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"Synthesis of Metal Sulfadoxine Complexes and Studying Their Properties"

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ABSTRACT

The metal like Mn (II), Fe (II), Ni (II) & Cu (II) are the essential elements to the human being. These metal used for the synthesis of complex with Sulfadoxine the color, state and solubility of complex can be determine. Anti-microbial activity of these coordination check against E.coli and staphylococcus aureus bacteria.

Keywords: Sulfadoxine, conductance, antimicrobial, ligand, complex etc.

I. INTRODUCTION

The co-ordination chemistry is important branch of inorganic chemistry. A many co-ordination compound have great importance in living organism. Among them chlorophyll and hemoglobin are important. Chlorophyll is chief constituent of green plants. It is a co-ordination compound which is formed by combination of Mg and Porphyrin and has important in synthesis the carbohydrate in a green plant.

Hemoglobin is a chief constituent of blood, it is formed by combination of Fe and Porphyrin ligands and has importance in transportation of Co_2 and O_2 in animal circulatory system. The earliest recorded co-ordination compound is Prussian blue obtained by Disbranch & Rosset. A compound that interacts with a biological system to produce a biological response is called drug.

The fundamental & classical investigation in co-ordination chemistry were carried out by Danish Chemist S.M. Jorgensen & the Swiss Alfred Werner. They prepare thousands of compound s. Werner postulated a theory to explain the nature & formation of co-ordination compounds. He received Noble prize in 1913 for his work in co-ordination chemistry.

According to Werner co-ordination are those comp. Which are formed due to the combination of metal & ligand. The ligand donate a pair of electrons to metal & form an active bond. According to Werner's theory, in co-ordination compound central metal atom possess two types of valences primary & secondary. Primary valiancy is ion sable and secondary valiancy is non ion sable. Secondary valiancy of many metal is fixed .In co-ordination compound primary valiancy is satisfied by –vie ligand & denoted by dotted lines. The secondary valance is satisfied by –ve ligand & denoted by think line. The secondary is in a space around the central metal atom. Therefore the geometry of co-ordination compound is depends upon secondary valences. Every metal tend to satisfy both its primary & secondary valences in order to meet this requirement a negative ion may perform a dual function of satisfying both type of valances .

When two or more than two stable salts or compound combine together in a stoichiometric (equimolar) proportion form new compound there are two types of molecular compounds. These are

1. Double salt &
2. co-ordination compounds.

Double salt is compound or molecular compound. It always exist in crystal lattice & retain their identity but it dissolve in water it break down into their constituent & loss their identity .e.g. Mohr salt $FeSo_4(NH_3).SO_4\ 6H_2O$. Co-ordination compounds are those which exist in crystal-like lattice as well as in solution. It retain their identity in solids state as well as in solution. E.g. potassium hexocynopherate $K4(Fe(CN)_6)$.

Cisplatin or cis- diamine dichloroplatinum (II) names platoon. It is chemotherapy drug is used to treat various types of cancer. Compound cis-platin was first described by M.Peryone in 1845 & known for long time as Perion salt Its structure was given by Alfred Werner.

A drug is a substance, which is used in the cure treatment prevention or diagnosis of disease in man or in animals. Treatment of diseases with chemical substances has been known since the fifteenth century. I have taken sulfadoxine drug for the synthesis of complex with metal like Ni(II), Mn (II),Fe(II) & cu(II).Sulfadoxine is used in malarial treatment.

Preparation of complexes:

All the complexes were prepared using same general procedure. Approximately 10 m moles of partially dehydrated salts were dissolved in minimum amount of anhydrous ethanol. The ligand in excess over 1:2 metal to ligand ratio, was dissolved in the minimum amount of ethanol, the mixture was refluxed for 4 hrs. The product was filtered through Whatmann filter paper. The complexes were recrystallized from suitable solvents.

M +Sulfadoxine ⟶ M (Sulfadoxine) 2

(M = Ni(II), Mn (II),Fe(II) & cu(II).)

Conductance:

Operational Procedure:

Their electrolyte conductance of an electrolyte is measured in "conductivity cells" which are specially designed vessels of suitable size and shape in which two plates of inert metal (Pt or gold) are provided to serve for the flow in and flow out of electrons. The electrolyte whose conductivity is to be measured is taken in fused state or in aqueous solution.

First we connect the conductivity cell to the conductometre. Switch on the conductometre. Then keep the conductometre on calibration known. The conductivity cell is then dipped in the test solution .Then calibration is change to measure because at this position we want to measure the conductivity. After some time we get the table reading of observed conductometre. In this way we can measure the conductivity of any solution.

CONDUCTIVITY OF COMPLEX

Table 1

Sr. No.	Name of Metal Complex	Conductivity
1	Sulfadoxine Manganese Chloride complex	0.05
2	Sulfadoxine nickel nitrate complex	0.03
3	Sulfadoxine Ferrous nitrate complex	0.02
4	Sulfadoxine copper chloride complex	0.05

ANTIMICROBIAL CTIVITIES

All living organisms are chemically dynamic systems. The presence of a "foreign" chemical within a living

system can readily upset this balance by enhancing, inhibiting or otherwise interacting with one or more of the chemical reactions or compounds on which its integrity depends. Such a chemical can be said to possess some form of biological activity.

Biological activity can take many different forms and may be measured in different ways depending on the level at which the investigation is conducted, when the critical site and mechanism of action of a chemical are known, biological activity can be measured directly in terms, for example, of the degree of inhibition or enhancement of an enzyme system as measured in vitro. More usually, however, biological activity is measured in an indirect manner through in vivo observations of the end results of the chain of events initiated by the interaction of chemical with some unknown biochemical components. In the case of a pesticide, for instance, it is customary to measure biological activity in terms of the percent mortality of an organism without necessarily having any knowledge of the mode of action of the material at the molecular level. More strictly defined this should be termed biological effect or response.

Microbial Testing:

The literature survey of the antimicrobial activity of metal complexes of sulfadoxine have shown that many of them are useful as the best bactericides and fungicides against the various gram positive and gram negative bacteria and fungi. Some of the representative compounds synthesized in the present investigation were screened for their antibacterial and antifungal activities. *Escherichia coli* (*E. coli*) is one of the main species of bacteria living in the lower intestines of mammals, known as gut flora. When located in the large intestine, it actually assists with waste processing, vitamin K production, and food absorption.

Test organism:

The test organisms were selected from both gram positive and gram negative to test.The stock cultures were collected from the culture unit of the Department of Microbiology, D.S.M. College Parbhani. These organisms were cultured on agar slants and incubated for 24 hrs. at 32–34 °C. From these slants a suspension were made using sterile saline solution (saline solution was prepared by dissolving 0.9 gm of sodium chloride in 100 ml distilled water and then sterilized).

Method of testing:

Bactericidal activities were evaluated by the paper disc plate method15. The nutrient agar medium and 5mm diameter paper discs (Whatmann No. 1) were used. The compounds were dissolved in DMSO making known stock solution. A known volume of stock solution is diluted in ethanol making 500 ppm concentration. The filter paper discs were soaked in different solutions of the compounds and then placed in the petri-plates previously seeded with the test organisms (*Staphylococcus aureus* and *Escherichia Coli*). The plates were incubated for 24-30 hrs. at 28 ±1°C and the inhibition zone around each disc were measured. The standard drug streptomycin (500 ppm) was tested for its activity under the same conditions. All these experimental procedures were repeated thrice with three replicates for each compound.

Table 2

Sr. No.	Name of Metal Complex	Activity[mm]
1	Sulfadoxine Manganese Chloride complex	6mm
2	Sulfadoxine nickel nitrate complex	8mm
3	Sulfadoxine Ferrous nitrate complex	13 mm
4	Sulfadoxine copper chloride complex	12mm

CHARACTERISATION OF COMPLEX

Table 3

Sr. No.	Name of complex	Mol. Wt. Of complex	Percentage of each element
1	Sulfadoxine Manganese Chloride complex	646.5	C=36.785%, H=4.53%,N=8.58%, O=18.39%,S=9.80%, Mn=9.73% Cl=10.88%
2	Sulfadoxine nickel nitrate complex	652.5	C=36.785%, H=4.53%,N=8.58%, O=18.39%,S=9.80%, Ni=9.73% Cl=10.88%
3	Sulfadoxine Ferrous nitrate complex	648.5	C=36.785%, H=4.53%,N=8.58%, O=18.39%,S=9.80%, Fe=9.73% Cl=10.88%
4	Sulfadoxine copper chloride complex	654.5	C=36.785%, H=4.53%,N=8.58%, O=18.39%,S=9.80%, Cu=9.73% Cl=10.88%

II. RESULT AND DISCUSSION

As number of authors were interested to investigate the biological and medicinal properties of transition metal complexes. The ligands with nitrogen and oxygen donor systems inhibit enzyme production. Complex formation reduces the polarity of the metal ion due to the partial sharing of its positive charge with the donor groups and delocalization of pi electrons. This process increases the lipophilic nature of the central metal atom, which is responsible for increasing the hydrophobic character and liposolubility of the molecule in crossing cell membrane of the microorganism, and hence enhances antibacterial activity. The of drugs shows moderate antibacterial activity, but their metal (II) complexes show more antibacterial activity than corresponding ligands. It was found that the Mn (II) complexes are more active than the free ligands and Co (II) complexes. The increase in antibacterial activity is due to faster diffusion of metal complexes as a whole through cell membrane or due to the combined activity effect of the metal and ligand.

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