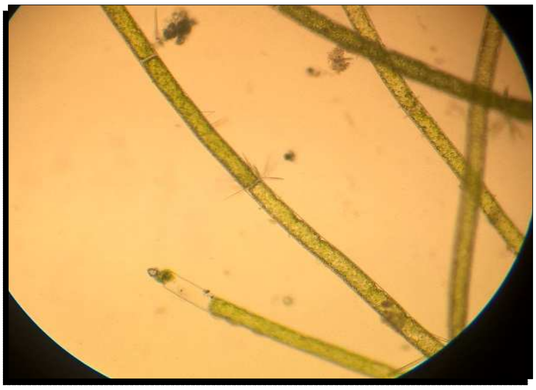


Fig.4.6- *Pithophora mooreana* (Collins)

Fig.4.7- *Rhizoclonium crassipelitum* (West & West).

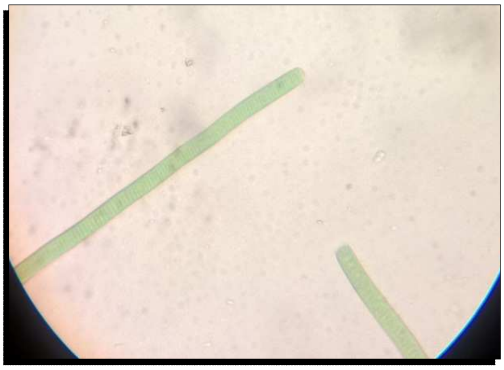


Fig.4.8-*Ocillatoria subbrevis*(Schmidle)

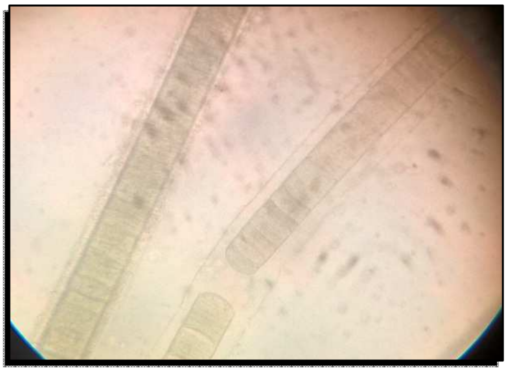


Fig.4.9-*Lyngbyastagnina* (Kuetzing)

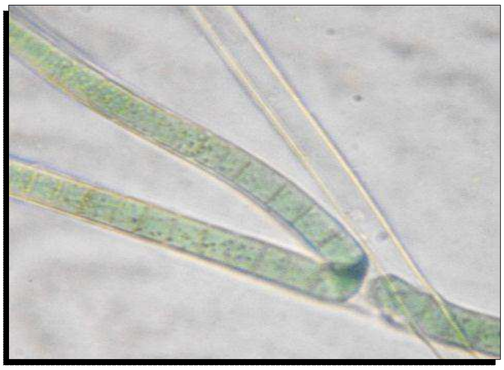


Fig.4.10- *Scytonema ocellatum* (Lyngbye ex. Born)

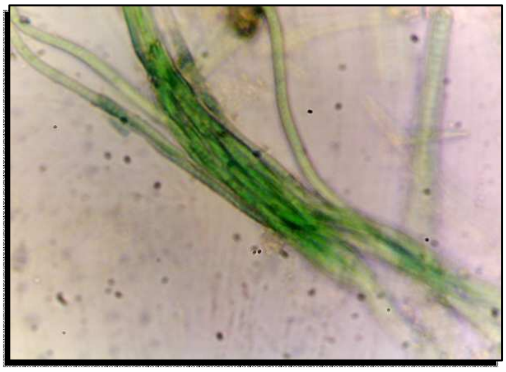


Fig.4.11-*Microcoleus chthonoplastes* (Thuret ex. Gomont)

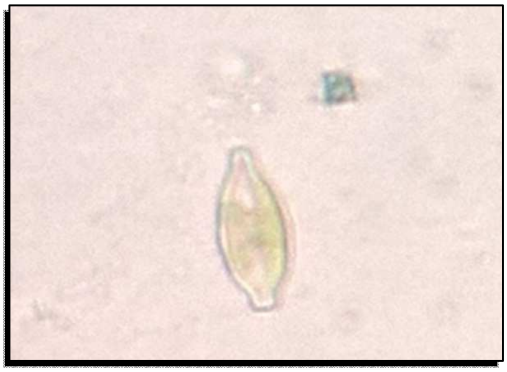


Fig.4.12-*Naviculacuspidate* (Kuetz . Var. ambigua)

Fig.4.13- *Pinnularia borealis* (Nitzsch.)

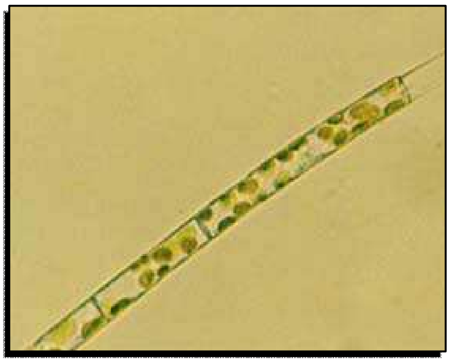


Fig.4.14- Milosiragranulate(Ehr.)

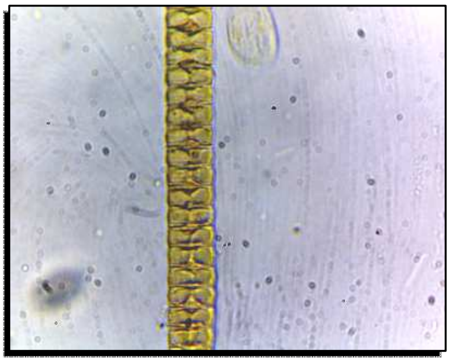


Fig.4.15-*Fragilaria intermedia* (Kuetz.)

Fig.4.16-*Nitzschia palea* (Kuetz.) W. Smith

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