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Anti-Microbial Activity of Silver Metal Complex (OMC)

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Abstract
The antimicrobial activity of silver metal complexes has gained considerable interest due to their potential applications in various fields, including medicine, agriculture, and water treatment. This abstract provides an overview of recent research exploring the antimicrobial properties of silver metal complexes and their mechanisms of action. Silver metal complexes have shown broad-spectrum antimicrobial activity against a wide range of bacteria, fungi, and viruses. This activity is attributed to the release of silver ions from the metal complex, which interact with microbial cells and disrupt their vital processes. Various types of silver metal complexes, including silver nanoparticles, silver ions coordinated with organic ligands, and silver chelates with different metals, have been investigated for their antimicrobial properties. The mode of action and efficacy of these complexes can be influenced by factors such as the nature of the ligands, the size and shape of the nanoparticles, and the presence of other metals. The antimicrobial activity of silver metal complexes has been demonstrated against both drug-sensitive and drug-resistant microbial strains. Studies have shown their effectiveness in inhibiting the growth of multidrug-resistant bacteria, such as methicillin-resistant Staphylococcus aureus (MRSA) and carbapenem-resistant Enterobacteriaceae (CRE). Furthermore, the combination of silver metal complexes with existing antimicrobial agents has shown synergistic effects, leading to enhanced antimicrobial activity. Organo-metallic compounds has shown interestingly research are for researchers, the OMC are widely used both stoichiometrically in research and industrial chemical reactions, as well as in the role of catalysts to increase the rates of such reactions, OMC include polymers, pharmaceuticals. The metalation of silver complexes with ligand salicyclic acid and yield was 2.5g. The OMC compound further taken study for Anti-Microbial activity on E. coli and Staphylococci species.

Keywords: OMC, metalation, silver complex, anti-microbial activity.

Introduction

Complex Metal ION

A complex ion consists of metal ion to which number of molecules attaches to its centre. These molecules are attached by co-ordinate bonds. The metal is known as the central metal ion. The anions or molecules that are attached to the metal are known as ligands. The bond between the metal and the ligand, where the ligand gives both electrons is known as Co-ordinate Covalent bond. They have active lone pair of electron in the outer energy level. And hence are used to form co-ordinate bonds with the metal ion. They function as “Lewis acid”. In our metal-ligand complex we are considering the part of the metal as precursor molecule and ligand as Schiff's base.

Precursor: Precursor be defined as a compound that participates in a chemical reaction and produces another compound

Schiff Base: Schiff Base is often used as chelating ligands in coordination chemistry. For example we known that N and S atom play an important role in the coordination chemistry of metal at the active sites of numerous Metallo bio- molecules. These schiff base metal complexes are studied widely because they have industrial and antifungal, antibacterial, anticancer and herbicidal application. They serve as a model for biologically important species and also find applications in biomimetic catalytic reaction. Chelating ligand containing N, S,O donor atom show broad biological activity and are special

interest for bonding with metal ion. The fact is known that the metal ion bonded with the biologically active compound enhance the activity of the metal.

Methodology

Preparation of Ligand

For preparation of Ligand: Addition of 1, 4 phenyl hydrazine in 15 ml ethanol and dissolve properly. Now we added 2 mole of salicylic acid in inert atmospheric conditions and under reduced pressure.

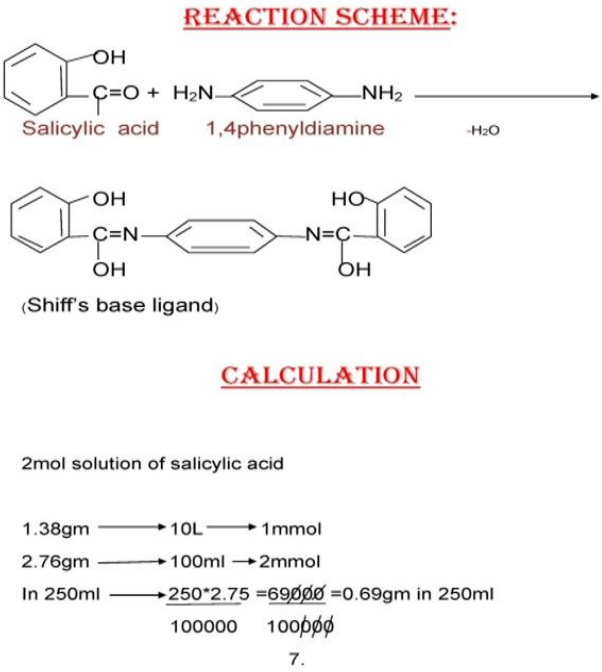

Fig 1: Reaction scheme for preparation of ligand

Preparation of Complex

For preparation of complex Addition of Re-crystallized precursor (ligands) 0.5gm and 1gm $AgNO_3$ solution with 10ml acetone in inert atmosphere and reflux for 4 hours. Color changes orange to dark green. Now decant off and evaporate and dry

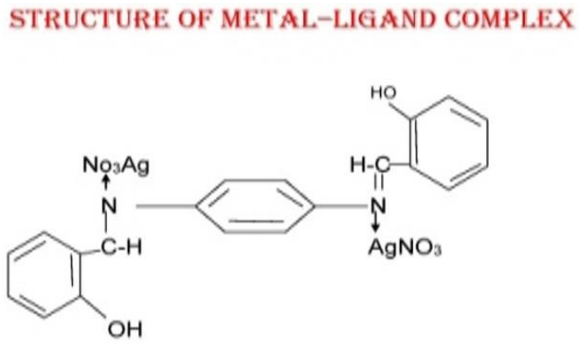

Fig 2: structure of metal-ligand complex

Antimicrobial Activity

Sterilization is done to destroy or remove all living organisms without Damaging or altering the substances being sterilized. Sterilize all glassware in a hot-air oven at 180°C for 2-3 hours. After sterilization don't open the oven. Allow it to cool slowly. Remove the material and store them. Agar media broths and other liquids are sterilized under steam pressure in the autoclave. The temperature inside the autoclave at 15lbs. Steam pressure is about 121°C.Usually 15-20 minutes at 15lbs. Steam pressure is used to sterilize the culture media. If an autoclave is not available, Pressure cooker can be used for sterilization. For our work too, we have used pressure cooker for sterilization. Sterilize all glassware's like Petri dish, flask etc.

Preparation of Culture for Bacteria

For culturing media of bacteria we have performed Nutrient agar method (NAM)

Nutrient Agar Method

Nutrient Agar method is nutrient media used for the cultivation of microbes. Supporting growth of a wide range of non-fustidious organisms. This method is very popular because it can grow a variety of type of bacteria and fungi and contain many nutrients needed for the bacterial growth. Suspend 28gm of nutrient agar powder in 1 liter distilled water .Heat the mixture while stirring to fully dissolve all components. Autoclave the dissolved mixture at 121 degree Celsius for 15 min in laminar air flow once the nutrient agar has been autoclaved, allow it to cool but not solidify. Pour nutrient agar into each plate and leave plates on the sterile surface until the agar has solidify. Replace the lid of each petri dish and store the plate in a refrigerator.

Agar Well Diffusion Method

This test is formed by inoculating the surface of an agar plate with bacteria. (E.coli or Staphylococcus bacilli). Then the antibiotic is punched into it. Then the plates are incubated. If an antibiotic stops the bacteria from growing or kills bacteria. Then there will be an area around the disk where the bacteria will not be grown. And will be invisible. For this process, we take one test Solution and one control. Each of three different concentrations. Distinctly 0.02, 0.05 and 0.1 in six different test tube. Three of Control and three of test. We take four nutrient agar plates. The agar plate surface is inculcated by spreading a volume of the microbial inoculums over the entire agar surface. Then a hole is punched with the help of puncher machine.

Results and Discussions

Antimicrobial Activity of Staphylococci

Table 1: Antimicrobial activity of Staphylococci

S. No.	Concentration	Diameter	Antibiotic
1	-	Control	test
2	0.02	2.5	2.5
3	0.05	1.5	2.7
4	0.1	1.2	3.2

Fig 3 & 4: Zone of inhibition observed in E. coli

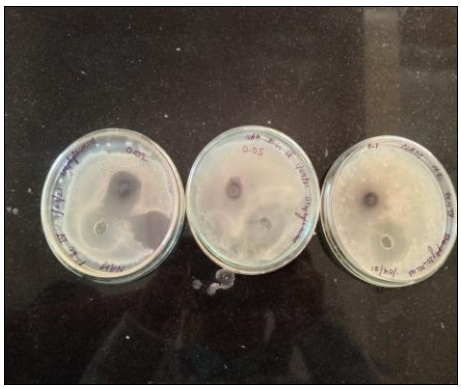

Fig 5: Zone of inhibition observed in staphylococci

Antimicrobial Activity of E.coli

Table 2: Antimicrobial activity of E.coli

S. No.	Concentration	Diameter	Antibiotic
1	-	Control	test
2	0.02	1.8 cm	3 cm
3	0.05	1.9 cm	3.1cm
4	0.1	2 cm	3.2 cm

Conclusion

With the above obtained observation, we concluded that our complex is surely creating a zone of inhibition (i.e. it is stopping the bacterial growth). If taken in large concentration, we could have developed a larger zone of inhibition.

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