*The Journal of Science, Technology & Humanities*

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## Editor-in-Chief – Sankalan - (ISSN Online: - 2455-3557)

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# MESSAGE AND NOTE THROUGH DESK

## [A]. Mentor - Prof. (Dr.) R.K. Khandal
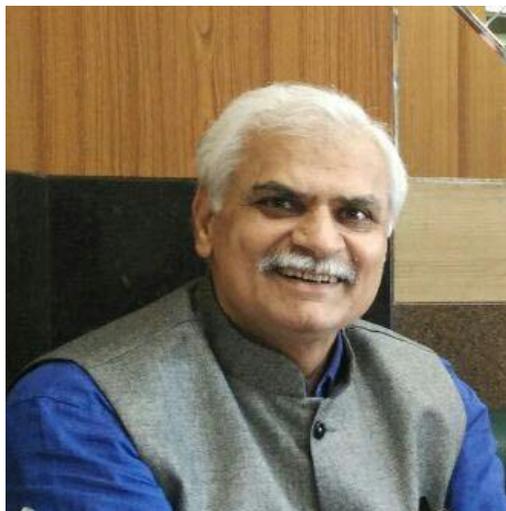


**Prof. Dr. R. K. Khandal**

**Brief Profile:**

a. Prof. Dr. R.K. Khandal Is the President, R&D and Business Development at India Glycols Limited, a well renowned and one of its kind company in the world manufacturing Surfactants from sugarcane molasses. Former Vice Chancellor, Uttar Pradesh Technical University, Lucknow, a Fellow of the Royal Society of Chemistry, London

b. Unanimously elected President of WAITRO (World Association of Industrial & Tech. Organizations), a UN body, 2010-2012 and 2012-2014

c. Expert member of High level Committees of Govt. of India:

   i.     Ministry of Science and Technology
   ii.    Ministry of Child and Women Welfare
   iii.   Ministry of Food Processing Industries
   iv.   Recruitment and Appraisal committees of CSIR, DRDO etc

d. Guided 30 PhD's from 10 Universities. 15 International Patents published 118 research papers in peer reviewed journals, five books and two edited.

e. He has received several awards; prestigious ones include:
   i.     INSME (International award for innovation);
   ii.    R.N. Bangur Memorial award for novel technologies;

Website: - www.sankalan.org

iii.     R.G. Deshpande award for popularizing Radiation processing technology;

iv.     U.P. Ratna Award, 2014 for Transforming Technical Education in U.P.

v.      Rajasthan Samman Award, 2015 from Rajasthan Associations;

vi.     Meri Dilli award, 2010 for improving the living standards of citizens of Delhi

vii.    Srishti awards for green technologies, waste management etc.

viii.   Amity Academic Excellence award for pioneering research and academics

ix.     AMAR UJALA Excellence Award for outstanding contribution to education

x.      Life time achievement award by World Environment Congress in food preservation, safety, environment protection and renewable energy,

xi.     Eminent Engineers Award by Institutions of Engineers, India

xii.    Academic Excellence Award from Engineering Watch, India, in Singapore,

**Growth Path:**

a. Born on September 6, 1957, he started his career in 1982, as a **lecturer in Indian School of Mines, Dhanbad** at a very young age of less than 25 years.

b. In 1985, joined as a **Group leader in a UNIDO project of Govt. of India.** Post-Doctoral research` ~ 1 year in England and 2 years in France.

c. On return from France in 1991, joined as **Manager, ICI Specialty chemicals**, an MNC and worked for developing Technologies for specialty chemicals.

d. In 1993, joined **India Glycols Limited as General Manager.** Managed team of R&D and Production for 8 years to for new products for growth of the Company.

e. From 2001 to 2012, as the **Director, Shriram Institute, Delhi** established as a leader par excellence. Developed and established a self-sustainability model.

f. **DURING 2012 – 2015, AS THE** VICE CHANCELLOR OF UTTAR PRADESH TECHNICAL UNIVERSITY, **TRANSFORMED THE UNIVERSITY INTO AN INNOVATION UNIVERSITY.**

g. 2015 onwards, Prof. Khandal is, the **President, R&D and Business Development, India Glycols Limited,** a global supplier of Green performance chemicals

h. Prof. Khandal has been associated with leading private universities and institutions as a mentor

**Virtues:**

Prof. Khandal is a person of eminence with unique expertise and capabilities; a rare profile covering $360°$ research and innovation cycle in career: as an Academician and a Researcher (Govt. and Pvt.). He knows how to convert challenges into opportunities.

# [B]. Patron - in - Chief: – Prof. S.K. Singh

He is serving the nation in the field of science & technology. He has completed his graduation degree in Engineering in Electronics & Communication Engineering, from B.I.T. Sindri, in 1986 and postgraduate in Business Management from X.L.R.I. Jamshedpur, in 2004.

He has 30 years of wide experience in applied Research, Product Development and Program Management besides developing algorithms and their implementation for real-time embedded applications for signal processing in technologies like Software Defined Radio, Digital Subscriber Line, Cable Modem, Meteor Burst Communications and Satellite communications.

## Background Highlights:-

- 1986 - 1997, Defence Research & Development Organization (D.R.D.O.) as Scientist

- 1997 - 2006, As Engineering Manager / Program Manager in Multinationals like, Freescale Semiconductor, Ishoni Networks, General Electric Plessey etc.

- 2006 - 2008: Cofounded a Telecom Company Hertz Tele Networks Pvt. Ltd

- 2008 - 2010: Director: Genesis Futuristic Technology Ltd, Noida

- 2010 till date: Founded many organizations till date.

- He had Co-authored a paper on the issue of inter modulation products for D.S.P. based Modulators in 2$^{nd}$ International Symposium on "D.S.P. for Communication Systems" held at Adelaide in 2004. D.S.P. based Modulators: Problems and Solutions.

## Message from the Patron - in - Chief's Desk:-

**"SANKALAN:- The Journal of Science, Technology & Humanities"** (I.S.S.N. Online:- 2455 - 3557) is a Journal started with a goal to publish innovative ideas which proposes value in creating technologies for tomorrow and solving problems of today right from concept to implementation.

This Journal will try to set an example for extending opportunities to scholars of different field to publish their papers with ethics and honesty. I wish a grand success to all the stakeholders of the Journal.

# [C]. Executive Editor / Publisher: - Rahul Rai

He is working as Assistant Registrar at B.I.T. Mesra, Ranchi, Jharkhand. His areas of interest are Analytics, Marketing & Entrepreneurship. He is M.B.A with Distinction Marks from B.I.T.S., Pilani, Rajasthan and B.Tech with Distinction in IT and Management. He has 06 years of industrial experience in Analytics and Research industry.

## Background Highlights:-

- Worked as Academic Associate in Department of Management, B.I.T.S., Pilani, Rajasthan
- Qualified All India Level :- U.G.C. National Eligibility Test – Junior Research Fellowship (U.G.C. – N.E.T – J.R.F.) in Management in the year 2013
- Diverse Experience in various domain like Banking, Retail, Media & Marketing
- Awarded Many Prizes and appreciations in the career in several fields till date
- Organized & Participated in several seminars and events till date

## Note from the Publisher / Executive Editor's Desk:-

Wishing you all a great year ahead!!!

Firstly, I will pay my gratitude to Almighty, my parents and all well-wishers with whose blessings and support we are able to start this journal "**SANKALAN:-The Journal of Science, Technology and Humanities",** (I.S.S.N. Online: - 2455 - 3557) We have started this journal publication for publishing new findings on Science, Technology and Humanities.

I hope this initiative will bring great value for academicians, researchers, students and all those who are involved in Research & Development work. We do have a highly reputed pool of advisory board members from well renowned universities, who help us in keeping high benchmark for quality and originality of our publications. Hence, I am confident that our mission to be the leading Research Journal in field of science, technology and humanities will very soon become true.

I hope very soon Buxar- Land of Rishi Vishwamitra; will soon become educational hub of Bihar.

## [D]. <u>Editor - in - Chief: - Rishabh Rai</u>

He is the Editor in Chief of this Journal. His areas of interest are Digital System Design, Communication Systems, Nanotechnology, Embedded System Design, Wireless & Mobile Communications & Low Power V.L.S.I. Design. He is M.Tech in V.L.S.I. Design specialization with Distinction Marks & B.Tech in Electronics & Telecommunication Engineering with Honours.

### <u>Background Highlights:-</u>

- Appreciated by the Govt. of India, Govt. of Bihar & Govt. of Jharkhand for the quality publication of the Journal – Sankalan: - The Journal of Science, Technology & Humanities (e - ISSN - 2455-3557), in the year 2016, 2017
- Earned the respective academic degrees in the career till date i.e. (Class $X^{th}$ to M.Tech.) with Distinction / Honours in aggregate
- Published 20 Technical / Research / Review / Study Papers in several National / International Conferences and Journals till date
- Authored many books, chapters in various publications till date
- Awarded Honorarium & Appreciated for the Paper Publication by A.K.G.E.C. International Journal of Technology in 2016
- Academic Excellence Award, for the academic performance in M.Tech. – (2013 – 2015)
- Academic Excellence Award , for the aggregate performance in B.Tech (2009 - 2013)
- I.E.E.E. National Merit Award – 2013, for the best Paper Presentation in National Conference - E.T.E.A.T – 2013
- Project Selection in the Sixth Science Conclave – 2013, at I.I.I.T Allahabad
- Amul Vidya Bhushan Award – 2009, for the academic excellence & performance in A.I.S.S.C.E. – 2009
- Awarded many awards (Winner), recognitions, appreciations at International, National, State, District, College & School Level in various academics and cultural (Solo Singing, Writing Books, Journals etc.) events till date

### <u>Note from the Editor - in - Chief's Desk:-</u>

Firstly, I am thankful to god and grateful to my venerated parents, and all those whose blessings and constant encouragement have helped me to complete this work, i.e. compilation and finalizing of the current issue of the Journal, "**SANKALAN:-The Journal of Science, Technology and Humanities", (I.S.S.N. Online: - 2455 - 3557**). Authors are requested to emphasize on novel theoretical standard and downtrodden concerns of the mentioned areas against the backdrop of proper objectification of suitable primary materials and documents. The papers must not be published, copied in parts or whole or accepted for publication anywhere else. For more information and ideas, one must visit the **"Quality & Plagiarism Check"** for such issues, as given in the website www.sankalan.org .

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# "SANKALAN"

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### OBJECTIVES:

- ❖ To develop and promote academic research activities on various contemporary techno-engineering issues and trends in management and humanities.

- ❖ To provide a platform to discuss the problems related to the technical as well as the managerial and research issues.

The most valuable and suggestive comments of all the readers are always awaited and welcomed in order to achieve the ultimate goal. We are looking forward for your contributions. All communications must be made only in electronic form e-mailed to:

**SANKALANDOTEDITOR(AT)GMAIL(DOT)COM**

**CONTACT:-**

**"SANKALAN -
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# CONTENTS

# Kinetics and Mechanism of Oxidation of Mixture of Oxalic Acid and Adipic Acid by Chromic Acid in Presence of Sulphuric Acid

**Dr. Mamta Mishra**

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*Abstract*- **The kinetics of oxidation of mixture of oxalic acid and adipic acid by chromic acid in presence of sulphuric acid has been studied. The products are succinic acid and carbon dioxide. The rate of oxidation increases with the increase in the concentration of $H_2SO_4$ Acid. kinetic of oxidation of mixture of oxalic acid and adipic acid by chromic acid shows first order reaction at $27^0$ c, order of the reaction is also one in presence of $H_2SO_4$ Acid. A mechanism consistent with the observed kinetic data has been proposed. The kinetic parameters such as catalytic constant, dielectric constant and temperature coefficient are calculated.**

*Keywords* - Kinetics and Mechanism of Oxidation**,** Chromic Acid,

## I. INTRODUCTION

Several kinetic studies of chromic Acid oxidation of different type of organic substrate have been carried out by different workers[2,5,6,7] to understand the mechanistic aspects of reduction of Cr(VI) to Cr(III), to explore the effect of the substituent on the redox activity of Cr(VI). The oxidation of oxalic acid ,co oxidation of carboxylic acid with oxalic acid and the oxidation of several carboxylic acids by acid chromate ion $(HcrO_4^{-1})$by substrate (s)producing radicals(R*). The radical reduce additional Cr(VI) to Cr(V) giving products.

$$Cr(VI)+2S \rightarrow CrS_2 \rightarrow Cr(III)+P+R* \qquad (1)$$

$$R*+Cr(VI) \rightarrow Cr(V)+P \qquad (2)$$

$$Cr(V)+S \rightarrow Cr(III)+P \qquad (3)$$
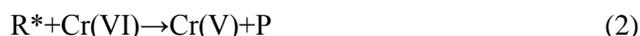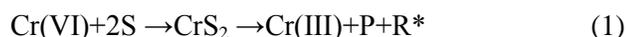
Chromic Acid has been long and successfully used as an oxidizing agent for both preparative and analytical purposes. The procedure underlying the stoichiometric equation (4) and (5)

$$HcrO_4^{-1} + 3Fe^{2+} + 7H^+ \rightarrow Cr^{3+} + 3Fe^{3+} + 4H_2O \qquad (4)$$

$$HcrO_4^{-1} + 6I^- + 14H^+ \rightarrow 2Cr^{3+} + 3I_2 + 8H_2O \qquad (5)$$
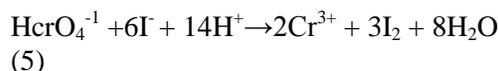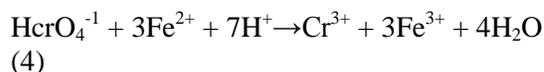
Equation (4) and (5) are among the classic method of quantitative analysis.

Materials and methods ; All the chemicals were of AR grade, Oxalic Acid (Merck) Adipic Acid (Merck) chromium trioxide (Qualigens) and Sulphuric Acid(B.D.H) and all other chemicals were used of highest purity available commercially. Solutions were prepared in doubly distilled water. Solutions of the oxidant and reaction mixtures containing known quantities of the substrates (Oxalic Acid – 20ml, Adipic Acid – 20ml) $H_2SO_4$ Acid- 20 ml, $H_2SO_4$ Acid – 20 ml and other necessary chemicals were separately thermo stated ($\pm$ $0.1^0$C).The reaction was initiated by mixing the requisite amounts of the oxidant with the reaction mixture, monitored by following the rate of disappearance of Cr (VI) by spectrophotometrically. Data so obtained $27^0$C on various reaction mixtures containing different concentration of $H_2SO_4$ Acid , while the concentration of Oxalic Acid, Adipic Acid and chromic Acid were kept constant at 0.1750M,0.1250M and 0.0038M respectively, concentration of $H_2SO_4$ Acid was varied from 0.0125 M to 0.1000M respectively.

1

**Table No.01- Rate Constant, pH Values and Hydrogen Ion Concentration**

| S. No. | Concentration Of $H_2SO_4$ Acid | Rate Constants $K \times 10^{-3}$ $Min^{-1}$ | Ph Value At $27^0c$ | Hydrogen ion Concentration $\times 10^{-2}$ |
|---|---|---|---|---|
| 1 | 0.0000 M | 5.3920 | 2.07 | 0.851 |
| 2 | 0.0125 M | 8.2877 | 1.84 | 1.445 |
| 3 | 0.0250 M | 10.4251 | 1.76 | 1.738 |
| 4 | 0.0375 M | 11.1250 | 1.73 | 1.862 |
| 5 | 0.0500 M | 12.6802 | 1.69 | 2.042 |
| 6 | 0.0625 M | 14.3500 | 1.66 | 2.188 |
| 7 | 0.0750 M | 15.7803 | 1.62 | 2.399 |
| 8 | 0.0875 M | 17.1054 | 1.57 | 2.692 |
| 9 | 0.1000 M | 18.4249 | 1.53 | 2.951 |
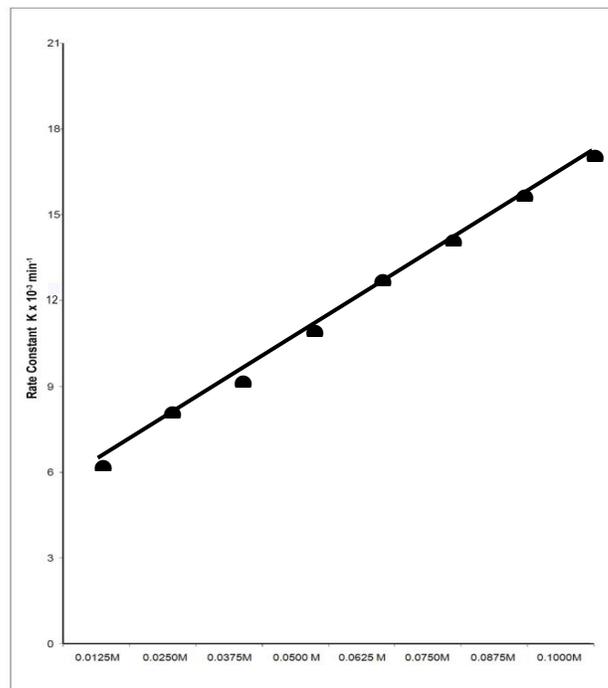


**Concentration of Sulphuric Acid (M)**

**Fig (1)**

**Variation of Rate Constant with the Hydrogen Ion Concentration of Sulphuric Acidcf Table -02**

**Variation of Rate Constant with the Concentration Cf Sulphuric Acid of Table -01**

2
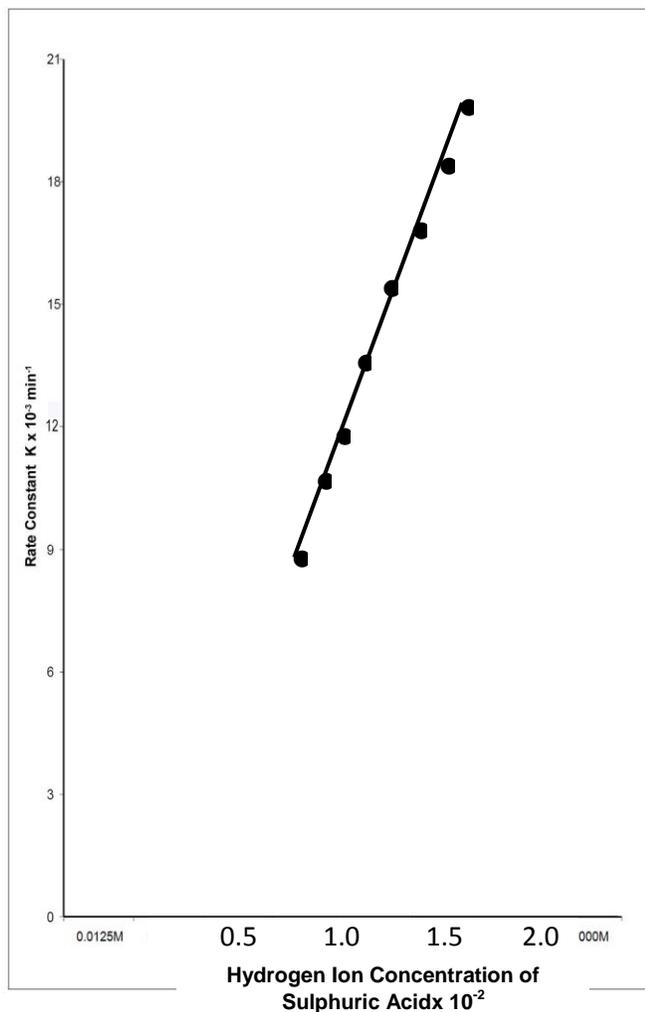
**Fig (2)**

**Tale no: 2**
**Catalytic Constant and Dielectric Constant**

| S.N o. | Concentratio n Of sulphuric Acid | Catalytic Constant $K_H^+ \times 10^{-1}$ | Di-electric Constant |
|---|---|---|---|
| 1 | 0.0000 M | - | 1.959[*] |
| 2 | 0.0125 M | 2.0033 | 1.877 |
| 3 | 0.0250 M | 2.8965 | 1.875 |
| 4 | 0.0375 M | 3.0790 | 1.871 |
| 5 | 0.0500 M | 3.5706 | 1.869 |
| 6 | 0.0625 M | 4.0958 | 1.863 |
| 7 | 0.0750 M | 4.3323 | 1.859 |
| 8 | 0.0875 M | 4.3518 | 1.857 |
| 9 | 0.1000 M | 4.4162 | 1.855 |
| Average value =1.1394*10⁻ | | | 1.867 |

| | | |
|---|---|---|
| $^1 \rightarrow 3.5931 \times 10^{-1}$ | | |

**\*Not Included in the Average.**

**Table No: 3**
**Rate Constant At Different Temperatures**

| S.N o. | Concentratio n Of sulphuric Acid | RATE CONSTANT $K_{\times 10}^{-3}$ MIN $^{-1}$ | | |
|---|---|---|---|---|
| | | $27^0$ C | $37^0$ C | $47^0$ C |
| 1 | 0.0000 M | 5.392 0 | 10.5 685 | 20.9266 |
| 2 | 0.0125 M | 8.287 7 | 16.4 090 | 31.9988 |
| 3 | 0.0250 M | 10.42 51 | 20.5 373 | 40.6639 |
| 4 | 0.0375 M | 11.12 50 | 21.5 815 | 42.9472 |
| 5 | 0.0500 M | 12.68 02 | 25.2 344 | 49.9635 |
| 6 | 0.0625 M | 14.35 00 | 28.2 697 | 55.1259 |
| 7 | 0.0750 M | 15.78 03 | 30.6 140 | 60.3086 |
| 8 | 0.0875 M | 17.10 54 | 33.6 980 | 65.7127 |
| 9 | 0.1000 M | 18.42 49 | 36.4 819 | 36.8689 |

**Table No: 4**
**Temperature Coefficient**

| S.No . | Concentration Of sulphuric Acid | TEMPERATURE COEFFICIENT | |
|---|---|---|---|
| | | $K_{37} / K_{27}$ | $K_{47} / K_{37}$ |

3

| 1 | 0.0000 M | 1.96 | 1.98 |
|---|---|---|---|
| 2 | 0.0125 M | 1.98 | 1.95 |
| 3 | 0.0250 M | 1.97 | 1.98 |
| 4 | 0.0375 M | 1.94 | 1.99 |
| 5 | 0.0500 M | 1.99 | 1.98 |
| 6 | 0.0625 M | 1.97 | 1.99 |
| 7 | 0.0750 M | 1.94 | 1.98 |
| 8 | 0.0875 M | 1.97 | 1.95 |
| 9 | 0.1000 M | 1.98 | 1.97 |

## II RESULTS AND DISCUSSION

Reaction Mixture Containing Oxalic Acid, Adipic Acid And Chromic Acid Were Stirred In Water At $27^0$C For 48 Hours. The Solvent Removed Using A Rotator Evaporator Under Reduced Presser. The Residue Was Extracted Using Diethyl Ether In Separator Funnel.

The Organic Layer Was Concentrated With A Rotator Evaporator. The Product Succinic acid was identified by its spot test[3]. Product succinic acid was also confirmed by its melting point. The evolution of carbon dioxide was tested by a conventional lime – water [9,10] test the order of the reaction with respect to chromic acid remains unaltered in the presence of Sulphuric Acid concentration in the system.

A graph obtained between the rate constant and added concentration of H2SO4 Acid (fig no. 01) suggests that the rate is a linear function of the concentration of H2SO4 Acid. Reaction is also first order with respect to $H^+$ as shown in fig No-02. The pH value decreases quite naturally with the increases in the H2SO4 Acid concentration.

No significant change in the values of dielectric constant and catalytic constant of the system is observed by the concentration of the added **$H_2SO_4$** Acid. Finally, the oxidation reaction was studied at three different temperatures, i.e., $27^0$C, $37^0$C and $47^0$C keeping all other experimental conditions constant. Values of rate

constants and temperature coefficient are given in Table No-03 and -04.

As the rate of the reaction is altered in presence of H2SO4 Acid, hence reaction is catalyzed. The rate of reaction does not depend on the concentration of $H^+$ ion only thus the effect is not due to specific acid catalysis it seems to be due to general acid catalysis.

## III. MECHANISM OF REACTION

$$CrO_3 + H_2O = H_2CrO_4 = H^+ + HCrO_4^-$$
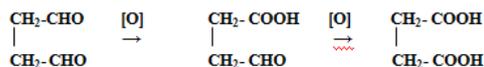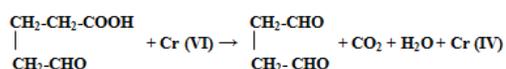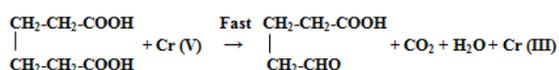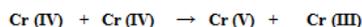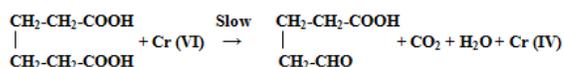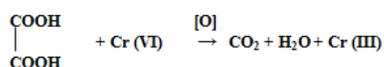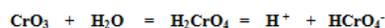


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**1- Dr. Mamta Mishra** is working as Assistant Professor in Applied Science Department at GLBITM Greater Noida, Uttar Pradesh. She has graduated (B.Sc.) from Pt Ravi Shankar Shukla university, Raipur in 2000, Post graduated (M.Sc.) from Pt Ravi Shankar Shukla university, Raipur in 2002 and Ph.D. from Varkatullah University, Bhopal in 2014. She has teaching experience of 13 years.

# Spectroscopic Determination of Electron Donor sites in (E)-2-(1-(4-hydroxy-2oxo-2H-Chromen-3yl) Ethylideneamino)-3-Methylbutanoic acid

**Manoj Kumar Goel [1], Pooja Rani [2],**

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*Abstract-* **Coumarins are oxygen containing heterocyclic compounds having unique photochemical and photo physical properties which depend on the electron donar atom or group present in it. (E)-2-(1-(4-hydroxy-2oxo-2H-Chromen-3yl) ethylideneamino)-3-methylbutanoic acid (HCMB) is coumarin derivative synthesized by condensation of 7-hydroxy-2-oxo-2H chromene-8-carbaldehyde and 2-amino-3-methylbutanoic acid and I.R., ^{1}H and ^{13}CNMR spectroscopic techniques exhibit the presence of electron donar atom which cause the fluorescence activity of synthesized molecule**

*Keywords* **-** Coumarin derivatives, electron donar atoms

## I. INTRODUCTION

Coumarin consists of a benzene ring fused together with a pyrone ring .

The pyrone ring also contains a double bond such that it extends the conjugate π system across the molecule. In Coumarin moiety an aromatic ring is contain six carbon atom as ring -I and pyrone ring as ring-II. .

The various coumarin derivatives that bear an electron donar group are most commonly used for fluorescence applications. [1]

The unique photochemical and photo physical properties of coumarin derivatives make them useful in a variety of optical application such as in optical brighteners laser dyes, nonlinear optical chromophores, solar collector systems and organic light emitting diodes.[2-6]

The present paper deal with the synthesis of compound HCMB by the condensation of 7-hydroxy-2-oxo-2H chromene-8-carbaldehyde and 2-amino-3-methylbutanoic acid and identification of electron donor sites present in such compound by Electronic, I.R., ^{1}H and ^{13}CNMR spectroscopic techniques.

## II. EXPERIMENTAL

### i- Materials and Apparatus

All solvents were dried by standard methods. Starting materials were commercially available and were purchased from BDH chemicals Ltd.

All solvents used are of HPLC or spectroscopic grade Product was purified by flash chromatography on silica gel (230–400 mesh, Merck) using Hexane: ethyl acetate (3:1) as eluent.

Melting points were taken on an Electro thermal X-4 apparatus. The IR spectra of synthesized compound is recorded in the range of 4000-400 cm$^{-1}$

This is done by using a Thermo Nicolet 320 FTIR spectrometer using KBr disc at room temperature $^1$H NMR and $^{13}$C NMR spectra were recorded on a Varian NMR system 400(400 MHz) with TMS as an internal standard. UV-Vis spectra were recorded with a 1-cm path quartz cell on a Shimadzu UV-2550.

## ii. Synthesis of (E)-2-(1-(4-hydroxy-2oxo-2H-Chromen-3yl) ethylideneamino)-3-methylbutanoic acid (HCMB)-

The methanolic solution of 7-hydroxy-2-oxo-2H chromene-8-carbaldehyde (1.9 gm, 1mole) was added to the methanolic solution of 2-amino-3-methylbutanoic acid (1.17 gm, 1 mole) and the mixture was refluxed for 30 minute. After cooling the mixture, the solvent was evaporated and the residue was purified by column chromatography on silica gel (hexane-ethyl acetate, 4:1, volume ratio), yielding the product as yellow crystal. [7]



7-hydroxy-2-oxo-2H-chromene-8-carbaldehyde

2-amino-3-methylbutanoic acid

(E)-2-(1-(4-hydroxy-2-oxo-2H-chromen-3-yl)ethylideneamino)-3-methylbuta
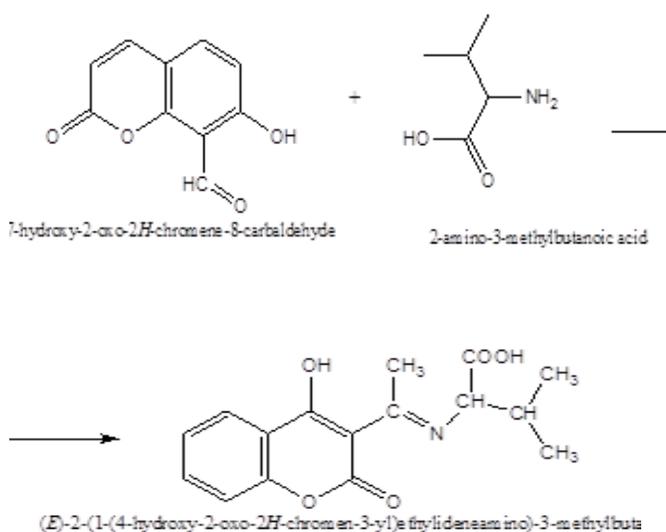
## III. RESULTS AND DISCUSSION

**i-Micro-Analysis:**(E)-2-(1-(4-hydroxy-2oxo-2H-Chromen-3yl) ethylideneamino)-3-methylbutanoic acid (HCMB), $C_{16}H_{17}NO_5$, mol. wt 303, M.P. 125 °C, **C%=** 63.36,**H%**=5.65,**N%** =4.62,**O%**=26.37.

## ii- UV-Vis Absorption Spectra

The electronic spectra of methanolic solution of HCMB observed at 497 nm, this band tentatively assigned to the $\pi \to \pi^*$ transition. [7-8] the electronic spectra of HCMB in various aqueous buffer solution are shown in Fig-1. The spectra show a small amount of bathochromic shift with increased pH.

Table:1

| Solvent | Λmax | λex(nm) | E | ϕ |
|---|---|---|---|---|
| **Methanol** | 457 | 475 | 520 | $1.05 \times 10^4$ |
| **Ethanol** | 468 | 475 | 515 | $1.25 \times 10^4$ |
| **Propanol** | 470 | 478 | 512 | $1.35 \times 10^4$ |
| **Butanol** | 465 | 485 | 510 | $1.30 \times 10^4$ |
| **Acetonitrile** | 479 | 465 | 525 | $1.75 \times 10^4$ |

ϕ, Quantum yield; $\varepsilon$, molar absorptivity L mol$^{-1}$ cm$^{-1}$.



Fig 1

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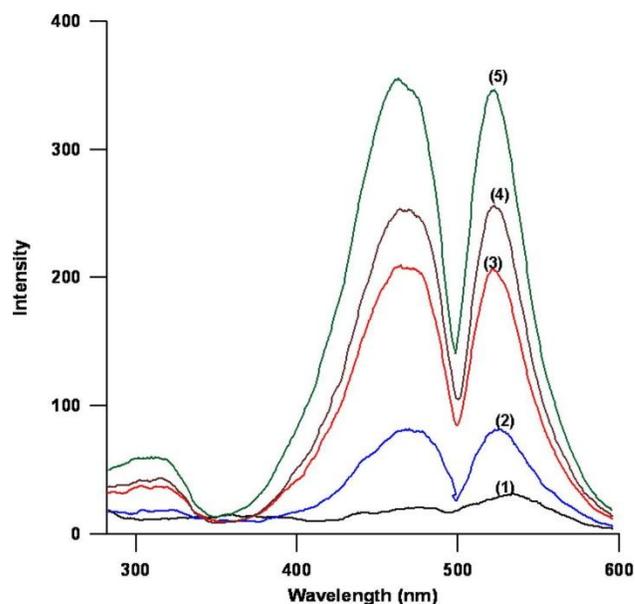
## ii- I.R. Spectral studies

The IR spectra of HCMB show a broad band in region 3000-3200 cm$^{-1}$ assigned to the stretching vibrations of –OH group. [9] the appearance of medium intensity band 1360-1350 cm$^{-1}$ , 1230-1250 cm$^{-1}$ suggested the presence of coumarin ring in compound. [10]The band appeared at 1660-1670 cm$^{-1}$ & 1760-1690 cm$^{-1}$assigned to the lactone carbonyl moiety present in compound [11-12].

The appearance of medium intensity band 1360-1300 cm$^{-1}$ suggested the presence of azomethine bond in HCMB while the presence of medium intensity band at 1615-1625 cm$^{-1}$ and 1566-1570 cm$^{-1}$ assigned to the existence of –COOH group in compound.[13]

The IR spectral bands suggested the presence of following electron donor sites in HCMB

- Nitrogen atom of Azomethine bond (C=N bond)
- Oxygen atom of cyclic carbonyl group of coumarin ring
- -COOH group
- -OH group
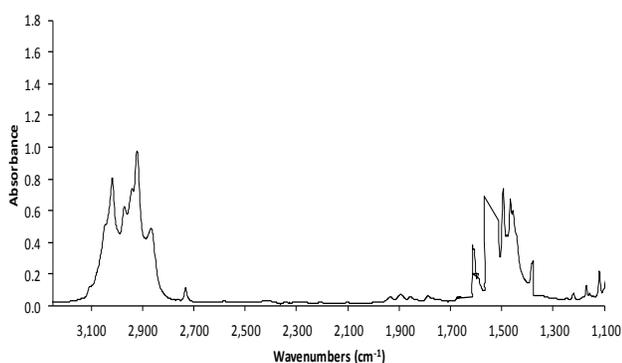


Fig 2- IR Spectra of HCMB

## iii-H-NMR Spectral studies:-

A multiplet of proton signal appeared at δ =7.02-7.27 ppm assigned to the proton signal attached with C$_5$, C$_6$, C$_7$, C$_8$, C$_9$ and C$_{10}$ atom of coumarin ring. [14] The appearance of singlet a δ =15 ppm suggested the presence of –OH group while another sharp singlet appearance at δ =11.0 ppm indicate the proton signal associated with –COOH group which can generate an electron donor site after deportonation. [15-17]
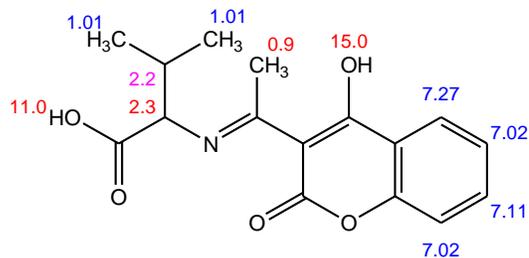


Fig 3 -$^1$HNMR chemical shift δ/ppm of HCMB
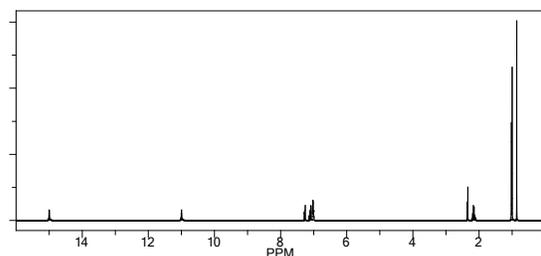


Fig 4 -$^1$HNMR Spectra of HCMB

## v- $^{13}$C NMR Spectral studies :

the $^{13}$CNMR spectra of HCMB show nine nonaromatic carbon signal at δ =159.5,165.3,126.8,125.5,128.4,121.5,150.2 & 117.5 ppm of C-2,C-3, C-4,C-5,C-6,C-7,C-8,C-9 and C-10 atom of 4-hydroxy coumarin ring.[18]. The carbon signal appeared at δ =159.5 ppm assigned to the C=O group carbon atom signal of coumarin ring. HCMB show a sharp signal at δ = 177 ppm assigned to the presence of azomethine bond. The sharp carbon signal appeared at δ = 177.5 ppm due to the presence of COOH group.[19-20].
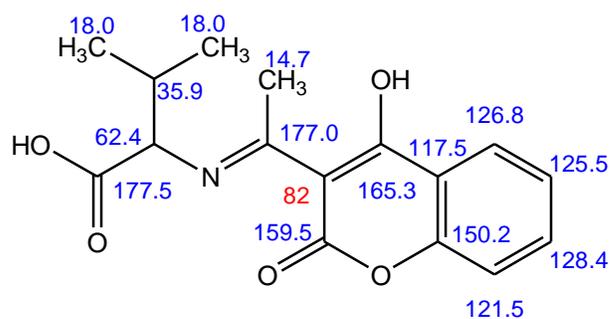


Fig 5 -$^{13}$C-NMR chemical shift δ/ppm of HCMB

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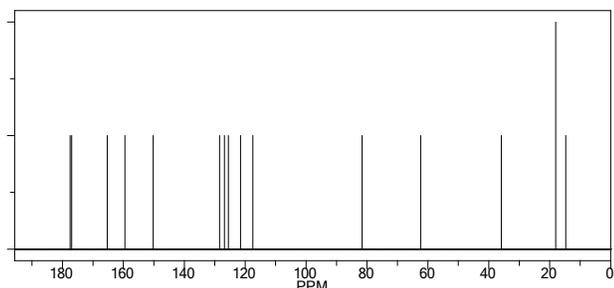
Fig 6- $^{13}$CNMR Spectra of HCMB

## IV. CONCLUSION

From the data of Electronic, I.R. and NMR spectral studies is observed that compound (E)-2-(1-(4-hydroxy-2oxo-2H-Chromen-3yl) ethylideneamino)-3-methylbutanoic acid (HCMB) have the following electron donor sites Nitrogen atom of Azomethine bond (C=N bond) Oxygen atom of cyclic carbonyl group of coumarin ring

-COOH group
-OH group
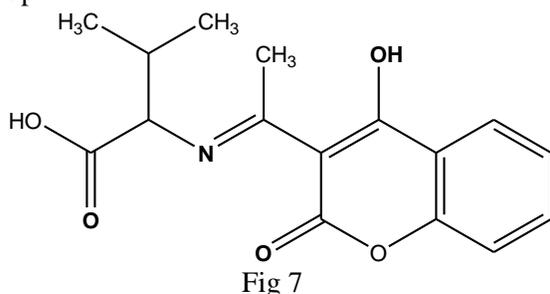


Fig 7

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# Mobile Operating Set-Up Signal Reception: A Review

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*Abstract*—**Present paper carries out a review of different channel impairments that exist in Satellite signal propagation and techniques that could be used to compensate for the same. Mobile Satellite Systems (MSS) are used to provide reliable contiguous coverage by combining the Satellite and the terrestrial cellular networks to take their respective advantages. High frequency operation, channel impairments, existence of LoS component etc. must be properly accessed for radio channel modeling of the system. This paper discusses some of these signal degradation mechanisms prevailing in Satellite links. Finally, some reception improvement techniques in view of the MSS is presented.**

*Index Terms— Mobile Satellite Systems; fading; MIMO; polarization; LNA.*

## I. INTRODUCTION

Historically, Mobile Satellite Systems (MSSs) have been used in Marine and Military Communications for providing the seamless connectivity to mobile users in regions where no other means of network can be established. MSS have also been successfully utilized in disaster management situations when all other forms of communication systems fail to respond. Recently, Hybrid Mobile Satellite Systems (HMSS) [1] have been opted in several countries due to the possibility of retrieving the combined advantages of terrestrial Cellular networks and Satellite Systems. Cellular Systems provide high bandwidth, low latency data and voice services. On the other hand, use of Satellite Systems extends the geographical coverage of the overall network. MSS systems like Thuraya, ACeS, and INMARSAT etc. have contributed a lot in the development of hybrid network by coordinating with cellular vendors across the globe.

Main aim of an efficient MSS is to provide seamless radio hand over from terrestrial cellular system to satellite system as per the radio channel condition and availability. Since cellular and satellite radio channels behave differently in many aspects, separate considerations are required for both forms of wireless systems for simultaneous optimization. Satellite system faces multipath fading of signal strength based on the humongous distance that the signal has to travel and natural phenomenon of reflection, refraction, diffraction and scattering. In order to provide uniform connectivity, channel estimates based on shadowing effects and Doppler effects need to be addressed. Common Satellite mobile channel models noted in the literature are C.Loo model [3], Lutz model [4], and Corazza model [5]. Main aim of all satellite channel models is based on probabilistic description of the abnormality of the radio propagation.

In this paper, an introduction to various signal propagation mechanism affecting the signal is provided in section II. This is followed by some mitigation schemes which can be used to provide reliable MSS coverage to the mobile user.

## II. SATELLITE LINK IMPAIRMENTS

To incorporate a low cost, high spectrally efficient wireless communication system, a complete description of all the propagation impairments is necessary. Satellite signal

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consists of a direct component, called the Line Of Sight (LoS), and multiple copies of this direct component known as multipath components. Situation is depicted in Figure 1. ITU-r [6] gives an exhaustive explanation of all the possible scenarios that the signal may encounter while its propagation. In [7], authors have modelled the received signal as

$$C(t) = A_0 e^{j(\omega_0 t + \varphi_0)} + \sum_{m=1}^{M} A_m e^{j(\omega_m t + \varphi_m)} + n(t) \quad (1)$$

Where $A_0$, $\omega_0$, are amplitude, Doppler shift and phase of the LOS component while summation part quantifies the '$M$' multipath components and $n(t)$ is the White Gaussian Noise.

prime concern to the radio engineer to facilitate the anywhere, anytime connectivity supported by MSS Sat Com.
Some techniques are suggested in this section for

In equation (2), σ denotes the standard deviation and 'r' denotes the envelope of the signal.

be used to mitigate the fades in Satellite communication link. Using more than one antenna each at transmitter and at the receiver brings multiple link establishments to the same mobile user into play. Designing an MIMO scheme is based on Space Time Coding (STC). As demonstrated in, additional dimension that comes into picture is the space which needs to be modelled in a similar way as time and frequency modelling in case of a SISO (Single Input Single Output) channel. A classical way adopted by several researchers is to model a wideband MIMO as being comprised of several narrowband SISO channels. Efficiency of such channel models depends upon the de-correlations among different fading paths available to multiple antennas. Spatially uncorrelated paths may be obtained using definite separation among multiple antennas in terms of wavelength at the frequency of operation. Key is to sample signals in spatial domain so as to generate

According to equation (1), signal received by the mobile handset receiver comprises of a dominating LOS and several other components shifted in frequency and relative phase. Based on this fact and the fact that the signal has to cover a long distance various impairments in satellite signal path are discussed next.

### A. Free Space Path Loss

FSL (Free Space Loss) is determined by the amount of distance that the signal has to travel and on the system's operating frequency. High operating frequency and larger distance results in higher losses. Even in the LoS component of received signal, FSL impacts the signal strength and mobile receiver front end must provide the legitimate amplification in improving the quality of reception.

### A. MIMO Techniques

Multiple Input Multiple Output (MIMO) antenna techniques provide advantages of diversity and multiplexing gain that can multiple parallel channels as depicted in Fig.2. In order to achieve full benefit of MIMO model, certain trade-offs must be made between BER (bit error rate), system throughput, physical size of the receiver and amount of correlation between different antenna elements.

Effect of atmospheric attenuation on LoS based MIMO scheme is very well described in which brings various interesting notes about the underlying technique. Under certain restrictions, Authors invoke the point that MIMO channel capacity is not affected by phase of the signal and that the capacity of SISO is almost half of the capacity obtained from a 2 X 2 MIMO scheme.

Limitation over the size of the mobile handset restricts the implementation of higher order of MIMO requiring multiple antennas with certain predefined separations. In case of MSS, the handset

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antenna needs to be made even larger in physical size due to absence of LoS component of signal. Satellite communication offers polarization as a means to combat this issue. Cross-polarized antenna arrays provide orthogonal or nearly orthogonal polarization (LHCP and RHCP or Horizontal and Vertical) fields which can be used for simultaneous reception of signals mitigating the multipath fade effects. This is shown in Fig. 2 (a) where one antenna at Satellite transmitter is utilized to create redundant paths. Another way to generate MIMO scheme is to use Spatial or Satellite Diversity where two Satellites can be shifted in the space to provision two distinguished links to the mobile user use. It can be noted from Fig.2 (b) that two Satellites use the same polarization to achieve diversity. Literature reveals the combination of polarization multiplexing and polarization diversity in order to double the effective amount of uncorrelated paths the arrangement for it is shown in Fig. 2 (c). Here, two Satellites provide the required spatial diversity while the dual polarizations (LHCP and RHCP)per Satellites provisions a 2 X 4 MIMO scheme. A common difficulty faced in such implementations is of separating the multipath signal from the strong LOS component. System designer also needs to address issues like polarization mismatch between various radio paths and change in orientation of polarization due to Ionospheric propagation of the Satellite signal.

## B. Fade Mitigation Techniques

Several FMTs (Fade Mitigation Techniques) have been utilized in the past depending upon the application for which they are developed. After performing a link budget calculations based on required coverage and availability, various techniques could be adopted for mitigating the impairments.

Downlink Power Control (DLPC) can be opted for combating rain attenuation by adjusting onboard power output. Onboard Beam Shaping (OBBM) can be employed to utilize active antenna which allows spot beam power to adopt according to the propagation conditions.

### Figure 2(a) Polarization Diversity
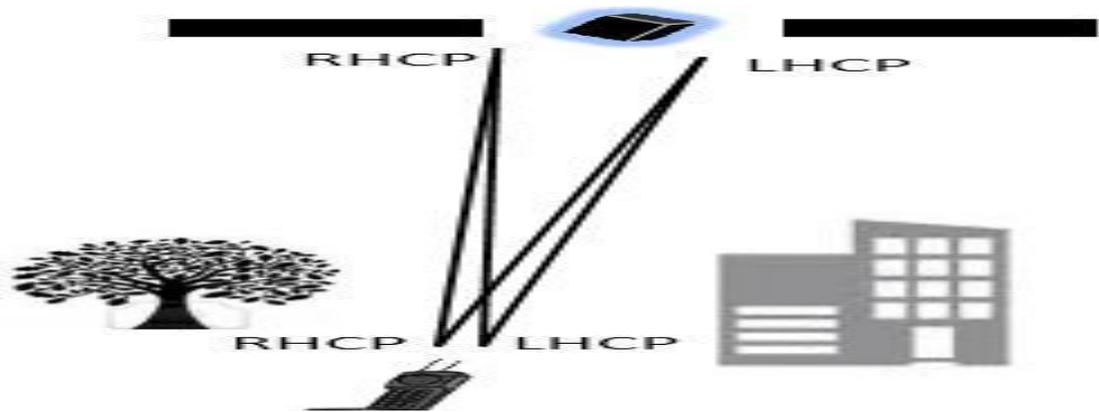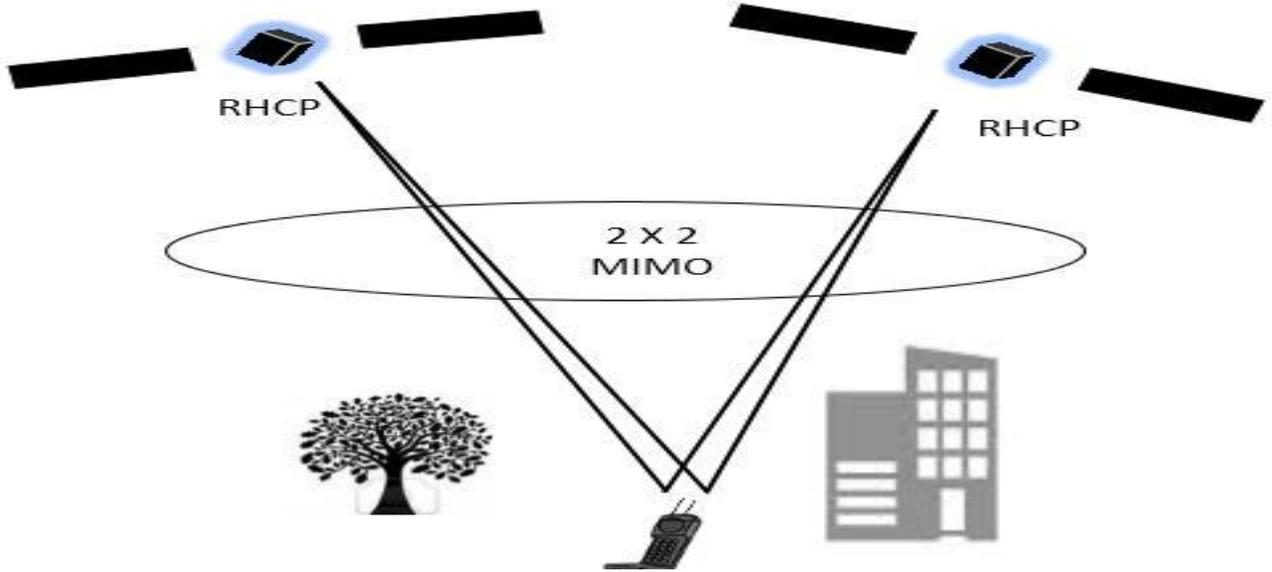
Figure 2(b) Satellite Diversity
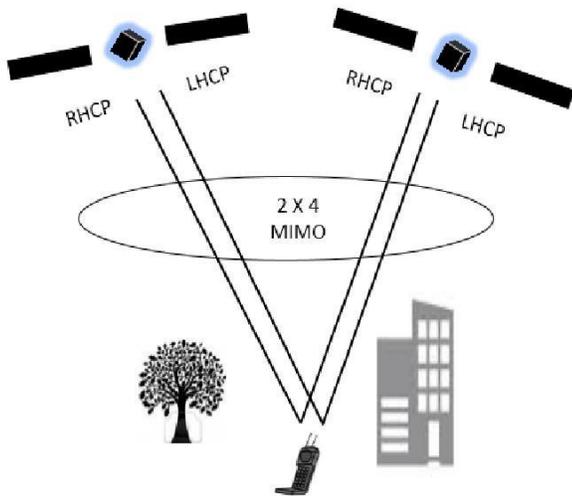


Figure 2(c) Dual Satellite/ Dual Polarization
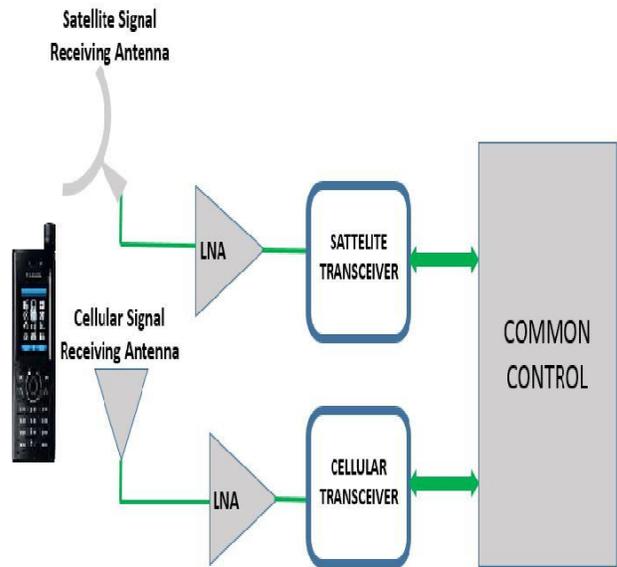


Figure 3 Hybrid Mobile Receiver Unit

Since both DLPC and OBBM techniques require

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downlink power modif1ication they can be used with effect in MSS where only mobile equipment is power constrained. Adaptive Modulation (AM) and Adaptive Coding (AC) are FMTs based on physical layer adaptability to the existing channel condition. In clear sky conditions, higher system capacity can be obtained from a given bandwidth using a spectrally efficient modulation scheme. In an AM scheme, tropospheric degradations can be mitigated by falling over to spectrally less efficient modulation scheme in order to make the physical layer more robust. AC consists of implementing a variable code rate matched to conditions in the radio propagation. As pointed out in the last section, Satellite Diversity (*SatD*) is yet another FMT that can be utilized to enhance reception quality and is very well discussed in. It mainly comprises of optimizing the satellite constellation size in accord with the minimum elevation angle that the MSS will support.

### C. Receiver RF Front End Optimization

Improvement in reception can be best optimized at the RF front end of the mobile receiver. MSS handset is designed to process signal both from terrestrial cellular systems and satellite. Due to matured MMIC (Monolithic Microwave Integrated Circuits) Technology, miniaturization of hardware has resulted into physically smaller equipment. A hybrid solution and an integrated solution have been noted.

In hybrid solution, both Satellite and cellular intelligence is housed in a single enclosure but they work separately as standalone receivers. In Integration based solution, both modems are grown over same wafer making the switching between two networks a smooth transition. Fig. 3 demonstrates the basic structure of a hybrid mobile receiver unit with separate antenna systems for Satellite and terrestrial cellular end. Satellite reception consideration deals with a weak signal arriving at the receiving antenna (or a collection of antennas in case of an MIMO scheme), the output of which is connected to Low Noise Amplifier (LNA). To

improve the quality of reception, distance between antenna and LNA has to be optimized first. Second important aspect is the design of the LNA. The amount of noise of subsequent stages of the receiver following the LNA is reduced by the gain of the LNA, while noise contributed by it is directly added to the received signal. This leaves two important considerations to the device engineer in high gain and small noise figure (NF) to be obtained simultaneously. Generally, these two parameters are opposing to obtain as the maximizing of one adversely affects the other. Gain maximization deals with minimization of VSWR (Voltage Standing Wave Ratio) which in turn depends upon impedance matching. Different optimization techniques have been reported for simultaneous gain maximization and NF minimization in.

Generally a dual LNA system is utilized for microwave amplification of receiving signal as shown in Fig. 4. This is one of the better way of achieving opposite requirements simultaneously. In such a scheme, the first of the two LNAs is designed with lowest possible NF for pre-amplification as it dominates the noise performance of the subsequent sections by the famous Friis Formula. Preamplifier should be placed as close to the antenna as possible and is sometimes fully integrated with it which gives rise to 'active antenna'. Bandpass Filter (BPF) is used to reject the intermodulation products of the preamplifier. The output of the BPF is again amplified using an LNA, this time with superior gain. This scheme has been adopted by several satellite mobile service providers although an extra LNA might increase the cost of the equipment.
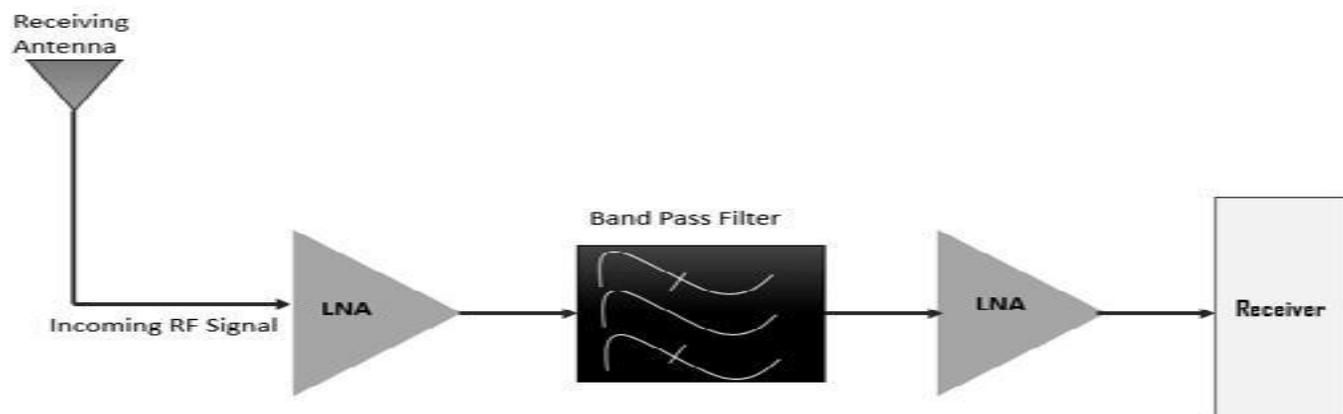
Figure 4 Dual LNA Receiver Front End

## IV. CONCLUSION

In this paper, satellite radio channel impairments are presented and various means of improving the reception of MSS are discussed. Possibilities regarding the compensation of multipath and shadowing fades are noted. Methods discussed need to be implemented both at radio as well as at the device level in order to accommodate a robust communication system. Reception Improvement Techniques can be used individually or in combination to optimize the mobile user signal reception.

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# TECHNIQUES OF IMAGE INPAINTING USED FOR WIRELESS COMMUNICATION

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*Abstract-* **Image inpainting is a technique, which employ various algorithms for filling the damaged portion of the image. This is accomplished by filling the unknown region by surrounding known region which is logically acceptable. Two things that is to be consider while performing image inpainting by any of the proposed algorithm is the texture and structure completion of the inpainted image which is the main challenge. There are many algorithms for performing image inpainting which has their own advantages and disadvantages.**

*Keywords : Texture , structure , erosion and dilation process , CNN.*

## I. INTRODUCTION

In our day to day life we have come across many images which are not in a good condition. Images are the means by which a person can hold their memories and emotions. But as the time passes these images are somehow damaged, become blurred , faded or may be spoiled due to dust. This is a common problem that a person face. Image inpainting is a technique that is the solution of this kind of problem which is firstly introduced by Bertalmio.et al..in 2000[1]. Image inpainting is a restoration process in which if a person does not know the original image than he cannot see the difference in the inpainted image. It also allow us to remove any object from the image which requires proper knowledge of the algorithm that you are using so that the texture and the structure of the original image is retained after inpainting.

In [10], a dual scheme for the compression and restoration of sequentially transmitted images over wireless sensor network is presented. This article proposes a novel dual transmission scheme, targeting mainly the area of Multimedia WSNs (WMSN) that aims to decrease the overall traffic load introduced by retransmission schemes.

In [1] Bertalmio.et al., uses smoothness function for filling the unknown region , although that algorithm fills the structure but it fails in filling the texture. Bertalmio introduced another algorithm in which he uses Navier-Stokes equation for fluids dynamics [2]. This algorithm is based on fluid dynamics and utilizes partial differential equations. basic principle is heuristic. It first travels along the edges from known regions to unknown regions (because edges are meant to be continuous). It continues isophotes (lines joining points with same intensity, just like contour joins points with same elevation) while matching gradient vectors at the boundary of the inpainting region. For this, some methods from fluid dynamics are used. Once they are

obtained, color is filled to reduce minimum variance in that area. The laplacian is used as the movement of the fluid. It has many parameters which is to be set manually and it still does not improve in filling of the texture although it shows improved result in structure filling.

## II. FAST MARCHING METHOD

In 2004, Alexandru Telea introduced image inpainting technique based on Fast Marching Method[3]. For this consider a region in the image to be inpainted. Algorithm starts from the boundary of this region and goes inside the region gradually filling everything in the boundary first. This pixel is replaced by normalized weighted sum of all the known pixels in the neighborhood. Selection of the weights is an important matter. More weightage is given to those pixels lying near to the point, near to the normal of the boundary and those lying on the boundary contours. Once a pixel is inpainted, it moves to next nearest pixel using Fast Marching Method. FMM ensures those pixels near the known pixels are inpainted first, so that it just works like a manual heuristic operation. Fig 1. shows the result of using above algorithms.



Figure 1 First image shows degraded input. Second image is the mask. Third image is the result of fast marching method and last image is the result of Navier-Stokes algorithm

## III. COLOR SEGMENTATION METHOD

In 2008, Hung, Liao, Huang, Tang, Chen[4], has introduced a method based on structure construction. This algorithm is based on color segmentation: mean shift segmentation.

In this method the structure information is separated from the image and then the missing contour is repaired by using Bézier curve .Then the exemplar-based image inpainting method is applied to recover all information of damaged area from other source area. Following Fig 1 ,flow chart shows this process. Fig 2. shows the inpainted image by using this algorithm.

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Figure 4 (a) Damaged image (b) Restored Image by CNN
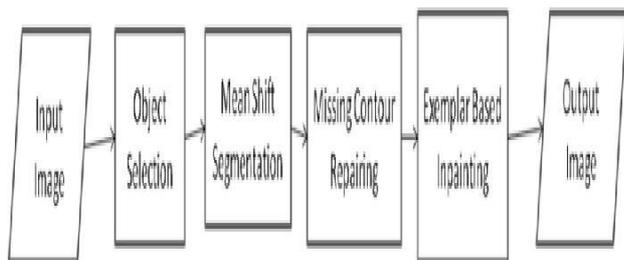
Figure 2 Flow Chart



(a) Source Image



(b) After Image Impainting

Figure 3 Cartoon picture shows the result of using color segmentation

applied to this Fig 3: shows the result by the CNN algorithm.

## IV. CELLULAR NEURAL NETWORK METHOD

In 2009, digital image inpainting by cellular neural network (CNN) is introduced [5] . It can be used to image inpainting for digital images and for video frames having very high noise ratio. This is also be used for motion pictures with high percentage of noise.

CNN is an artificial neural network of nearest neighbour interaction type. It is widely used for image inpainting, pattern recognition , moving object detection etc. In this large damaged image block(DIB) is divided into small image blocks(IBs) and each image block is subdivided into large pixel blocks(PBs). Then the recursive algorithm is

## V. WAVELET TRANSFORM

In 2011, Image Inpainting by Wavelet Transform is being proposed by Vaibhav and Sachin[6]. This paper demonstrates the removal of an object from a digital image and provides a image which has plausible background. The schemes that are used for image inpainting is classified into texture and surrounding oriented which we have mentioned earlier that these are the two main areas which is to be considered while selecting any kind of algorithm for the image inpainting.

The major advantage of using Wavelet Transform is the larger time interval and narrower band of frequencies. Wavelet Transform has been used for a good image representation and analysis tool mainly for the multi-resolution analysis etc.

The image repairing method is done by separating the texture and color composition. Then separately the image is being repaired by using color conversion formulae. Texture composition is more important than the color composition information. Fig 4 , shows the required inpainted image by using wavelet transform in which the first image is having a person doing bungee jumping and then after applying wavelet transform person is removed and the image is inpainted. Wavelet transform provide good results if coefficients are correctly chosen.



Figure 5 (a) Input Image (b) Inpainted Image by Wavelet Transform

## VI. EXEMPLAR BASED IMAGE INPAINTING

In 2012 , Oing Zhang and Jiajun Lin introduced image inpainting by color distribution analysis[7]. In this paper they used the inpainting algorithm which is exemplar-based. It has two basic steps : priority assignment and selecting the best matching patch. Exemplar – based algorithm first selects the best matching patch from the known surrounding image then using this algorithm this patch is placed in the targeted place so that a person who does not know the original image does not easily differentiate it. However, the computational time of this algorithm is not tolerable. Although there are different algorithms proposed for assigning the priority but the main problem behind selecting any of the algorithm is computational complexity and also getting the good result. In this paper they proposed different priority schemes to realize the inpainting by exemplar- based approach. They used isophote-driven priority which is also employed in earlier papers and then they have shown results using their own method i.e., color distribution analysis. They have actually compared the results by using these two methods by providing a well-defined table. They have also compared their result with the simultaneous structure and texture algorithm, which is proposed by Bertalmio in 2003[8]. Their results are robust to the high frequency components such as noises in the priority assignment. In 2013, image inpainting by erosion and dilation operation [9] is introduced in which algorithm is based on the morphological erosion and dilation operation. Erosion process is used to shrink the unknown region and Dilation process is used to take the information and texture from the

surrounding area. These methods are used for binary images. Erosion operation will shrink the foreground area. If there is a hole inside the foreground area it will enlarge. This same process is when reversed it is called dilation process. Dilation process is used for enlarging the foreground area. If any hole is inside the foreground area it will it will become small. In this they have used 3x3 structuring element. This structuring element is used in convolution with the image. Fig 5, shows the result of using erosion and dilation process and their comparison with the Telea and Navier-Stokes method.
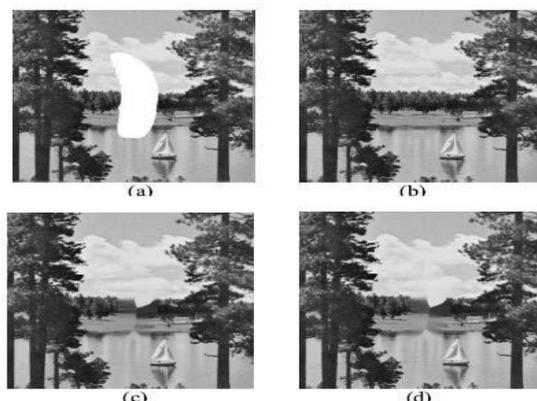


Figure 6 (a) Damaged image , (b) inpainted result by proposed method, (c) Navier-Stokes Method , (d) Telea method

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## VII. CONCLUSION

Image inpainting is the process by which one can get back their original image which is spoiled by somehow. There are various methods proposed since 2000 till date in the field of image inpainting. By using these methods we can remove any object from a digital image or we can get back our original image. Each of these algorithms has their own advantages and disadvantages. Depending on the resources available and individual choice any of the above process can be used for image inpainting.

Since image inpainting is a vast area in which every now and then new processes and algorithms will come across to the individual. It is their own choices that which particular result they have to consider so that the person can enhance the existing result by doing some kind of research in that field or they can use that algorithm for their personal use. Because images are such things which everyone have and they intact the memories and emotions of a person. Image inpainting is getting popular in recent years and research in this field will continue because any result will have a room for improvement it is a never ending process.

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**Author's Profile:-**

Ankit Sharma & Sunil Garg completed their research work in the field of Electrical & Electronics Engineering and they are performing the same coordination in the field of the respected domain of Engineering.

They have vast experience in the fields of applied research                and               development.

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[B]. Launching Poster of SANKALAN in Seminar Hall, V.I.T.M., Buxar

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[C]. Chief Guest, Guest of Honour, Chairman – (V.I.T.M.), Director - (V.I.T.M.),
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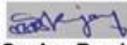
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I am pleased to write this, in appreciation of the efforts being made by the Chief Editor of the e-journal "SANKALAN", Mr. Rishabh Rai, the young and energetic fellow. It is a novel idea to bring out such a journal for facilitating academicians pursuing multi- disciplinary research in various institutions, especially from the private sector. It has been a great platform for youth engaged in resolving the issues of industry, society, and policymakers, to share their experiences with others. I am glad to note that the quality of the papers published in this journal has shown consistent improvement over each rendition.

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I wish the authors and team SANKALAN great success in their endeavours.

Regards,

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