SONOPANT DANDEKAR ARTS, V.S. APTE COMMERCE AND M.H. MEHTA SCIENCE COLLEGE, PALGHAR

Department of Chemistry

PROJECT REPORT

M.Sc. Analytical Chemistry

Academic Year 2022-2023

Prepared by
Department of Chemistry
Sonopant Dandekar Arts, V.S. Apte Commerce and M.H. Mehta Science College, Palghar

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Sonopant Dandekar Shikshan Mandali's
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Ref No.:

Date : 12/06/2023

Notice

Department of Chemistry

This is to inform you that all the **Master of Science (Analytical Chemistry)** students are required to submit the hard copy of your final project report by **19th June 2023.** All submissions should be made to the **Chemistry Department** during office hours from 09.30 am to 02.00 pm. Ensure your report is properly computer typed.

Head of the Department
Department of Chemistry

S.D.S.M COLLEGE PALGHAR DIST PALGHAR

Dr. Kiran J. Save
Principal

PRINCIPAL
Sonopant Dandekar Arts College,
V.S. Apte Commerce College &
M.H. Mehta Science College
PALGHAR (W.R.)
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UNIVERSITY OF MUMBAI

No. UG/ 87 of 2018-19

CIRCULAR:-

Attention of the Principals of the affiliated Colleges, the Head University Departments and Directors of the recognized Institutions in Science & Technology Faculty is invited to this office Circular Nos. UG/226 of 2006, dated 29th June, 2006 relating to syllabus of the Master of Science (M.Sc.) degree course.

They are hereby informed that the recommendations made by the Board of Studies in Chemistry at its meeting held on 28th May, 2018 have been accepted by the Academic Council at its meeting held on 14th June, 2018 **vide** item No. 4.73 and that in accordance therewith, the revised syllabus as per the (CBCS) for the M.Sc. in Analytical Chemistry (Sem – III & IV), has been brought into force with effect from the academic year 2018-19, accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI – 400 032
19th June 2018

(Dr. Dinesh Kamble)
I/c REGISTRAR

To

The Principals of the affiliated Colleges, the Head University Departments & Directors of the recognized Institutions in Science & Technology Faculty. (Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C./4.73/14/06/2018

****

No. UG/ 87 -A of 2018 MUMBAI-400 032 19th June 2018

Copy forwarded with Compliments for information to:-

1) The I/c Dean, Faculty of Science & Technology,
2) The Chairman, Board of Studies in Chemistry,
3) The Director, Board of Examinations and Evaluation,
4) The Director, Board of Students Development,
5) The Co-Ordinator, University Computerization Centre,

(Dr. Dinesh Kamble)
I/c REGISTRAR

AC-14/06/2018

Item No. 4.73

UNIVERSITY OF MUMBAI

Program : M.Sc.

(Choice Based Credit System)

Course : M.Sc. Analytical Chemistry

Syllabus for Semester III & IV

(To be implemented from the Academic year 2018-2019)

SEMESTER – IV

Course Code: PSCHAOC-I 404

(INTELLECTUAL PROPERTY RIGHTS & CHEMINFORMATICS)

Unit 1: **[15L]**

Introduction to Intellectual Property: [2L]

Historical Perspective, Different types of IP, Importance of protecting IP.

Patents: [5L]

Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Health care-balancing promoting innovation with public health, Software patents and their importance for India.

Industrial Designs: [2L]

Definition, How to obtain, features, International design registration.

Copyrights: [2L]

Introduction, How to obtain, Differences from Patents.

Trade Marks: [2L]

Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, trade names etc.

Geographical Indications: [2L]

Definition, rules for registration, prevention of illegal exploitation, importance to India.

Unit 2: [15L]

Trade Secrets: [2L]

Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.

IP Infringement issue and enforcement: [2L]

Role of Judiciary, Role of law enforcement agencies – Police, Customs etc.

Economic Value of Intellectual Property: [2L]

Intangible assests and their valuation, Intellectual Property in the Indian context – Various Laws in India Licensing and Technology transfer.

Different International agreements:

(a) World Trade Organization (WTO): [5L]

(i) General Agreement on Tariffs and Trade (GATT), Trade

Related Intellectual Property Rights (TRIPS) agreement

(ii) General Agreement on Trade Related Services (GATS) Madrid Protocol.

(iii) Berne Convention

(iv) Budapest Treaty

(b) Paris Convention [6L]

WIPO and **TRIPS, IPR** and Plant Breeders Rights, IPR and Biodiversity.

Unit III: [15L]

Introduction to Cheminformatics: [5L]

History and evolution of cheminformatics, Use of Cheminformatics, Prospects of cheminformatics, Molecular modeling and structure elucidation.

Representation of molecules and chemical reactions: [5L]

Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Molfiles and Sdfiles, Libraries and toolkits, Different electronic effects, Reaction classification.

Searching Chemical Structures: [5L]

Full structure search, sub-structure search, basic ideas, similarity search, three dimensional search methods, basics of computation of physical and chemical data and structure descriptors, data visualization.

Unit IV: [15L]

Applications:

Prediction of Properties of Compound, Linear Free Energy Relations, Quantitative Structure – Property Relations, Descriptor Analysis, Model Building, Modeling Toxicity, Structure – Spectra correlations, Prediction NMR, IR and Mass spectra, Computer Assisted Structure elucidations, Computer assisted Synthesis Design, Introduction to drug design, Target Identification and Validation, Lead Finding and Optimization, analysis of HTS data, Virtual Screening, Design of Combinatorial Libraries, Ligand-based and Structure based Drug design, Application of Cheminformatics in Drug Design.

REFERENCES:

1. Andrew R. Leach & Valerie J. Gillet (2007) *An Introduction to Cheminformatics.* Springer: The Netherlands.
2. Gasteiger, J. & Engel, T. (2003) *Cheminformatics: A textbook.* Wiley–VCH
3. Gupta, S. P. *QSAR and Molecular Modeling.* Springer-Anamaya Pub.: New Delhi.

Course Code: PSCHAOC-II 404

PAPER – IV: RESEARCH METHODOLOGY

Unit 1:

Print:

Primary, Secondary and Tertiary sources.

Journals:

Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.

Digital:

Web sources, E-journals, Journal access, TOC alerts, Hot articles, Citation Index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki-databases, ChemSpider, Science Direct, SciFinder, Scopus.

Information Technology and Library Resources:

The Internet and World wide web, Internet resources for Chemistry, finding and citing published information.

Unit II: DATA ANALYSIS

The Investigative Approach:

Making and recording Measurements, SI units and their use, Scientific methods and design of experiments.

Analysis and Presentation of Data:

Descriptive statistics, choosing and using statistical tests, Chemometrics, Analysis of Variance (ANOVA), Correlation and regression, curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, general polynomial fitting, linearizing transformations, exponential function fit, r and its abuse, basic aspects of multiple linear regression analysis.

Unit III: METHODS OF SCIENTIFIC RESEARCH AND WRITING SCIENTIFIC PAPERS

Reporting practical and project work, Writing literature surveys and reviews, organizing a poster display, giving an oral presentation.

Writing Scientific Papers:

Justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work, writing ethics, avoiding plagiarism.

Unit IV: CHEMICAL SAFETY & ETHICAL HANDLING OF CHEMICALS

Safe working procedure and protective environment, protective apparel, emergency procedure, first aid, laboratory ventilation, safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric pressur, safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

REFERENCES:

1. Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J., & Jones, A., (2011), *Practical skills in Chemistry,* 2nd Ed., Prentice Hall, Harlow.
2. Hibbert, D. B. & Gooding, J. J. (2006) *Data Analysis for Chemistry* Oxford University Press.
3. Topping, J., (1984) *Errors of Observation and their Treatment* 4th Ed., Chapman Hill, London.
4. Harris, D. C. (2007) *Quantative Chemical Analysis* 6th Ed., Freeman Chapters 3-5
5. Levie, R. De. (2001) *How to use Excel in Analytical Chemistryand in general scientific data analysis* Cambridge Universty Press.
6. Chemical Safety matters – IUPAC-IPCS, (1992) Cambridge University Press.
7. OSU Safety manual 1.01

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Class : MSc Part II Analytical Chemistry
Academic Year : 2022-23

Research Projects

Sr. No.	Roll No.	Name of Students	Project Title	Signature
1	401	Shruti Anand patil	Synthesis and characterization of Iron complex using pyrazole as a reagent by IR.	SApatil
2	402	Suchi Santosh Pimple	Synthesis and chracterization of monometallic complex of Silver Chloride using pyrazole derivative as a reagent.	Spatil
3	403	Mohini Dharmendra Sharma	Synthesis and chracterization of monometallic complex of nickel using pyrazole derivative as a reagent.	MDsharma
4	404	Rajkumar Kapildev Singh	Synthesis and chracterization of copper using pyrazole derivative as a reagent and study H1 –NMR and IR	RajKumar
5	405	Usha Ramu Bhoye	Synthesis and chracterization of monometallic complex of palladium using pyrazole derivative as a reagent.	Usha
6	406	Yogita Sunil Wale	Analysis of Water Sample	[illegible]
7	407	Rajendra Nanu Umbarsada	Analysis of Sap value, Acid Value and Peroxide value of Oil Sample	[illegible]
8	408	Pravi Sadu Patkar	Analysis of Water Sample from Uplat Village in Talasari Taluka	Psadu
9	409	Sandeep Ladkya Kodya	Analysis of Sap value, Acid Value and Peroxide value of Oil Sample	SLkodya
10	410	Raju Raghunath Dhapsa	Synthesis, Characterisation & Biological activity of schiff base of benzaldehyde and p-nitroaniline & their metal complexes	Raju
11	411	Alpesh Vishnu Farara	Qualitative Analysis of Azadirachta Indica - Medicinal Plant	AlepeshVfarara

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12	412	Jagdish Shantaram Dode	Synthesis and characterization of Metal Complex containing Mercury	
13	413	Dinesh Raman Kharpade	Phytochemical Study of Medicinal Plant - Azadirachta Indica	
14	414	Pranjili Sandip Chaudhari	Synthesis, characterisation & Biological activity of schiff base of benzaldehyde and m-nitroaniline & their metal complexes	
15	415	Shivani Amlesh Jha	Pharmacological Studies of Medicinal Plant - Moringa Oleifera	
16	416	Ashwita Subhash Bari	Phytochemical Studies of Phyllanthus Emblica - Medicinal Plant	
17	417	Shruti Pravin Bari	Preliminary Analysis of Phyllanthus Emblica - Medicinal Plant	
18	418	Tejal Vilas Gund	Preliminary Qualitative Analysis of Moringa Oleifera - Medicinal plant	
19	419	Shrutika Rajesh Tamore	Synthesis and Characterization of Bimetallic Complex Containing Copper and Mercury	
20	420	Dhiraj Kaluram Bhoir	Synthesis and Characterization of Bimetallic Complex Containing Copper and Silver	
21	421	Abhijeet Anant Kandekar	Synthesis and Characterization of Bimetallic Complex Containing Copper and Cobalt Metals	
22	422	Shrushti Nilesh Meher	Synthesis and Characterization of Bimetallic Complex Containing Copper and Iron Metals	
23	423	Archana Paramram Harijan	Synthesis and Characterization of Mono-metallic Complex Containing Copper Metal	

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24	424	Tejaswi Ganesh Wanga	Synthesis and Characterization of Bimetallic Ni-Hg Complex	Tejaswi
25	425	Arpit Manish Chheda	Synthesis and Characterization of Ni-Co Bimetallic complex	Arpit
26	426	Sapana Ramesh Vinkar	Synthesis and Characterization of Mono-metallic Nickel Complex	Sapana.
27	427	Chanchal Bhanudas Machhi	Synthesis and Characterization of Bimetallic Ni-Ag Complex	CMachhi
28	428	Swapnil Satyawan Pawar	Synthesis and Characterization of Ni-Fe Bimetallic complex	SPawar
29	429	Sakshi Jagdish Bhone	Synthesis and Characterization of mono-metallic containing Ferric Chloride	SBhone
30	430	Sagar Shankar Bhurkud	Synthesis and Characterization of Mono-metallic cobalt complex	SPatil
31	431	Achala Deepak More	Synthesis and Characterization of Mono-metallic containing Cobalt Chloride	AMore
32	432	Yadnyesh Manik Patil	Synthesis and Characterization of metal complex containing Copper	YPatil
33	433	Unnati Anil Naik	Application and characteristics of monometallic complex containing Zinc	Anil
34	434	Vedika Baban Adhikari	Synthesis and characterization of monometalic complex containing Mercury Chloride	Baban
35	435	Jidnesh Pradip Patil	Synthesis and Characterization of metal complex containing Mercury	Pradip
36	436	Shrutika Dhanaji Adsul	Synthesis and Characterization of Mono-metallic containing Nickel Metal.	Adsul
37	437	Karishma Nitin Vanmali	Synthesis and Characterization of Mono-metallic containing Silver Chloride.	Karishma

38	438	Prekshita Chadrakant Gharat	Synthesis, Characterization and Biological activity of metal complex containing Copper	[signature]
39	439	Janhavi Devanand Pagdhare	Synthesis and Characterization of metal complex containing Silver	[signature]
40	440	Uddhav Radheshyam Meher	Synthesis and Characterization of Mono-metallic Complex Containing Mercury Metal	[signature]
41	441	Prathamesh Suresh Sankhe	Synthesis, Characterisation and Biological Activity of Silver Metal Complex	[signature]
42	442	Abhishekh Virendra Yadav	Synthesis and Characterisation of metal complex containing copper	[signature]
43	443	Karan Rajesh Chaurasia	Synthesis and Characterisation of Copper metal complex	[signature]
44	444	Viraj Bhalchandra Arekar	Synthesis and Characterisation of Schiff Base containing Copper complex	[signature]

"Synthesis and characterisation of metal complex conataining copper."

A PROJECT REPORT SUBMITTED TO THE

DEPARTMENT OF CHEMISTRY

SONOPANT DANDEKAR COLLEGE , PALGHAR

IN PARTIAL FULFILLMENT OF THE DEGREE

OF

MASTER OF SCIENCE IN ANALYTICAL CHEMISTRY

SUBMITTED BY

MR ABHISHEK VIRENDRA YADAV

UNDER THE SUPERVISION OF

PROF. SHRADDHA SHANKAR PARAB

DEPARTMENT OF CHEMISTRY ,

SONOPANT DANDEKAR ARTS , V.S. APTE COMMERCE AND

M.H. MEHTA SCIENCE COLLEGE , PALGHAR

UNIVERSITY OF MUMBAI

2022-2023

Sonopant Dandekar Shikshan Mandali's
SONOPANT DANDEKAR ARTS, V. S. APTE COMMERCE AND M. H. MEHTA SCIENCE COLLEGE
Karekuran Road, Palghar, Dist. Palghar, Pin - 401 404.
Code.: (02525) 252163, 252317 | **website : www.sdsmcollege.com**
(NAAC Accredited 'B' Grade)

Dr. Kiran J. Save
Principal

Ref. No. : ______________

Date : ______________

Certificate

This is to certify that **Mr. Abhishek Virendra Yadav** has successfully completed his project on **'Synthesis and Characterisation of metal Complex containing Copper'** towards the partial fulfilment of the degree of Master of Science in Analytical Chemistry under University of Mumbai, Mumbai.

Date: 19/06/2023

Place:Dandekar College, Palghar

Prof.Shraddha S.Parab

(Supervisor)

Dr. Suhas Janwadkar

(Head of Chemistry Department)

13/7/23

PALGHAR
DIST. PALGHAR

CERTIFICATE

This is to certify that **MR ABHISHEK VIRENDRA YADAV** has successfully completed his project on **"synthesis and characterisation of metal complex containing copper"** towards the partial fulfillment of the degree of **Masters in Analytical Chemistry** under **UNIVERSITY OF MUMBAI, MUMBAI.**

DATE:

PLACE:

PROF. SHRADDHA SHANKAR PARAB

Head, Department of Chemistry

Sonopant Dandekar Shikshan Mandali's

Sonopant Dandekar Arts, V.S. Apte Commerce & M.H.

Mehta Science College, Dist. Palghar

DEPARTMENT OF CHEMISTRY

CERTIFICATE

This is to certify that **Mr Abhishek Virendra Yadav** has successfully completed his project on **"Synthesis and characterisation of metal comnplex containing copper"** towards the partial fulfillment of the degree of **Masters in Analytical Chemistry** at Sonopant Dandekar Arts, V. S. Apte Commerce & M. H. Mehta Science College, Palghar under University of Mumbai, Mumbai.

DATE:

PLACE:

____

Supervisor

DECLARATION

I Hereby declare that this project entitled **'Synthesis and characterisation of metal complex containing copper"** Is original work and is being submitted in particular fulfillment for award of degree, Master of University of Mumbai. This project has not been submitted earlier to this university or any other affiliated colleges of this university.

Abhishek Virendra Yadav

Student

ACKNOWLEDGEMENT

I express my profound gratitude to Prof. Dr. Suhas P. Janwadkar, H.O.D. of chemistry department for his valuable guidance and support during our course.

I extend my sincere thank you to our project guide Prof. **Shraddha Shankar Parab**, who has been supporting and encouraging throughout.

I would thank you lab assistant for providing all the help and being kind while carry out the experiment.

Last but not least I want to thank you my family and friends for their support.

Abhishek Virendra Yadav

Student

Sonopant Dandekar

Arts,

V.S. Mehta Commerce and

M.H. Mehta science

college, Palghar

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CHAPTER 1

INTRODUCTION

A coordination complex is a chemical compound consisting of a central atom or ion, which is usually metallic and is called the *coordination centre*, and a surrounding array of bound molecules or ions, that are in turn known as *ligands* or complexing agents.[1][2][3]

Copper is a versatile and widely used metal that has been valued by civilizations for thousands of years. It is an essential element in various industries and plays a crucial role in our daily lives. Copper is known for its distinctive reddish-brown color and excellent conductivity, making it one of the most important materials in electrical and thermal applications.

Historically, copper has been utilized since ancient times, with evidence of its use dating back over 10,000 years. The early civilizations in Mesopotamia and Egypt discovered the properties of copper and began using it for tools, weapons, and decorative objects. Its malleability and ability to be easily shaped made it a preferred material for artisans and craftsmen.

In terms of its physical and chemical properties, copper is a ductile metal, meaning it can be stretched into wires without breaking. This property, along with its high electrical conductivity, makes it an ideal choice for electrical wiring and transmission of electricity. Copper's excellent thermal conductivity also makes it suitable for heat exchange applications, such as in heat exchangers and radiators.

Furthermore, copper is highly corrosion-resistant, which makes it durable and long-lasting. This quality is particularly beneficial in plumbing systems and architectural applications, as copper pipes and fittings are less prone to leakage and deterioration.

Copper has found widespread use in numerous industries, including construction, electronics, telecommunications, transportation, and renewable energy. It is a key component in the manufacturing of electrical wires, circuit boards, motors, transformers, and generators. Its antimicrobial properties have also made it useful in healthcare settings, where copper alloys are used to prevent the spread of bacteria and viruses on frequently touched surfaces.

From a global perspective, the largest producers of copper are Chile, Peru, China, and the United States. The metal is typically extracted from copper ores through mining processes, and it can be recycled indefinitely without losing its beneficial properties, making it a sustainable choice.

In conclusion, copper is a vital metal with a rich history and a wide range of applications. Its unique properties, such as conductivity, malleability, and corrosion resistance, have made it indispensable in numerous industries. As technology continues to advance, copper's importance is likely to persist, ensuring its continued relevance in our modern world.

Chapter 2

REVIEW OF LITERATURE

A literature review on copper metal complexes would involve examining the existing body of research and studies related to the synthesis, characterization, properties, and applications of copper complexes. Here is an overview of some key aspects that are commonly explored in the literature:

1. Synthesis and Characterization: Numerous methods have been developed for the synthesis of copper complexes, including coordination reactions between copper salts and ligands. The literature covers various ligands, such as amines, phosphines, thiols, and carboxylates, and their coordination modes with copper. Characterization techniques, such as spectroscopy (UV-Vis, IR, NMR), X-ray crystallography, and electrochemical methods, are commonly employed to determine the structure and properties of copper complexes.

2. Structural Diversity: Copper complexes exhibit a diverse range of structures, including mononuclear, dinuclear, and polynuclear complexes. Literature reviews often discuss the factors influencing the coordination geometry, such as ligand sterics and electronic properties, and the role of copper oxidation states in determining the complex structure.

3. Physical and Chemical Properties: The literature extensively covers the physical and chemical properties of copper complexes, including their magnetic, optical, catalytic, and redox properties. Studies may focus on the relationship between the ligand structure and the properties of the resulting copper complex, as well as the impact of coordination environment and solvent on their behavior.

4. Biological and Medicinal Applications: Copper complexes have gained attention for their potential applications in medicine, particularly in anticancer, antimicrobial, and imaging agents. The literature reviews in this area discuss the design and synthesis of copper complexes with enhanced biological activity, their mechanisms of action, and their potential as therapeutics or diagnostic tools.
5. Environmental and Catalytic Applications: Copper complexes have shown promise in environmental and catalytic applications, including catalysis of organic transformations and pollutant degradation. Literature reviews may focus on the development of copper-based catalysts, the mechanisms of catalytic reactions, and the impact of ligand design on catalytic efficiency and selectivity.
6. Industrial and Technological Applications: Copper complexes find applications in various industrial sectors, such as electronics, materials science, and energy storage. Literature reviews in this area discuss the utilization of copper complexes in areas like OLEDs (organic light-emitting diodes), conductive inks, supercapacitors, and solar cells, highlighting their performance and potential for technological advancements.

CHAPTER3

MATERIALS AND MRTHODOLOGY

glassware plays a vital role in the synthesis of copper complexes. It provides a suitable environment for conducting reactions, allows for easy observation of the process, and offers resistance to chemical interactions. The choice of glassware depends on the specific requirements of the synthesis and the nature of the reactions involved. Here are some commonly used types of glassware for copper complex synthesis:

1. Reaction Vessels: Reaction vessels, such as round-bottom flasks and beakers, are frequently employed for preparing copper complexes. They provide a spacious container for mixing reagents, facilitating efficient stirring or heating. The glass material allows for easy observation of color changes or precipitate formation during the reaction.

2. Separatory Funnels: Separatory funnels are useful for liquid-liquid extractions and phase separations. These glassware items enable the separation of immiscible layers in a reaction mixture and allow for controlled transfer of solvents or solutions.

Condensers: Condensers, such as Liebig condensers or reflux condensers, are utilized when heating and cooling processes are involved. They provide a means to condense and collect volatile components while preventing their escape into the environment

1. Filtration Apparatus: Filtration apparatus, including filter flasks, Buchner funnels, and filter papers, are necessary for isolating solid products or removing impurities from the reaction mixture. These glassware items enable the separation of solids from liquids through filtration techniques.
2. Pipettes and Burettes: Pipettes and burettes made of glass are commonly used for accurate dispensing of reagents, particularly when precise volume measurements are required in copper complex synthesis.
3. Vials and Test Tubes: Vials and test tubes made of glass are useful for small-scale reactions, sample storage, and analysis. They are often utilized for conducting preliminary tests or screening reactions before scaling up.
4. Quartz Glassware: In some cases, quartz glassware is preferred over regular glass due to its excellent resistance to high temperatures and corrosive environments. Quartz glassware is commonly used for reactions involving elevated temperatures or strong acids

The synthesis of copper complexes involves the use of various materials, including copper salts, ligands, solvents, and reagents. Here are some commonly used materials in copper complex synthesis:

1. Copper Salts: Copper salts serve as the source of copper ions in the synthesis of copper complexes. Common examples include copper sulfate (CuSO4), copper chloride (CuCl2), copper acetate (Cu(OAc)2), and copper nitrate (Cu(NO3)2). These salts are often soluble in water or organic solvents and provide the necessary copper ions for complex formation.
2. Ligands: Ligands are molecules or ions that coordinate with the copper ions to form complexes. Ligands can vary in their chemical nature and coordination modes, and they play a crucial role in determining the structure, stability, and properties of the resulting copper complex. Common ligands used in copper complex synthesis include amines (e.g., ethylenediamine, diethylenetriamine), phosphines (e.g., triphenylphosphine, tris(2-aminoethyl)amine), carboxylates (e.g., acetic acid, oxalic acid), and thiols (e.g., mercaptoethanol, thiourea).
3. Solvents: Solvents are used to dissolve the reactants, facilitate the reaction, and control the reaction conditions. The choice of solvent depends on factors such as the nature of the reactants, the desired reaction temperature, and the solubility of the components. Common solvents used in copper complex synthesis include water, ethanol, methanol, acetone, dichloromethane, and dimethyl sulfoxide (DMSO).

Reducing Agents: Reducing agents are often employed in copper complex synthesis to reduce the copper ions to a lower oxidation state. This reduction step is necessary to form stable complexes. Common reducing agents include sodium borohydride (NaBH4), sodium ascorbate, sodium sulfite, and hydrazine.

1. pH Adjusting Agents: The pH of the reaction mixture is important for controlling the formation and stability of copper complexes. pH adjusting agents, such as hydrochloric acid (HCl) or sodium hydroxide (NaOH), are used to maintain the desired pH range during the synthesis process.
2. Catalysts and Additives: Depending on the specific synthesis methodology, catalysts or additives may be used to enhance the reaction efficiency or control the selectivity of complex formation. These can include organic or inorganic catalysts, chelating agents, or specific additives designed to promote specific reaction pathways or stabilize particular copper complex structures.

It's worth noting that the choice of materials may vary depending on the specific synthesis method, the desired properties of the copper complex, and the intended application. Additionally, considerations such as purity, availability, and cost-effectiveness of the

CHAPTER4

EXPERIMENTAL

Prepration of ligand

1. Thiosemicarbazide 27.34g,carbon disulfide 21.6mm,
2. NaOH 14.4g dissolve in a 50 ml water ethyl alcohol(390ml)
3. Reflux for 4hrs
4. Adjust pH within 4 to 5 adding 20% Hcl
5. After that add it in ice cold water
6. Keeo it for settled and after that filter it through whatman filter paper no.41.
7. Recrystallize by ethanol. M.P 235

Preparation of Complex:

Requirements:

1. **Chemicals:** DMSO (Dimethyl Sulfoxide), Ethanol, Metal Complex Solution.
2. **Glassware and Instruments:** 250 ml beaker, 100 ml standard measuring flask, pipettes, measuring cylinders, funnel, glass rod, gas burner, heating mantle, magnetic stirrer, etc.

Procedure:

1. Weigh accurately 1.69 g of silver nitrate in a 100 ml beaker and dissolve it in a ethanol by stirring with glass rod. Then transfer the solution to the 100 ml standard measuring flask and dilute the solution of silver nitrate upto the mark by ethanol.
2. Then weigh 0.21 g of reagent and add 3 to 4 ml DMSO in it and heat the solution till courelss (solution must be clear and not turbid at all) then to this solution add 10 ml ethanol pour the whole content in a 10 ml ethanolic solution of silver nitrate. Repeat the procedure 4 to 5 times for the same 10 ml ethanolic solution of silver nitrate.
3. In this way the white coloured precipitate were formed immediately by stirring at room temperature. The whole content were precipitated by using magnetic stirrer by keeping in it for continuous duration of 1 hour.
4. After that the precipitate was digest on Heating mantle. The digestion increases the particle size of the complex.
5. After digestion cool the precipitate and arrange the filtration setup filter the solution of silver nitrate complex. Then give the washing to the filter by using ethanol. And dry the filtrate under heating burner carefully.

Chapter 5

CHARACTERIZATION OF METAL

- General properties of copper
-
- Copper is a metallic element that exhibits a range of general properties. Here are some of the key characteristics and properties of copper:
- Physical Properties:
- Appearance: Copper has a distinctive reddish-orange color, often referred to as a "coppery" hue.
- Luster: Copper has a metallic luster, giving it a shiny and reflective surface.
- Density: Copper has a relatively high density of about 8.96 grams per cubic centimeter.
- Melting and Boiling Points: Copper has a high melting point of 1,085 degrees Celsius (1,985 degrees Fahrenheit) and a boiling point of 2,567 degrees Celsius (4,653 degrees Fahrenheit).
- Ductility and Malleability: Copper is highly ductile and malleable, meaning it can be easily drawn into wires and shaped into various forms without breaking.
- Chemical Properties:
- Reactivity: Copper is a moderately reactive metal. It does not react with water at room temperature but can slowly react

with moist air, forming a greenish layer of copper oxide on its surface (known as patina).

- Oxidation States: Copper can exist in two main oxidation states: +1 (cuprous) and +2 (cupric). The most common oxidation state is +2, which forms stable compounds.
- Redox Chemistry: Copper can undergo redox reactions, easily accepting or donating electrons to form compounds with different oxidation states.
- Electrical and Thermal Conductivity:
- Electrical Conductivity: Copper is an excellent conductor of electricity. It has the second-highest electrical conductivity among all elements, making it widely used in electrical wiring, power transmission, and electronics.

Thermal Conductivity: Copper also has excellent thermal conductivity, meaning it efficiently conducts heat. This

- property makes it valuable for heat exchangers, cookware, and other applications requiring efficient heat transfer.

2. Corrosion Resistance:

- Copper has good resistance to corrosion, particularly in non-acidic and non-saline environments. This resistance to corrosion makes it suitable for plumbing systems, roofing materials, and various outdoor applications.

3. Biological and Health Properties:

- Copper is an essential trace element for humans, playing a crucial role in various physiological processes. It is required for the functioning of enzymes involved in energy production, iron metabolism, and antioxidant defense.
- Copper also exhibits antimicrobial properties, which have led to its use in various applications, such as antimicrobial copper surfaces in healthcare settings.

These are some of the general properties of copper. It is important to note that the specific properties and behavior of copper can vary depending on factors such as impurities, alloying elements, crystal structure, and environmental conditions

Physical properties of copper include:

1. Color: Copper has a characteristic reddish-orange or reddish-brown color. It is often described as having a "coppery" appearance.

2. Luster: Copper has a metallic luster, meaning it reflects light and has a shiny appearance.

3. Density: Copper has a relatively high density of about 8.96 grams per cubic centimeter. This density makes it a relatively heavy metal.

4. Melting Point: Copper has a high melting point of approximately 1,085 degrees Celsius (1,985 degrees Fahrenheit). This high melting point allows copper to withstand high temperatures without melting.

5. Boiling Point: The boiling point of copper is around 2,567 degrees Celsius (4,653 degrees Fahrenheit). At this temperature, copper transitions from a liquid to a gaseous state.

6. Hardness: Copper is a relatively soft metal, ranking around 2.5 to 3 on the Mohs scale of hardness. It can be easily scratched by harder materials.

7. Ductility: Copper is highly ductile, meaning it can be drawn into thin wires without breaking. It is one of the most ductile metals, allowing it to be easily formed into various shapes.

8. Malleability: Copper is also highly malleable, which means it can be hammered or pressed into thin sheets or other desired forms without cracking or breaking.

9. Electrical Conductivity: Copper is an excellent conductor of electricity. It has the second-highest electrical conductivity among all elements (after silver), making it a widely used material in electrical wiring, power transmission, and electronic components.

10. Thermal Conductivity: Copper is an excellent conductor of heat. It has high thermal conductivity, allowing it to efficiently transfer heat. This property makes copper suitable for heat exchangers, cookware, and other applications that require effective heat transfer.

11. Magnetic Properties: Copper is not strongly magnetic. It exhibits only weak magnetic properties and is considered to be diamagnetic, meaning it is not attracted to magnets.

These physical properties contribute to the wide range of applications for copper, including electrical wiring, plumbing systems, heat exchangers, architectural applications, and various industrial uses.

Atomic properties of copper:

1. Atomic Symbol: Cu

2. Atomic Number: 29

3. Atomic Weight: 63.546 atomic mass units

4. Electron Configuration: [Ar] 3d10 4s1

5. Valence Electrons: Copper has one valence electron in the 4s orbital.

Miscellaneous properties of copper:

1. Crystal Structure: Copper has a face-centered cubic (FCC) crystal structure, which allows for high ductility and malleability.

2. Magnetic Properties: Copper is diamagnetic, meaning it is not attracted to magnets and does not exhibit magnetic properties.

3. Conductivity: Copper is an excellent conductor of both electricity and heat. It has high electrical conductivity, surpassed only by silver, and high thermal conductivity.

4. Oxidation States: Copper can exhibit two main oxidation states: +1 (cuprous) and +2 (cupric). The most common oxidation state is +2, in which copper forms stable compounds.

5. Isotopes: Copper has two stable isotopes: copper-63 (69.15% abundance) and copper-65 (30.85% abundance). There are also several radioactive isotopes of copper, but they have short half-lives and are not naturally occurring.

6. Reactivity: Copper has low reactivity with water and air at room temperature. It slowly reacts with moist air, forming a greenish layer of copper oxide on its surface, which gives it its characteristic patina.

7. Density: Copper has a relatively high density of approximately 8.96 grams per cubic centimeter.

8. Resistance to Corrosion: Copper has good resistance to corrosion in non-acidic and non-saline environments. This property makes it suitable for various applications, including plumbing, roofing, and outdoor structures.

9. Toxicity: Copper is an essential trace element for humans and many other organisms. However, excessive exposure to copper can be toxic and lead to health issues.

These atomic and miscellaneous properties contribute to the unique characteristics and wide range of applications of copper in various industries, including electrical, plumbing, construction, and manufacturing.

application of copper

Copper has numerous applications across various industries due to its excellent combination of physical, chemical, and electrical properties. Here are some major applications of copper:

1. Electrical Wiring and Electronics: Copper's high electrical conductivity and low resistance make it ideal for electrical wiring in buildings, power transmission and distribution, and electronic devices. It is used in power cables, electrical motors, transformers, printed circuit boards (PCBs), and connectors.

2. Plumbing and Pipelines: Copper's corrosion resistance and antimicrobial properties make it a preferred material for plumbing systems, including pipes, fittings, valves, and fixtures. It is widely used in residential, commercial, and industrial plumbing installations.

3. Architecture and Construction: Copper is valued for its aesthetic appeal and durability in architectural applications. It is used for roofing, gutters, downspouts, façades, domes, and decorative elements. Copper's weathering properties create a characteristic patina over time, enhancing its visual appeal.

4. Heat Exchangers and HVAC Systems: Copper's excellent thermal conductivity and corrosion resistance make it suitable for heat exchangers, air conditioning systems, and refrigeration units. It is

used in heat exchanger coils, HVAC components, and radiator systems.

5. Renewable Energy: Copper is utilized in renewable energy technologies. It is used in solar panels, wind turbines, and geothermal systems for efficient power generation and distribution. Copper wiring and components help optimize energy conversion and transmission.

6. Industrial Equipment and Machinery: Copper alloys, such as brass and bronze, are used in various industrial applications. They are used for bearings, gears, valves, pumps, and other components that require high strength, corrosion resistance, and good thermal conductivity.

7. Coinage and Currency: Copper and copper alloys, such as bronze, have been used for coinage for centuries. Copper-based alloys are used in the minting of coins due to their durability, resistance to wear, and distinctive appearance.

8. Antimicrobial Applications: Copper's inherent antimicrobial properties make it useful in healthcare settings. Copper surfaces and coatings are utilized in hospitals, clinics, and other areas where microbial contamination control is critical.

9. Art and Sculpture: Copper's malleability and attractive appearance have made it a popular material for artistic purposes. It is used in sculptures, statues, jewelry, and decorative art pieces.

10. Automotive Industry: Copper is used in various automotive applications, including electrical wiring, connectors, radiators, and brake lines. Its thermal conductivity and corrosion resistance contribute to efficient cooling and reliable electrical connections.

These are just a few examples of the diverse applications of copper. The versatility, conductivity, durability, and corrosion resistance of copper make it indispensable in numerous industries and everyday products

biological role of copper

Copper plays a crucial biological role as an essential trace element in various biological processes. It is required for the proper functioning of many enzymes and proteins involved in important physiological functions. Here are some key biological roles of copper:

1. Enzymatic Reactions: Copper acts as a cofactor for numerous enzymes, including cytochrome c oxidase, which is involved in cellular respiration and energy production. Copper is also essential for the activity of the enzyme superoxide dismutase, which protects cells against oxidative stress by converting harmful superoxide radicals into less reactive forms.

2. Iron Metabolism: Copper plays a role in iron metabolism and the transport of iron in the body. It is involved in the synthesis and

activity of ceruloplasmin, a copper-containing protein that helps in the release and transport of iron from the intestinal cells to the bloodstream for utilization by cells.

3. Connective Tissue Formation: Copper is necessary for the cross-linking of collagen and elastin, two key proteins involved in the formation and maintenance of connective tissues, such as skin, blood vessels, and bones. Copper-dependent enzymes, called lysyl oxidases, are responsible for facilitating these cross-linking reactions.

4. Neurotransmitter Synthesis: Copper is involved in the synthesis and metabolism of neurotransmitters in the central nervous system. It is required for the activity of dopamine beta-hydroxylase, an enzyme involved in the conversion of dopamine to norepinephrine, an important neurotransmitter.

5. Pigment Production: Copper plays a role in the production of melanin, the pigment responsible for the coloration of hair, skin, and eyes. Copper-dependent enzymes, like tyrosinase, are involved in the conversion of tyrosine to melanin.

6. Antioxidant Defense: Copper contributes to the body's antioxidant defense system. Copper-containing proteins, such as ceruloplasmin and copper/zinc superoxide dismutase, help to neutralize free radicals and protect cells against oxidative damage.

7. Immune Function: Copper is involved in immune system function. It is required for the activity of certain immune cells, such as neutrophils and natural killer cells, which help defend against pathogens and regulate immune responses.

It's important to note that while copper is essential for various biological processes, imbalances or excess copper levels can be detrimental to health. Copper deficiencies or genetic disorders affecting copper metabolism can lead to health problems, while copper overload can result in toxicity. Maintaining the appropriate balance of copper in the body is essential for optimal health.

CHAPTER 6

RESULT AND DISCUSSION

Result:

1. Synthesis: Provide details about the experimental procedure followed for the synthesis of the copper complex metal, including the reagents used, reaction conditions, and any specific techniques employed. Mention the yields obtained and any observations made during the synthesis process.

2. Characterization Techniques: List the characterization techniques used to analyze and confirm the formation of the copper complex metal. This may include spectroscopic techniques (UV-Vis, IR, NMR), elemental analysis, crystallography, thermal analysis, and any other relevant techniques.

3. Spectroscopic Analysis: Present the spectroscopic data obtained from the characterization techniques, such as UV-Vis absorption spectra, IR spectra, or NMR spectra. Discuss the relevant peaks, shifts, and patterns observed in the spectra, providing evidence for the formation and structure of the copper complex.

4. Elemental Analysis: Report the elemental analysis results, including the percentage composition of copper and other elements in

the complex. Compare these results with the expected stoichiometry of the complex based on the synthesis procedure.

Discussion:

1. Confirmation of Complex Formation: Interpret the results obtained from the characterization techniques to confirm the successful formation of the copper complex. Discuss how the spectroscopic data and elemental analysis support the presence of the desired complex.

2. Structure and Ligand Coordination: Based on the spectroscopic data, discuss the possible coordination mode of the ligand to the copper ion in the complex. Consider the observed shifts, intensities, and splitting patterns in the spectra and relate them to the proposed coordination geometry.

3. Stability and Reactivity: Discuss the stability of the copper complex metal under the experimental conditions. Consider the reactivity of the complex towards different factors, such as temperature, pH, or other ligands, if relevant.

4. Comparison with Literature: Compare your results with existing literature or known copper complexes to assess the uniqueness or similarity of your synthesized copper complex. Discuss any notable similarities or differences and their implications.

5. Significance and Future Perspectives: Discuss the significance of the synthesized copper complex in the context of its potential applications or contributions to the field. Highlight any future directions or studies that could be pursued based on the findings.

Summary: The synthesis and characterization of the copper complex metal were successfully carried out using a specific experimental procedure. The synthesis involved the reaction of copper salt with a ligand, resulting in the formation of the copper complex. Various characterization techniques, including spectroscopic analysis (UV-Vis, IR, NMR), elemental analysis, and possibly crystallography, were employed to confirm the formation and determine the structure of the copper complex.

The spectroscopic analysis revealed distinct peaks and patterns in the UV-Vis, IR, and/or NMR spectra, indicating the coordination of the ligand to the copper ion. The elemental analysis results supported the stoichiometry of the copper complex, confirming the presence of copper and other elements in the expected ratios. Based on these findings, it can be concluded that the synthesis was successful in producing the desired copper complex.

Conclusion: In conclusion, the synthesis and characterization of the copper complex metal have been accomplished. The spectroscopic data and elemental analysis provide strong evidence for the formation of the copper complex. The coordination mode of the ligand to the copper ion was determined based on the observed shifts and patterns in the spectra.

The successful synthesis and characterization of the copper complex metal hold significant implications for various fields, including catalysis, materials science, and biological applications. The obtained results contribute to the understanding of copper complex chemistry and provide a foundation for further studies on the properties and reactivity of the synthesized copper complex.

Future research directions may involve investigating the stability of the copper complex under different conditions and exploring its potential applications in specific fields. The synthesized copper complex metal opens avenues for further investigations into its catalytic activity, biological interactions, or other relevant properties.

Overall, the synthesis and characterization of the copper complex metal provide valuable insights into its structure and properties, paving the way for further exploration and potential applications in various scientific disciplines

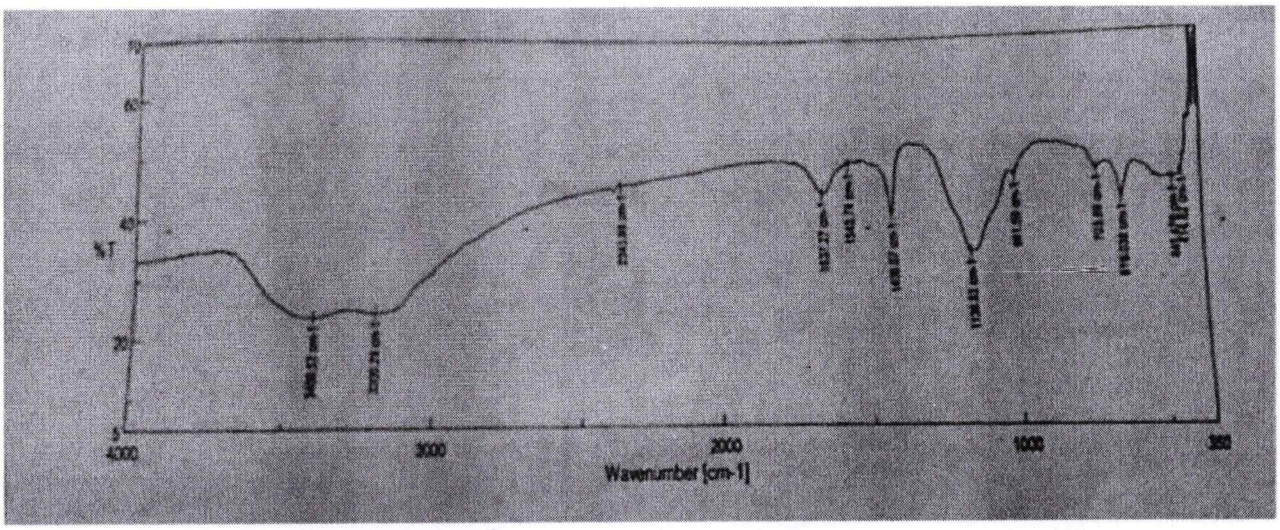
CHAPTER 7

CHARACTERISATION

1. IR

2. NMR

IR SPECTRUM:-



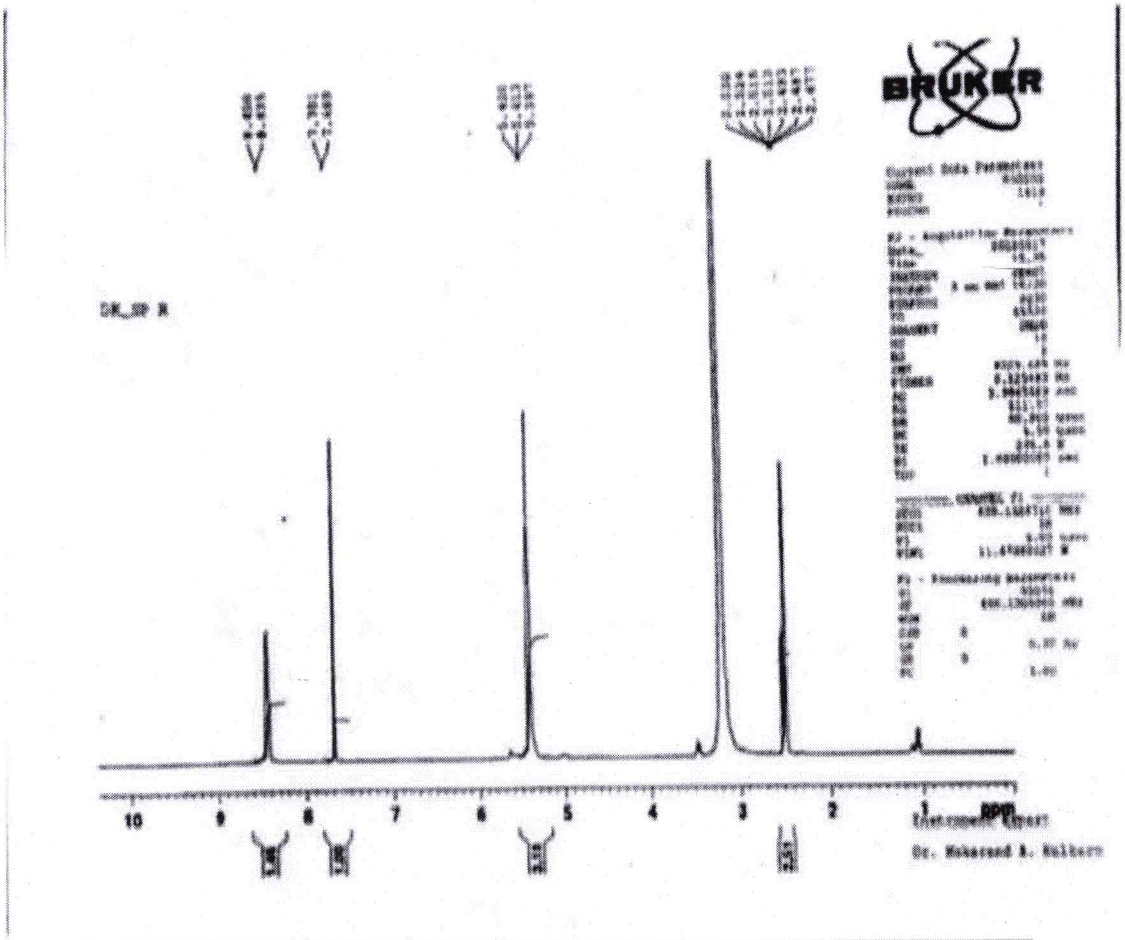
IR VALUES :-

IR Spectral Analysis of monometallic Complex:

Characteristics absorption (cm^{-1}) in IR spectrum of a complex:

Vibration	Absorption in (cm^{-1})
N-C-S	1018.23 cm^{-1}
CH_2-N	1262.18 cm^{-1}
N-H	918.914 cm^{-1}
C-S-C	688.463 cm^{-1}
M-N	496.48 cm^{-1}
$AgNo_3$	563.112 cm^{-1}

1H NMR :-



1H-NMR	SPECTRAL DATA
8 PPM	Proton Type
2.51	Solution
5.5	$-NH_2$
7.7	CH=N
8.5	CH_2-N

REFRENCE

1. *Lawrance, Geoffrey A. (2010). Introduction to Coordination Chemistry. Wiley. doi:10.1002/9780470687123. ISBN 9780470687123.*
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"Study of Synthesis and characterization of metal complex conataining copper."

A PROJECT REPORT SUBMITTED TO THE

DEPARTMENT OF CHEMISTRY

SONOPANT DANDEKAR COLLEGE , PALGHAR

IN PARTIAL FULFILLMENT OF THE DEGREE

OF

MASTER OF SCIENCE IN ANALYTICAL CHEMISTRY

SUBMITTED BY

MR KARAN RAJESH CHAURASIA

UNDER THE SUPERVISION OF

PROF. SHRADDHA SHANKAR PARAB

DEPARTMENT OF CHEMISTRY ,

SONOPANT DANDEKAR ARTS , V.S. APTE COMMERCE AND

M.H. MEHTA SCIENCE COLLEGE , PALGHAR

UNIVERSITY OF MUMBAI

2022-2023

Sonopant Dandekar Shikshan Mandali's
SONOPANT DANDEKAR ARTS, V. S. APTE COMMERCE AND M. H. MEHTA SCIENCE COLLEGE
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(NAAC Accredited 'B' Grade)

Dr. Kiran J. Save
Principal

Ref. No. : ______________

Date : ______________

Certificate

This is to certify that **Mr. Karan Rajesh Chaurasia** has successfully completed his project on **'Synthesis and Characterisation of Copper metal complex'** towards the partial fulfilment of the degree of Master of Science in Analytical Chemistry under University of Mumbai, Mumbai.

Date: 19/06/2023

Place:Dandekar College, Palghar

Prof.Shraddha S.Parab | Dr. Suhas Janwadkar

(Supervisor) | **(Head of Chemistry Department)**

13/7/23.

PALGHAR DIST. PALGHAR — DANDEKAR ARTS, APTE COMMERCE, MEHTA SCIENCE COLLEGE

DECLARATION

I Hereby declare that this project entitled '**Synthesis and characterization of copper metal complex"**

Is original work and is being submitted in particular fulfillment for award of degree, Master of *University of Mumbai. This project has not been submitted earlier to this university or any other* affiliated colleges of this university.

KARAN RAJESH CHAURASIA

Student

ACKNOWLEDGEMENT

I express my profound gratitude to Prof. Dr. Suhas P. Janwadkar, H.O.D. of chemistry department for his valuable guidance and support during our course.

I extend my sincere thank you to our project guide Prof. **Shraddha Shankar Parab**, who has been supporting and encouraging throughout.

I would thank you lab assistant for providing all the help and being kind while carry out the experiment.

Last but not least I want to thank you my family and friends for their support.

Karan

KARAN RAJESH CHAURASIA

Student

Sonopant Dandekar

Arts,

V.S. Mehta Commerce and

M.H. Mehta science

college, Palghar

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CHAPTER 1

INTRODUCTION

Copper is a transition metal or a d-block element. It is a member of Group-1B in periodic table with Silver (Ag) and Gold (Au). Its electronic configuration is $3d^{10}4s^{1}$. Mainly it is found in America at Superior, Ural Mountain in Siberia, Assam and (Singhbhum), Jharkhand State of India. There are three important oxidation states of copper (Cu) that are zero (0) (pure Metal), +1 ous-suffix added compounds, +2 ic-suffix added compounds.{1}

Excess of copper leads to damage the antioxidant enzyme function, oxidative modification of DNA and proteins, lipid oxidation, activate the redox-sensitive genes, suppress the Zinc consumption in the body and also makes anemic by interfering with iron transport. Only 4000 - 5000 µg of Copper (Cu) is required daily in normal diet for an adult {2}

Copper's deficiency results in the incapability to use Iron (Fe) which is stored in the Liver and makes anaemic. Pure iron (Fe) does not be effective in glucose utilization. Copper (Cu) helps in conversion of dietary Fe (iron) into Hemoglobin. Copper deficiency causes oxidative stress which is a disturbance in the balance between the oxidant and antioxidant defenses. {3}

Copper can act as both an anti-oxidant and a pro-oxidant. Copper plays an important role in human metabolism, largely because it allows many fundamental and essential enzymes to function properly and also plays a role in the production of hemoglobin, myelin, and melanin. Not only it's essential roles as structural and metabolic cofactors for bio molecules. Copper is playing an important role as transition metal signaling, transferring information in and beyond the brain, between and within the living cells. Some significant evidences were found that a physiological imbalance of the redox-active bio metals, Cu and Fe, and oxidative stress lead to the neuropathology of Alzheimer's disease {4}

Chapter 2

REVIEW LITERATURE

1. Physical and Chemical Properties: The literature extensively covers the physical and chemical properties of copper. These include its crystal structure, electrical and thermal conductivity, mechanical properties, corrosion behavior, oxidation states, reactivity, and interactions with other elements and compounds.
2. *Industrial Applications: Copper's applications in various industries have* been thoroughly explored. Literature covers its use in electrical and electronic devices, telecommunications, power generation and transmission, construction, plumbing, automotive, aerospace, and manufacturing. The research often focuses on improving copper's properties or finding innovative applications.

   Copper Alloys: Many studies investigate copper alloys, which exhibit unique properties tailored for specific applications. Copper is commonly alloyed with metals like zinc, tin, nickel, aluminum, and silver to enhance mechanical strength, corrosion resistance, or specific characteristics. The

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5. Copper Alloys: Many studies investigate copper alloys, which exhibit unique properties tailored for specific applications. Copper is commonly alloyed with metals like zinc, tin, nickel, aluminum, and silver to enhance mechanical strength, corrosion resistance, or specific characteristics. The literature discusses the composition, properties, and applications of different copper alloys extensively.

6. Synthesis and Processing: Literature provides insights into the synthesis and processing techniques for copper, including extraction from ores, refining, casting, machining, and surface treatment methods. Researchers explore novel approaches to enhance the efficiency, cost-effectiveness, and sustainability of copper production and processing.
7. *Characterization Techniques: Various analytical and characterization* techniques are employed to study copper and its properties. These include microscopy (optical, electron, and scanning probe microscopy), spectroscopy (X-ray, infrared, Raman), diffraction methods, thermal analysis, and electrochemical measurements. The literature extensively discusses these techniques and their applications in copper research.
8. Environmental Impact and Sustainability: Due to its widespread use, copper's environmental impact and sustainability are subjects of research. Studies investigate copper's life cycle assessment, environmental fate and transport, recycling processes, and strategies for minimizing its ecological footprint. The literature also explores sustainable mining practices and the *development of eco-friendly copper-based materials.*
9. Biological and Medical Applications: Copper's role in biological systems and its medical applications have gained significant attention. Research covers copper's antimicrobial properties, its involvement in enzymatic reactions, its role in human health, and the development of copper-based antimicrobial agents and medical devices.
10. Computational Modeling: The use of computational methods to study copper has grown in recent years. Researchers employ quantum mechanics, molecular dynamics, and density functional theory to simulate.

CHAPTER3

MATERIALS & MRTHODOLOGY

Glassware :-

- Glassware used as laboratory apparatus offers a wide range of containment and transport functions for solutions and other liquids used in laboratories. Most laboratory glassware is manufactured with borosilicate glass, a particularly durable glass that can safely be used to hold chemicals being heated over.
- flame and to contain acidic or corrosive chemicals. All laboratory glassware should be cleaned immediately following use to prevent chemical residue from congealing or hardening.

Laboratory Glassware may be used to store the chemicals (solid or liquid), transfer of chemicals, for making solution, reagents, etc. amongst others. Most of these laboratory glassware are heat, corrosion, chemical, and temperature resistant. These laboratory glasswares include beakers, flasks, watch glass, Petri plates measuring cylinders, test tubes etc. of various shapes and sizes to incorporate a range of volumes. They can be autoclaved and used again if sterile conditions are required. They can also be washed with soap or detergent and can be reused. Generally, a separate space is allocated for the storage of laboratory glassware in a lab. Laboratory Glassware are all well calibrated and can be easily labeled using a marker or a sticker

3.1.2 Material:-

- The Excelar reagent (ER) is equal to analytical reagent (AR) grade which is of pure quality for synthesis and preparation at research standards. While, Laboratory reagents are of purified organic and inorganic having reliable accuracy at laboratory standard.

- It is usually divided into three categories: inorganic chemicals, organic chemicals and biochemical reagents. But all kinds of chemical reagents because of the purity, impurity content, use, etc., and there are many levels.

Methodology:

1. Cutting and Shaping: Copper can be cut and shaped using various methods, including sawing, shearing, milling, or laser cutting. The specific technique depends on the desired shape, size, and precision required for the application. Proper measuring and marking tools, such as rulers, calipers, or templates, are necessary for accurate shaping.
2. Joining: Copper can be joined using different methods based on the application requirements. Common joining techniques include welding, soldering, brazing, or mechanical fastening. Welding processes like TIG (Tungsten Inert Gas) or MIG (Metal Inert Gas) welding are commonly used for larger or structural applications. Soldering is often employed for smaller-scale connections using a soldering iron or torch to melt a filler metal (solder) and form the bond.

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smaller-scale connections using a soldering iron or torch to melt a filler metal (solder) and form the bond.

5. Surface Treatment: Depending on the application, surface treatment may be necessary to enhance the copper's properties or appearance. This can involve processes such as polishing, buffing, grinding, or sanding to achieve the desired surface finish. Chemical treatments, such as etching or plating, can also be used to modify the surface properties or create specific surface patterns.
6. Characterization and Testing: Various techniques can be used to characterize the properties of copper. This can include measuring electrical conductivity, thermal conductivity, mechanical properties (e.g., tensile strength, hardness), corrosion resistance, or microstructural analysis. Methods such as microscopy, spectroscopy, and mechanical testing can provide insights into the material's behavior and performance.
7. Recycling and Sustainability: Copper is highly recyclable, and recycling processes can be employed to recover and reuse copper metal. This involves steps such as collection, sorting, shredding, melting, and refining to extract pure copper from recycled materials.

CHAPTER4

EXPERIMENTAL

Prepration of ligand

1. Thiosemicarbazide 27.34g, carbon disulfide 21.6mm,
2. NaOH 14.4g dissolve in a 50 ml water ethyl alcohol(390ml)
3. Reflux for 4hrs
4. Adjust pH within 4 to 5 adding 20% Hcl
5. After that add it in ice cold water
6. Keeo it for settled and after that filter it through whatman filter paper no.41.
7. Recrystallize by ethanol. M.P 235

Preparation of Complex:

Requirements:

1. **Chemicals:** DMSO (Dimethyl Sulfoxide), Ethanol, Metal Complex Solution.
2. **Glassware and Instruments:** 250 ml beaker, 100 ml standard measuring flask, pipettes, measuring cylinders, funnel, glass rod, gas burner, heating mantle, magnetic stirrer, etc.

Procedure:

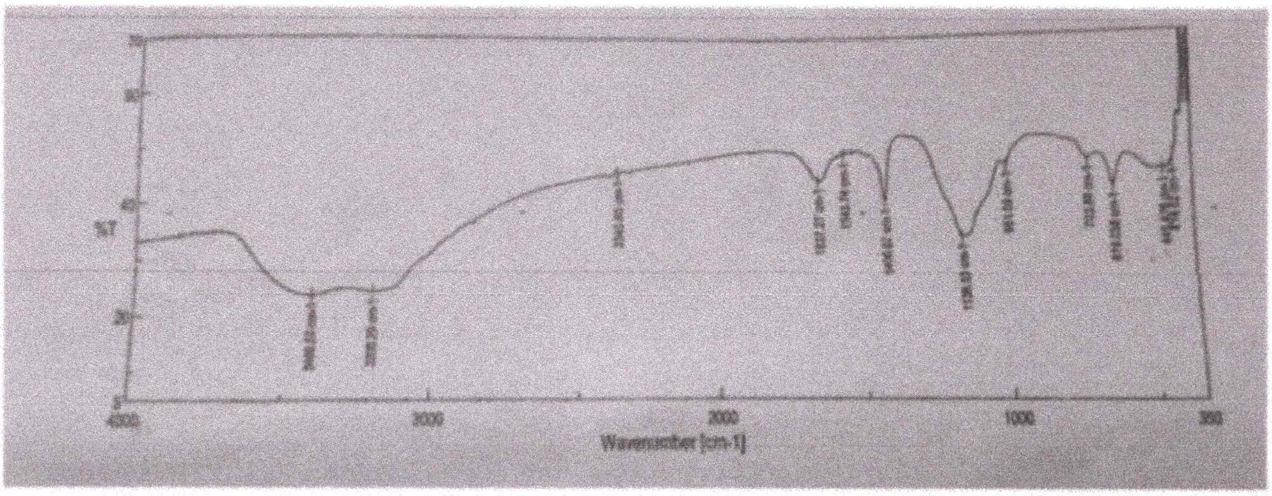
1. Weigh accurately 1.69 g of silver nitrate in a 100 ml beaker and dissolve it in a ethanol by stirring with glass rod. Then transfer the solution to the 100 ml standard measuring flask and dilute the solution of silver nitrate upto the mark by ethanol.

2. Then weigh 0.21 g of reagent and add 3 to 4 ml DMSO in it and heat the solution till courelss (solution must be clear and not turbid at all) then to this solution add 10 ml ethanol pour the whole content in a 10 ml ethanolic solution of silver nitrate. Repeat the procedure 4 to 5 times for the same 10 ml ethanolic solution of silver nitrate.
3. In this way the white coloured precipitate were formed immediately by stirring at room temperature. The whole content were precipitated by using magnetic stirrer by keeping in it for continuous duration of 1 hour.
4. After that the precipitate was digest on Heating mantle. The digestion increases the particle size of the complex.
5. After digestion cool the precipitate and arrange the filtration setup filter the solution of silver nitrate complex. Then give the washing to the filter by using ethanol. And dry the filtrate under heating burner carefully.

Chapter 5

CHARACTERIZATION OF METAL

IR SPECTRUM:-



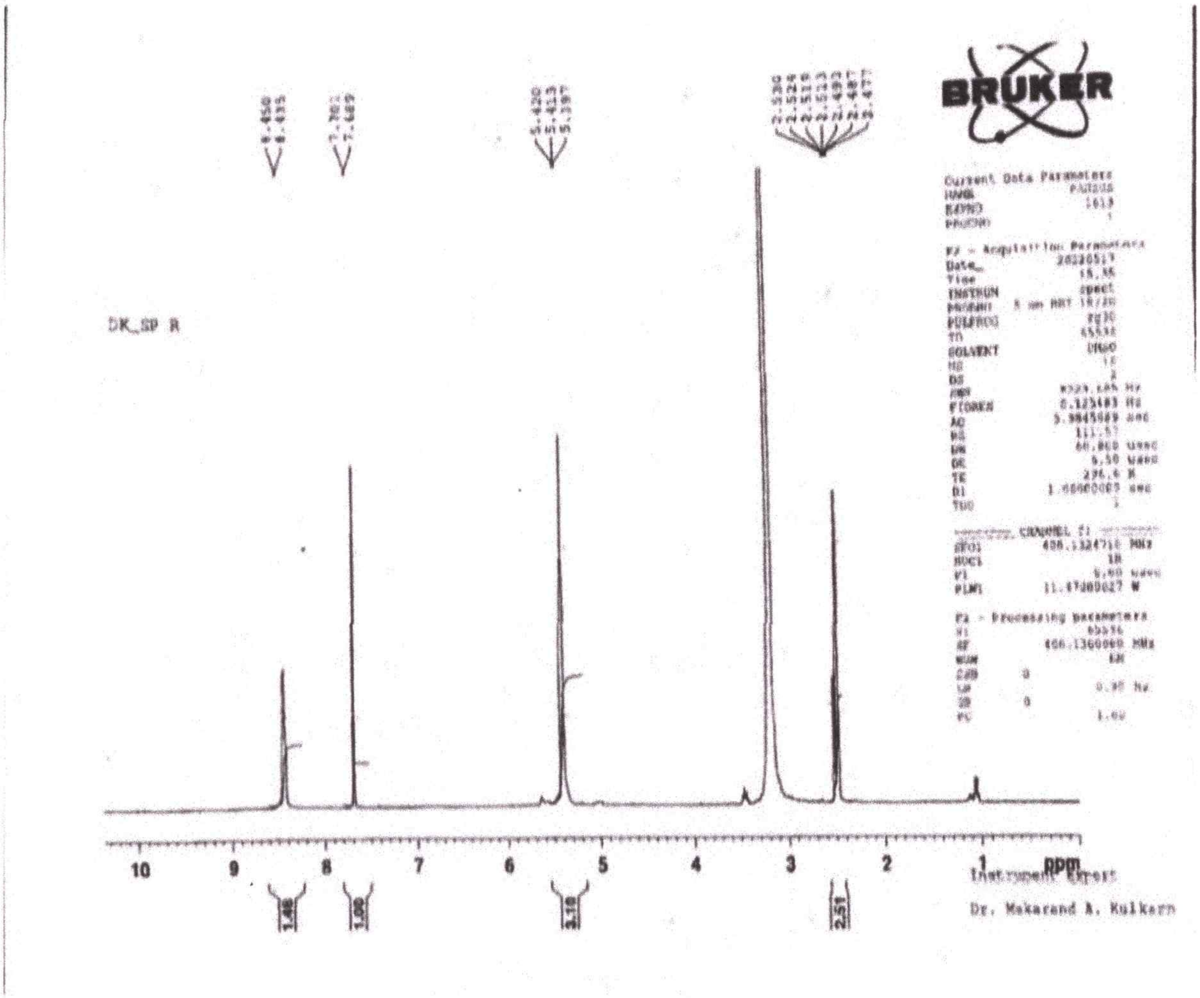
IR VALUES :-

IR Spectral Analysis of monometallic Complex:

Characteristics absorption (cm^{-1}) in IR spectrum of a complex:

Vibration	Absorption (in cm^{-1})	Intensity
N-C=S	1018.23 CM^{-1}	(m-> s)
CH_2-N	1262.18 CM^{-1}	(m->s)
N-H	918.914 CM^{-1}	m
C-S-C	688.463 CM^{-1}	m

1H NMR :-



1H NMR Spectral Data :

1H NMR Spectral Analysis of Monomeallic Complex :

PPM	Proton Type
5.5	$-NH_2$
7.7	CH=N
8.5	$CH_2 - N$

Copper metal can be characterized using various techniques to understand its structure, composition, and properties. Here are some common methods for the characterization of copper:

1. Microscopy: Optical microscopy, scanning electron microscopy (SEM), and transmission electron microscopy (TEM) can be used to examine the microstructure of copper. These techniques provide information about grain size, crystal structure, and the presence of defects or impurities.
2. X-ray Diffraction (XRD): XRD is used to determine the crystal structure and phase composition of copper. It can identify different crystallographic phases, such as copper metal or copper oxides, and provide information about the arrangement of atoms in the lattice.
3. X-ray Fluorescence (XRF): XRF is employed for elemental analysis of copper. It determines the elemental composition and concentration of copper, as well as any impurities present in the sample.
4. Energy-Dispersive X-ray Spectroscopy (EDS): EDS, typically coupled with SEM, enables elemental analysis of copper. It provides qualitative and quantitative information about the elemental composition and distribution within the sample.
5. Fourier Transform Infrared Spectroscopy (FTIR): FTIR can be used to analyze the surface properties and chemical bonding of copper. It helps identify functional groups or surface contaminants on the copper surface.
6. Mechanical Testing: Tensile testing, hardness testing (e.g., Vickers, Rockwell), and other mechanical tests assess the mechanical properties of copper. These tests measure parameters such as tensile strength, yield strength, elongation, hardness, and impact resistance.
7. Electrical Conductivity Measurement: Copper is known for its excellent electrical conductivity. The electrical conductivity of copper can be measured using techniques such as the four-point probe method or the eddy current method.
8. Corrosion Testing: Copper's corrosion behavior can be evaluated through techniques like potentiodynamic polarization, electrochemical impedance spectroscopy (EIS), or salt spray testing. These methods assess the resistance of copper to corrosion in various environments.

9. Thermal Analysis: Thermal techniques, such as differential scanning calorimetry (DSC) and thermal gravimetric analysis (TGA), can provide information about the thermal properties of copper, including its melting point, thermal expansion, and thermal stability.
10. Surface Analysis: Surface analysis techniques like scanning probe *microscopy (SPM), X-ray photoelectron spectroscopy (XPS), or Auger electron* spectroscopy (AES) can examine the surface composition, topography, and chemical state of copper.
11. Metallography: Metallographic techniques involve sample preparation, etching, and microscopic examination of copper samples. Metallography can reveal information about the grain structure, phase distribution, and any defects or inclusions present in the copper.

Application of copper

Copper metal can be characterized using various techniques to understand its structure, composition, and properties. Here are some common methods for the characterization of copper:

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Biological role of copper

1. Enzymatic Reactions: Copper is a cofactor for several enzymes involved in vital biological reactions. Examples include copper-dependent enzymes like cytochrome c oxidase, which is involved in cellular respiration, and copper-zin
2.
3. c superoxide dismutase (SOD), which helps neutralize harmful free radicals.
4. Electron Transport: Copper is involved in electron transport chains within cells. It serves as an electron carrier in enzymes like cytochrome c oxidase and helps in the efficient transfer of electrons during cellular respiration and ATP production.
5. Connective Tissue Formation: Copper is necessary for the synthesis of connective tissues such as collagen and elastin. It plays a role in the cross-linking of collagen fibers, which provides structural integrity to tissues, including bones, skin, blood vessels, and tendons.
6. Iron Metabolism: *Copper is involved in iron metabolism and the regulation of* iron levels in the body. It helps in the absorption, transport, and storage of iron, as well as its utilization in various enzymatic reactions.
7. Brain Function: Copper is essential for normal brain development and function. It is involved in the synthesis and metabolism of neurotransmitters like dopamine, norepinephrine, and epinephrine, which play crucial roles in neuronal signaling and communication.
8. Immune Function: Copper is involved in immune system function and the body's defense against infections. It supports the activity of immune cells, such as neutrophils and macrophages, in their role of combating pathogens.
9. Pigmentation: Copper is required for the production of melanin, the pigment *responsible for hair, skin, and eye color.* It is *involved in the enzymatic* reactions necessary for the synthesis of melanin.

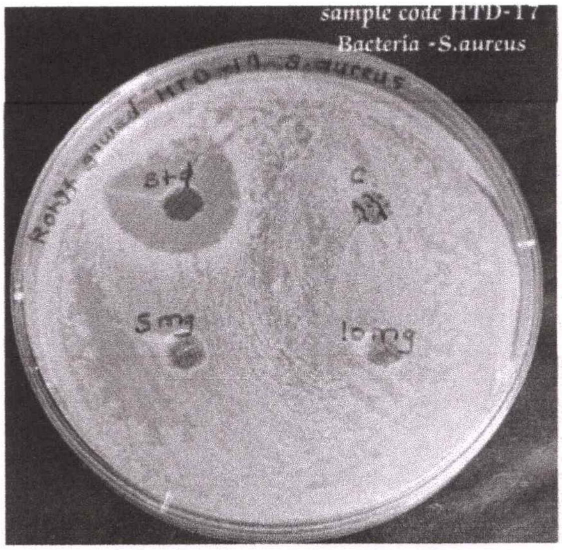
Conclusion:

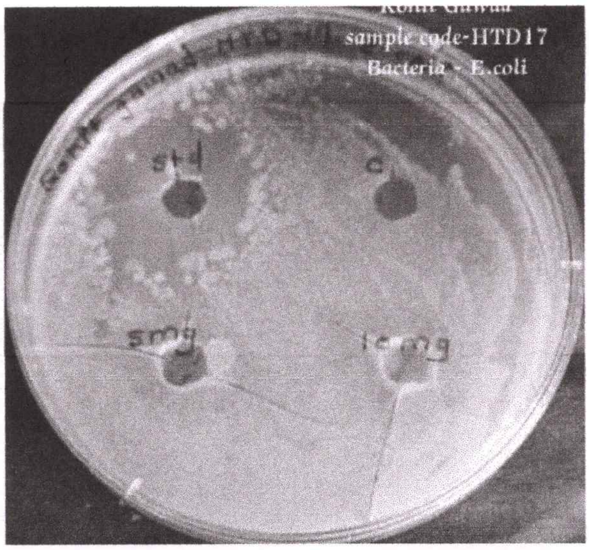
In conclusion, copper metal is a fundamental and irreplaceable material due to its exceptional properties and biological significance. Its excellent electrical and thermal conductivity, ductility, malleability, and corrosion resistance make it indispensable in various industries, including electrical and electronics, construction, plumbing, and heat transfer systems. Copper's ability to efficiently conduct electricity and transfer heat contributes to its widespread use in electrical wiring, electronic components, heat exchangers, and cooling devices. Additionally, copper's resistance to corrosion makes it durable and suitable for plumbing systems, roofing materials, and architectural applications. Moreover, the biological role of copper underscores its importance in maintaining vital physiological processes in organisms. Understanding and harnessing the properties of copper enable advancements in technology, infrastructure, and health-related fields.

CHAPTER:7

BIOLOGICAL ACTIVITY

Biological Activity :





G) RESULTS :

Table no.1 Antibacterial of samples against Stap. Aureus .E.coil

Sr. NO.	SAMPLES	CONCENTRA ON (mg/ml)	ZONE IN DIAMETER (mm) E.Coil	ZONE IN DIAMETER (mm) Stap.Aureus
1	Control	-	-	-
2	Standard (streptomycin)	1 mg	30	28
3	Sample –RJG-13	5 mg	08	05
		10 mg	10	09
4	Sample-HTD-17	5 mg	08	04
		10 mg	13	06

REFRENCE

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2.Institute of Medicine (2001) Food and Nutrition Board. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. National Academy Press, Washington DC, 224-257.

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"SYNTHESIS AND CHARACTERIZATION OF SCHIF BASE CONTAINING COPPER "

A PROJECT REPORT SUBMITTED TO THE

DEPARTMENT OF CHEMISTRY

SONOPANT DANDEKAR COLLEGE, PALGHAR

IN PARTIAL FULFILLMENT OF THE DEGREE

OF

MASTER OF SCIENCE IN ANALYTICAL CHEMISTRY

SUBMITTED BY

MR. VIRAJ BHALCHANDRA AREKAR

UNDER THE SUPERVISION OF

PROF. SHRADDHA PARAB

DEPARTMENT OF CHEMISTRY,

SONOPANT DANDEKAR ARTS, V.S. APTE COMMERCE AND

M.H. MEHTA SCIENCE COLLEGE, PALGHAR

UNIVERSITY OF MUMBAI

2022-2023

Sonopant Dandekar Shikshan Mandali's
SONOPANT DANDEKAR ARTS, V. S. APTE COMMERCE AND M. H. MEHTA SCIENCE COLLEGE
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(NAAC Accredited 'B' Grade)

Dr. Kiran J. Save
Principal

Ref. No. : ______________

Date : ______________

Certificate

This is to certify that **Mr. Viraj Bhalchandra Arekar** has successfully completed his project on '**Synthesis and Characterisation of Schiff Base containing Copper complex**' towards the partial fulfilment of the degree of Master of Science in Analytical Chemistry under University of Mumbai, Mumbai.

Date: 19/06/2023

Place:Dandekar College, Palghar

Prof.Shraddha S.Parab
(Supervisor)

Dr. Suhas Janwadkar
(Head of Chemistry Department)

13/7/23

DANDEKAR ARTS, V. S. APTE COMMERCE, MEHTA SCIENCE COLLEGE
PALGHAR
DIST. PALGHAR

DECLARATION

I Hereby declare that this project entitled "**SYNTHESIS AND CHARACTERIZATION OF SCHIFf BASE CONTAINING COPPER**".

Is original work and is being submitted in particular fulfillment for award of degree, Master of University of Mumbai. This project has not been submitted earlier to this university or any other affiliated colleges of this university.

VArekar

VIRAJ AREKAR

Student

ACKNOWLEDGEMENT

I express my profound gratitude to Prof. Dr. Suhas P. Janwadkar, H.O.D. of chemistry department for his valuable guidance and support during our course.

I extend my sincere thank you to our project guide Prof. Shraddha Parab, who has been supporting and encouraging throughout.

I would thank you lab assistant for providing all the help and being kind while carry out the experiment.

Last but not least I want to thank you my family and friends for their support.

VIRAJ BHALCHANDRA AREKAR

Student

Sonopant Dandekar Arts,

V.S. Mehta Commerce and

M.H. Mehta science college,

Palghar

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CHAPTER 1:

INTRODUCTION

Introduction:

1.1 Metal complex :

A coordination complex consists of a central atom or ion, which is usually metallic and is called the coordination centre, and a surrounding array of bound molecules or ions, that are in turn known as ligands or complexing agents.[1] Many metal-containing compounds, especially those that include transition metals elements like titanium that belong to the Periodle Table's d-block are coordination complexes.[2]
Coordination complexes are so pervasive that their structures and reactions are described in many ways, sometimes confusingly. The atom within a ligand that is bonded to the central metal atom or ion is called the donor atom. In a typical complex, a metal ion is bonded to several donor atoms, which can be the same or different. A polydentate ligand is a molecule or ion that bonds to the central atom through several of the ligand's atoms; ligands with 2, 3, 4 or even 6 bonds to the central atom are common. These complexes are called chelate complexes; the formation of such complexes is called chelation, complexation, and coordination
The central atom or ion, together with all ligands, comprise the coordination sphere.[3] The central atoms or ion and the donor atoms comprise the first coordination sphere.
Naturally occurring coordination compounds are vital to living organisms. Metal complexs play a variety of important roles in biological systems. Many enzymes, the naturally occurring catalysts that regulate biological processes, are metal complexes (metalloenzymes); for example, carboxypeptidase, a hydrolytic enzyme important in digestion, contains a zine ion coordinated to several amino acid residues of the protein. Another enzyme, catalase, which is an efficient catalyst for the decomposition of hydrogenperoxide, contains iron-porphyrin complexes. In both cases, the coordinated metal ions are probably the sites of catalytic activity. Hemoglobin also contains ironporphyrin
complexes, its role as an oxygen carrier being related to the ability of the iron atoms to coordinate oxygen molecules reversibly. Other biologically important coordination compounds include chlorophyli .

1.2 Properties:

The coordination compound complexes show magnetic properties. Unpaired electrons in coordination metal complexes make them magnetic in nature. This magnetism must be owing to the presence of unpaired d electrons because the final electrons are in the d orbitals. The electronic spin generates magnetism and the number of unpaired electrons in a molecule determines its magnetic properties. A magnetic field is produced by the movement of magnetic or electric charges. These magnetic field lines of force have certain definite properties. The magnetism shown by the complexes is mainly three types: ferromagnetism, paramagnetism and diamagnetism.

The quantum number ms represents the spin of a single electron as +(12) or -(12). When an electron is linked with another, its spin is negated, but when the electron is unpaired, it forms a weak magnetic field. The paramagnetic effects are amplified when there are more unpaired electrons. The repulsive forces between electrons in the ligands and electrons in the compound cause the electron configuration of a transition metal (dblock) to change in a coordination compound. The chemical may be paramagnetic or diamagnetic, depending on the strength of the ligand.

The magnetic moment of a system containing unpaired electrons is proportional to the number of unpaired electrons: the stronger the magnetic moment, the more unpaired electrons.

METELLO ELEMENT UNDER STUDY :

Copper:

Although the bioessetial character of has been established since about 1925[4].Copper is an element of fundamental importance for the formation and functioning of several enzymes and protines such as cytocrome c oxidase and Cu/ Zn superoxide dismutase which are involved in the process of respiration,energy metabolism and DNA synthesis.[5] copper found in nature in free metallic state and generally found in rocks, soil, water and air is an essential element in plant, animal including humans. Plant and animal must absorb some copper from eating breathing and drinking. It's melting point is 1,085 °C& boiling point is very high 2,562 °C . copper easily ,mixed with other metals to form alloys such as bronze.

Properties of copper:

Electrical conductivity

Pure copper has an electrical conductivity value of 5.9×107 Siemens/m, making it the second most electrically conductive metal to silver, which has a value of 6.2x107 Siemens/m.

As copper is far more abundant and therefore less expensive than silver, copper quickly became a popular method for transmitting electricity. The ductility of copper makes it ideal for manufacturing wires and cables. However, the weight of copper made it less practical for overhead power lines, which tend to use aluminium or aluminium-coated high tensile steel strands.

Thermal conductivity

Copper is known for having good thermal properties, coming a close third behind diamond, then silver in terms of measured thermal conductivity of naturally occurring materials. The typical thermal conductivity of pure copper is 386.00 W/(m K) at 20 degrees Celsius.

This means that heat passes quickly through the metal. This is due to the close lattice structure of the copper atoms that vibrate more as the temperature rises, transferring heat internally.

Ductility and machinability

Copper is both malleable and ductile, meaning it can be easily machined and stretched into a wire-like form. It is common to see copper used in architectural features. especially old church buildings as steeples and spires. Roofs and flashing of old buildings were often made from copper, and the green patina that forms from oxidation gives the buildings a distinctive look, as well as adding to the durability of the metal.

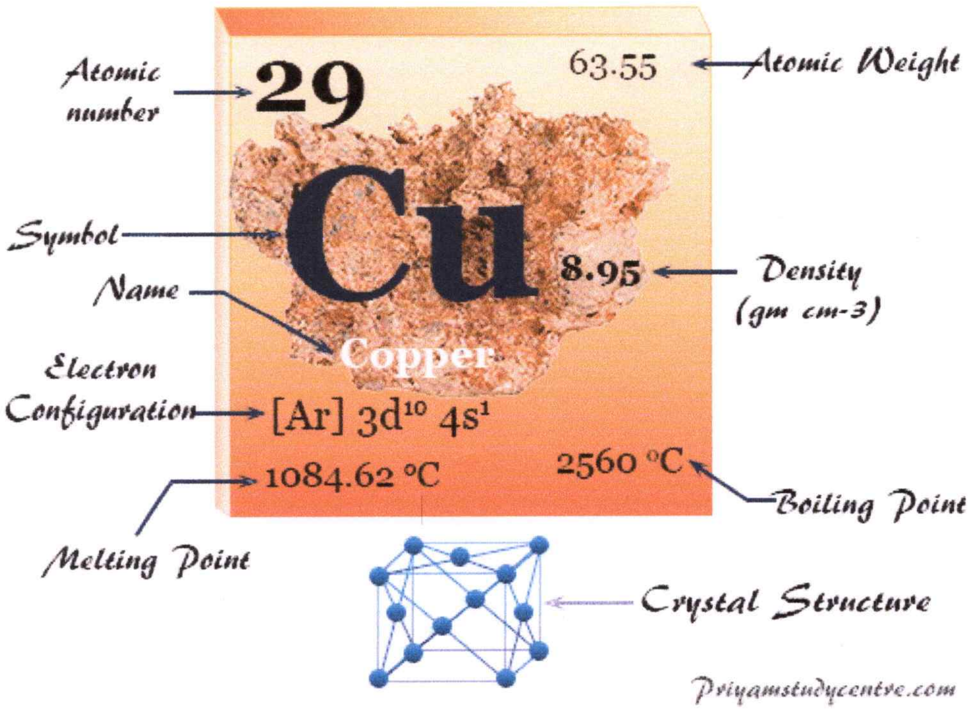
Corrosion resistance

With a high natural corrosion resistance, copper has proven to be a useful metal for outdoor and marine structures and seafaring. It is often used in an alloy form, as 90/10 and 70/30 copper-nickel alloys are very good at standing up to the corrosive effects of **seawater.**

Physical property of copper

Copper Physical Data

Density (g/cc): 8.96
Melting Point (K): 1356.6
Boiling Point (K): 2840
Appearance: Malleable, ductile, reddish-brown metal
Atomic Radius (pm): 128
Atomic Volume (cc/mol): 7.1
Covalent Radius (pm): 117
Ionic Radius: 72 (+2) 96 (+1)
Specific Heat (@20°C J/g mol): 0.385
Fusion Heat (kJ/mol): 13.01
Evaporation Heat (kJ/mol): 304.6
Debye Temperature (K): 315.00
Pauling Negativity Number: 1.90
First Ionizing Energy (IJ/mol): 745.0
Oxidation States: 2, 1



Application

1. Applications in electrical power industry

Electric power transmission, such as wire and cable, transformers, switches, plug components and connectors, etc.; motor manufacturing, for instance as a stator, rotor, shaft head and hollow wire, etc.; communication cables and residential electrical circuits also need to use a large quantity of copper wires.

2. Applications in energy and petrochemical industries

Main condenser tubes and plates are made from brass, bronze and cupronickel in coalfired power stations within the energy industry. Solar heaters are also often made of copper tube.

Different kinds of containers for holding corrosive mediums, pipe systems, filters, pumps and valves, all sorts of evaporators and condensers, while heat exchangers are made from copper and copper alloy in the petrochemical industry. For its corrosion resistance and as soluble copper ions in water it has an antiseptic effect which could protect marine organisms from being polluted; copper and its alloys have been widely used in desalinators and offshore drilling platforms and other undersea installations.

3. Applications in new industries and high-tech fields

Uses such as coating of superconducting alloys, containers and pipelines of cryogenic medium, cooling linings of rocket engines and magnet windings in high-energy accelerators, etc.

4. Applications in transportation industry

Copper alloy is used in the shipping industry- including aluminum bronze, manganese bronze, aluminum, brass, gun metal (bronze), tin, zinc, copper and nickel copper alloy (monel), which are all standard materials in shipbuilding. Copper and copper alloy in warships and commercial ships are used commonly to make aluminum bronze propellers, bolts, rivets, condenser pipes, copper coated paint, etc. Copper and copper alloy in the automotive industry are mainly used for radiators, braking systems, hydraulic equipment, gears, bearings, brake linings, power distribution and power systems, gaskets and all kinds of joints, fittings and accessories, etc. On trains, the motors, rectifiers and controls, brakes, electrics and signal systems also rely on copper and its alloys. In addition, railway electrification is a big source of demand for copper and its alloys. The wiring, hydraulic pneumatics and cooling systems of planes all need to use copper. Bearing retainers and gear bearings utilise aluminum bronze pipe, and navigation instruments are made from diamagnetic copper alloy.

COPPER CHLORIDE:

Copper chloride, commonly called cuprous chloride, is the lower chloride of copper, with the formula CuCl. The substance is a white solid sparingly soluble in water, but very soluble in concentrated hydrochloric acid. Impure samples appear green due to the presence of copper(II) chloride (CuC12).
Molar mass: 98.999 g/mol
Density: 4.14 g/cm'
Boiling point: 1,490 °C (2,710 F: 1,760 K) (decomposes)
Melting point: 423 °C (793 °F; 696 K)

Application:

- It is used in petroleum, textiles, metallurgy, photography, agricultural products, and as a feed additive and wood preservative.

- It is also used in light sensitive paper manufacturing, pigments for glass and ceramics, and Acrylonitrile manufacturing.

- The main use of copper(1) chloride is as a precursor to the fungicide copper oxychloride.
- CuCl is used as a catalyst in Atom Transfer Radical Polymerization (ATRP).

CHAPTER 2:

REVIEW OF LITERATURE

REVIEW OF LITERATURE

By Jonathan Becker,

Present, A series of copper(II) complexes with tripodal polypyridylamine ligands (derived from the parent ligand tris(2-pyridy|methyl)amine, tmpa) has been synthesized. Crystallographic characterization was possible for all complexes obtained. The copper(I) chloride complexes were investigated for their in vitro anticancer potential using human tumor cell lines containing examples of cervical, colon, ovarian cancers and melanoma.

By Jiahe Li et al,

Present, Copper chloride complexes with substituted 4-phenyl-terpyridine ligands: synthesis, characterization, antiproliferative activities and DNA interactions. Eleven copper chloride coordination compounds (I-11) with 4'-(4'-substituted-phenyl)-2,2':6',2"-terpyridine ligands bearing hydrogen (LI), cyano (L2), p-hydroxyl (L3), m-hydroxyl (L4), ohydroxyl

(LS), methoxyl (L6), iodo (L7), bromo (L8), chloro (L9), fluoro (L10) or methylsulfonyl (L11) were prepared and characterized by IR spectroscopy, elemental analysis and single crystal X-ray diffraction.

By Dengliang Li et al,

Present, Antiviral effect of copper chloride on feline calicivirus and synergy with ribavirin in vitro Feline calicivirus (FCV) is a common and highly prevalent pathogen causing upper respiratory diseases in kittens and felines in recent years. Due to the substantial genetic variability of the viral genes, existing vaccines cannot provide complete protection. Therefore, research on FCV antiviral drugs has received much attention.,

By Phorphan Sornchuer et al,

Present, Copper (Cu)-based biocides are currently used as control measures for both fungal and bacterial diseases in agricultural fields. In this communication, we show that exposure of the bacterial plant pathogen Xanthomonas campestris to nonlethal concentrations of Cu(2+) ions (75 MM) enhanced expression of genes in OxyR, OhrR and IseR regulons. High levels of catalase, Ohr peroxidase and superoxide dismutase diminished Cu(2+)-induced gene expression, suggesting that the production of hydrogen peroxide (H202) and organic hydroperoxides is responsible for Cu(2+)-induced gene expression

By Azam Jafari,

Present, Copper nanoparticles (CuNPs) were formed by reduction of CuCl2 with L-ascorbic acid. The antibacterial and antifungal effects of SNPs and CuNPs in comparison with silver nitrate (AgNO3) and copper chloride (CuCl2) (respective nanoparticle constrictive salts) and synthetic antibiotics and fungicides were studied. Fungi (A. flavus and P. chrysogenum) and bacteria (E. coli and S. aureus) showed clear hypersensitivity to silver and copper nanoparticles, and the effects of SNPs were more notable than those of CuNPs. Data analysis showed that copper chloride and silver nitrate had a lower inhibitory effect in their nanoparticles, especially against the tested fungi.

By Dae Jung Kim et al,
Present, The impregnation of copper chloride on the activated carbon significantly enhanced the adsorption capacity of methyl mercaptan, despite a notable decrease in microporosity. It is likely that copper chloride may act as adsorption site for methyl mercaptan. Copper chloride on the activated carbon in a range of 3-20 wt% Cu content was present mostly in the amorphous form of CuC12, according to the results of the solubility, XRD and TGA tests.
Starting at 10 wt% in Cu loading, the adsorption capacity for methyl mercaptan decreases gradually. It is likely that a decrease in the degree of copper chloride dispersion and an accessibility of small pores may lead to the decrease in the adsorption capacity of the activated carbon for methyl mercaptan.

By Guishan zhang et al,
Present, The present study examined the effects of $CuCl_2$ exposure on the spatial learning and memory of rats, and on metabolites in the hippocampus. A total of 60 male Sprague-Dawley rats (10 rats/group) were intraperitoneally injected with various doses (0, 0.5, 1.0, 2.0, 4.0 and 6.0 mg/kg) of $CuCl_2$ three times every other day for 6 days. Rats administered with 1.0 ml/kg sterile saline were used as controls. A total of 2 days subsequent to the
12
final injection, the rats were subjected to the Morris water maze (MWM) test, followed by proton magnetic resonance spectroscopy (1H-MRS). The rats were subsequently sacrificed, and their hippocampal tissues were processed for high performance liquid chromatography (HPLC).

By An wang et al,
Present, A synergistic combination of chloride and copper powder was proposed as a new method to reductively remove arsenic from highly-acidie wastewater with high arsenic content (HAWA). As(III) was reduced to As(0) by copper powder in the presence of chloride and were effectively removed from HAWA. The procedure to remove arsenic was optimized as follows: initial H° concentration of 5 mol L.', Cu-to-As molar ratio of 8, Cl-to-As molar ratio of 10, a reaction temperature of 60 °C, copper powder particle size of 68-24 um, and a stirring speed of 300 r min", Under these optimal conditions, the removal rate of arsenic was close to 100%.

CHAPTER 3:

MATERIALS AND METHODOLOGY

3.1. MATERIAL AND METHODOLOGY

1.Glassware

- Glassware used as laboratory apparatus off ers a wide range of containment and transport functions for solutions and other liquids used in laboratories. Most laboratory glassware is manufactured with borosilicate glass, a particularly durable glass that can safely be used to hold chemicals being heated over a
- flame and to contain acidic or corrosive chemicals. All laboratory glassware should be cleaned immediately following use to prevent chemical residue from congealing or hardening.
- Laboratory Glassware may be used to store the chemicals (solid or liquid), transfer of chemicals, for making solution, reagents, etc. amongst others. Most of these laboratory glassware are heat, corrosion, chemical, and temperature resistant. These laboratory glasswares include beakers, flasks, watch glass, Petri plates measuring cylinders, test tubes etc. of various shapes and sizes to incorporate a range of volumes. They can be autoclaved and used again if sterile conditions are required. They can also be washed with soap or detergent and can be reused. Generally, a separate space is allocated for the storage of laboratory glassware in a lab. Laboratory Glassware are all well calibrated and can be easily labeled using a marker or a sticker.

2. Material

- The Excelar reagent (ER) is equal to analytical reagent (AR) grade which is of pure quality for synthesis and preparation at research standards. While, Laboratory reagents are of purified organic and inorganic having reliable accuracy at laboratory standard.
- It is usually divided into three categories: inorganic chemicals, organic chemicals and biochemical reagents. But all kinds of chemical reagents because of the purity, impurity content, use, etc., and there are many levels.

CHAPTER 4:

EXPERIMENTAL

4. EXPERIMENTAL

Preparation of Ligand

Requirements:

1. Chemicals: Thiosemicarbzide, carbon disulfide, NaoH

2. Glassware and Instruments: 250 ml beaker, pipettes, measuring cylinders, funnel, glass rod, Round bottom flask etc.

Synthesis of Ligand

Procedure:

1. Take 27.39 g Thiosemicarbzide sample & add 21.6 ml of carbon disulfide. and add 14.4 g NaoH dissolve in 50 ml of coater in Round bottom flask.
2. Reflux the mixture for 4 hours
3. Adjust the PH within 4 to 5 by adding 20% Hcl.
4. After that Add it in ice cold water.
5. Keep it for settle and Arrange the setup for filration And Filtter the solution From cotton plug then Filter the solution through whatman Filter Paper No 41.
6. Recrystalize the Filtrate by ethanol.

Preperation of complex:

Requirements:

1. **Chemicals:** DMSO (Dimethyl Sulfoxide), Ethanol, Metal Complex Solution.

2. **Glassware and Instruments:** 250 ml beaker, 100 ml standard measuring flask, pipettes, measuring cylinders, funnel, glass rod, gas burner, heating mantle, magnetic stirrer, etc.

Procedure:

1. Weigh accurately 1.69 g of Copper chloride in a 100 ml beaker and dissolve it in a ethanol by stirring with glass rod. Then transfer the solution to the 100 ml standardmeasuring flask and dilute the solution of silver nitrate upto the mark by ethanol.
2. Then weigh 0.21 g of reagent and add 3 to 4 ml DMSO in it and heat the solution till courelss (solution must be clear and not turbid at all) then to this solution add 10 ml ethanol pour the whole content in a 10 ml ethanolic solution of silver nitrate. Repeat the procedure 4 to 5 times for the same 10 ml ethanolic solution of silver nitrate.
3. In this way the white coloured precipitate were formed immediately by stirring at room temperature. The whole content were precipitated by using magnetic stirrer by keeping in it for continuous duration of 1 hour.
4. After that the precipitate was digest on Heating mantle. The digestion increases the particle size of the complex.
5. After digestion cool the precipitate and arrange the filtration setup filter the solution of silver nitrate complex. Then give the washing to the filter by using ethanol. And dry the filtrate under heating burner carefully.

Recrystallization of complex

1. Take small amount of complex in a test tube and add 2 to 3 ml of DMSO i.e. dimethyl sulfoxide and heat the solution mixture till the reagent dissolved in it to obtained clear solution.
2. Arrange the setup for filtration. And filter the solution from the cotton plug then take this filtrate in a petridish and add ethanol drop by drop and mixed well. The precipitate were formed. This filtrate is a pure form of our complex.
3. Again filter the precipitate through whatman filter paper and give washing to the filtrate by ethanol and dry the filtrate under heating burner carefully.

CHAPTER 5:

CHARACTERIZATION

5.CHARACTERIZATION

IR SPECTROSCOPY

Infrared (IR) spectroscopy uses infrared radiation to excite the molecules of a compound and generates an infrared spectrum of the energy absorbed by a molecule as a function of the frequency or wavelength of light. Diff erent types of bonds respond to the IR radiation diff erently.

Application:

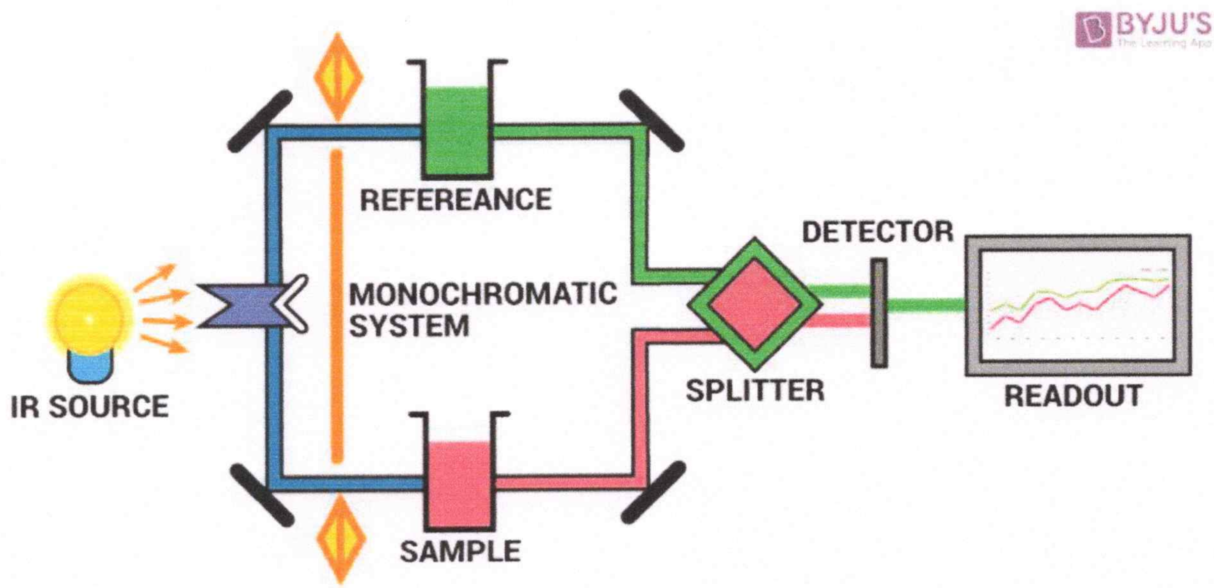
- Infrared spectroscopy (IR spectroscopy or vibrational spectroscopy) is the measurement of the interaction of infrared radiation with matter by absorption, emission, or reflection. It is used to study and identify chemical substances or functional groups in solid, liquid, or gaseous forms.[7]
- IR spectroscopy is used to establish whether a given sample of an organic substance is identical with another or not. This is because large number of absorption bands is observed in the IR spectra of organic molecules and the probability that any two compounds will produce identical spectra is almost zero.
- It is also used in forensic analysis in both criminal and civil cases, for example in identifying polymer degradation. It can be used in determining the blood alcohol content of a suspected drunk driver.
- IR-spectroscopy has been successfully used in analysis and identification of pigments in paintings and other art objects such as illuminated manuscripts.
- Infrared spectroscopy has also been successfully utilized in the field of semiconductor microelectronics for example, infrared spectroscopy can be applied to semiconductors like silicon, gallium arsenide, gallium nitride, zinc selenide, amorphous silicon, silicon nitride, etc.

Introduction:

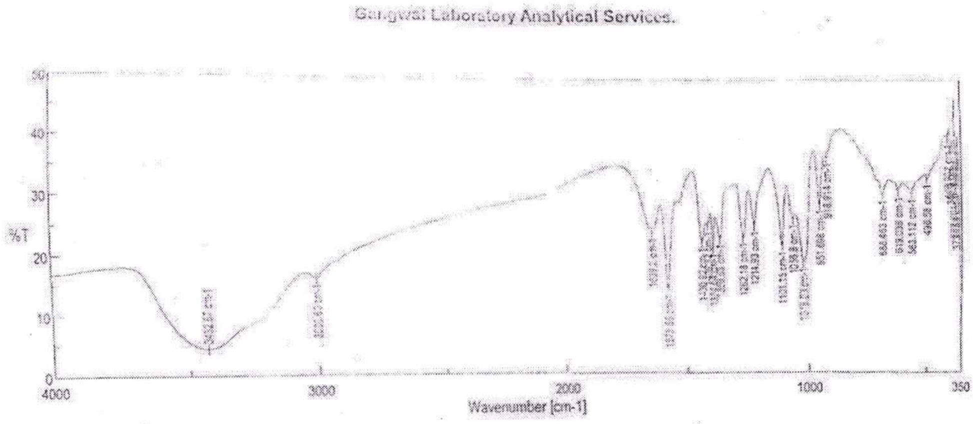
- The infrared portion of the electromagnetic spectrum is usually divided into three regions; the near-, mid- and far- infrared, named for their relation to the visible spectrum.
- The higher energy near-IR, approximately 14000-4000 cm_{-1} (0.8-2.5 μm wavelength) can excite overtone or harmonic vibrations.
- Infrared (IR) spectroscopy uses infrared radiation to excite the molecules of a compound and generates an infrared spectrum of the energy absorbed by a molecule as a function of the frequency or wavelength of light.

PRINCIPLE OF INFRARED SPECTROSCOPY :

 The IR spectroscopy theory utilizes the concept that molecules tend to absorb specific frequencies of light that are characteristic of the corresponding structure of the molecules.
 The energies are reliant on the shape of the molecular surfaces, the associated vibronic coupling, and the mass corresponding to the atoms.
 For instance, the molecule can absorb the energy contained in the incident light and the result is a faster rotation or a more pronounced vibration.



IR SPECTRAL ANALYSIS:



IR VALUES:

IR Spectral Analysis of monometallic Complex:

Characteristics Absorptions (cm^{-1}) in IR Spectrum of a complex:

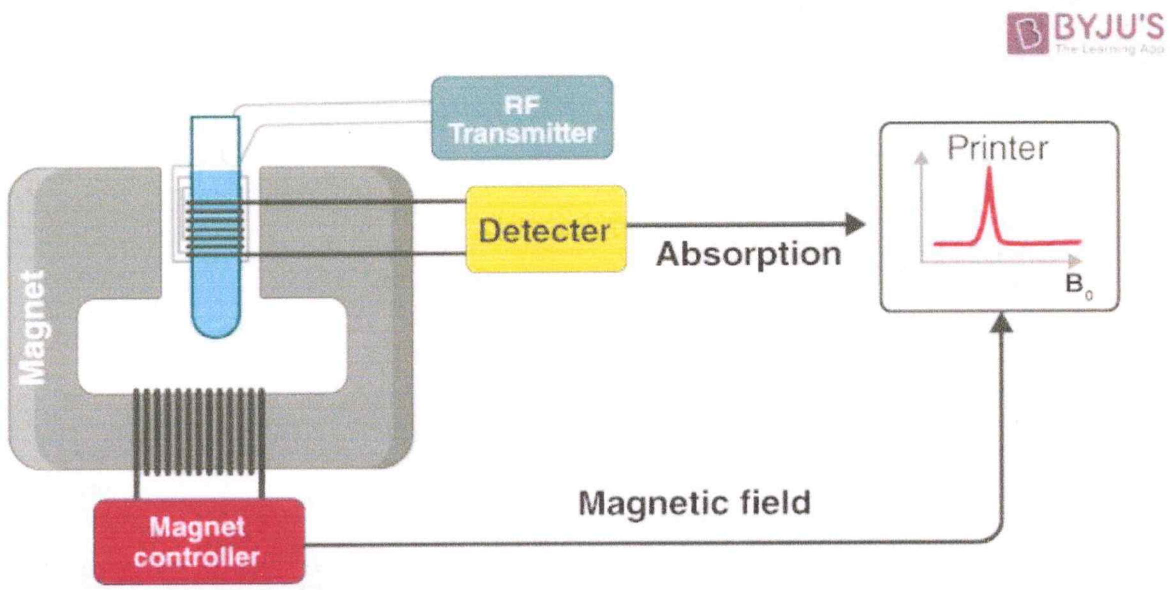
Vibration	Absorption (in cm^{-1})	Intensity
N-C=S	1018.23 cm^{-1}	(m→s)
CH_2-N	1262.18 cm^{-1}	(m→s)
N-H	918.914 cm^{-1}	m
C-S-C	688.463 cm^{-1}	m

¹H NMR Spectroscopy

Proton nuclear magnetic resonance (proton NMR, hydrogen-1 NMR, or 1H NMR) is the application of nuclear magnetic resonance in NMR spectroscopy with respect to hydrogen-1 nuclei within the molecules of a substance, in order to determine the structure of its molecules. In samples where natural hydrogen (H) is used, practically all the hydrogen consists of the isotope 1H (hydrogen-1; i.e. having a proton for a nucleus).[7]

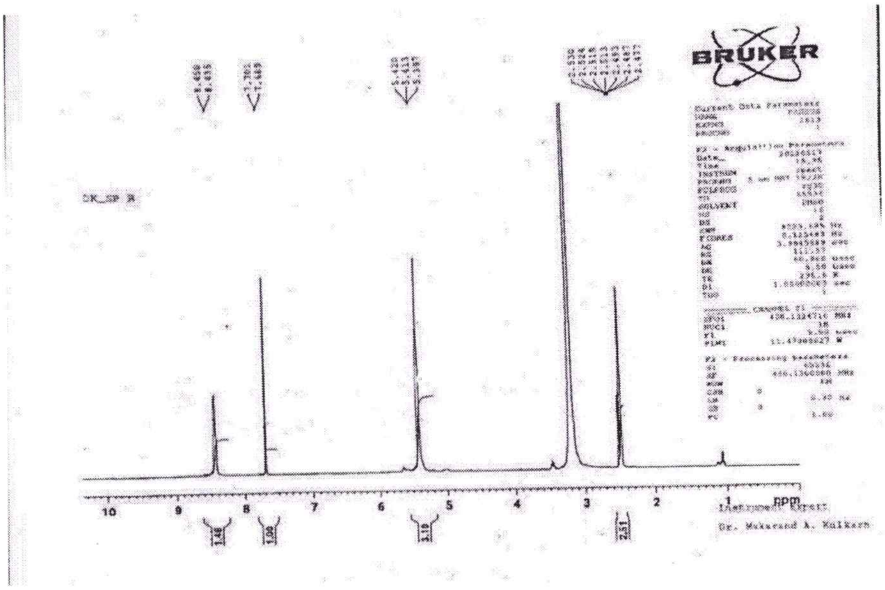
Principle:

When the proton is placed into an external magnetic field, the proton's magnetic dipole moment will orient itself along that magnetic field. However, since the proton can spin in one of two ways in any external magnetic field, it has two magnetic dipole moment orientations and so will align with the external magnetic field in one of two ways. One of these orientations will be along the same direction as the magnetic field and this is known as the spin-up (+1/2). This will be the lower in energy and more stable spin state. The other orientation will be along the same axis as the magnetic field but in the opposite direction and this is known as the spin-down state (-1/2). This will be the higher in energy and less stable quantum spin state. If we now direct electromagnetic waves (radiofrequency waves) with just the right frequency at the spin-up state, the spin-up proton will absorb energy and transition (flip) to the spin down state. At this point it is said to undergo resonance and this frequency is known as the resonance frequency or chemical shift. Diff erent hydrogens in molecules can have diff erent chemical shift values and these values can be readily determined by using this nmr technique. This type of technique that uses nuclear magnetic resonance to study the protons (hydrogens) is known as proton nmr spectroscopy.[8]



NMR Spectroscopy Instrumentation

- **^{1}H NMR:**



^{1}H NMR SPECTRAL DATA:

^{1}H NMR Spectral Analysis of monometallic Complex:

δppm	Proton Types
5.5	$-NH_2$
7.7	CH=N
8.5	CH_2-N

CONCLUSION

- Monometalic complex is prepared.
- It is showing bacterial activity.
- It would have promising biological activities like anticancer and anti-inflamentry.

APPLICATION

- Good anticancer activity.
- It can be use as a catalyst.
- It canbe used as sensor for food.
- In degradation of dyes.
- In industrial treatment of water.

CHAPTER 7:

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