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Review of various application of metal complexes of schiff bases as an antimicrobial drug

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ABSTRACT

Schiff bases are versatile ligands which are synthesized from the condensation of primary amines with carbonyl groups. Synthesis of Schiff base transition metal complexes by using Schiff base as ligands appears to be fascinating in view of the possibility of obtaining coordination compounds of unusual structure and stability. These transition metal complexes have received exceptional consideration because of their active part in metalloenzymes and as biomimetic model compounds due to their closeness to natural proteins and enzymes. These compounds are very important in pharmaceutical fields because of their wide spectrum of biological activities. Most of them show biological activities including antibacterial, antifungal, antidiabetic, antitumor, antiproliferative, anticancer, herbicidal, and anti-inflammatory activities. The biological activity of the transition metal complexes derived from the Schiff base ligands has been widely studied. This review summarizes the importance, Scope and antimicrobial activities of Schiff base metal complexes.

Keywords: Schiff bases, Metal complexes, Microorganism and antimicrobial activity

Synthesis of metal complexes attained increasing interest owing to their versatile coordination behaviour and in the understanding of molecular processes . Metal complexes are of significant attention in terms of its structural and coordination chemistry. They display diverse chemical, optical and magnetic properties by tailoring with
different ligands. In specific, the study of metal complexes of Schiff base (SB) ligands appears to be fascinating in terms of unusual structure and stability. SB complexes are considered to be among the most important stereochemical models in transition metal coordination chemistry due to their preparative accessibility and
structural variety . Structurally, a SB (also known as imine or azomethine) is a nitrogen analogue of an aldehyde or ketone in which the carbonyl group (>C = O) is replaced by an imine or azomethine group, (Aromatic aldehydes especially with an effective conjugation system) . Transition metal complexes which usually contain
nitrogen, sulphur or oxygen as ligand atoms have become increasingly important because these SB can bind with different metal centres involving various coordination sites and allow successful synthesis of metal complexes . The high affinity for the chelation of the SB towards the transition metal ions is utilized in preparing their solid
complexes . The interaction of these donor ligands and metal ions gives complexes of different geometries and literature survey reveals that these complexes are biologically active compounds. Thus, in recent years SB and their metal complexes have attained much attraction because of their extensive biological activities .
These complexes have also received exceptional consideration because of their active part in metalloenzymes and as biomimetic model compounds due to their closeness to natural proteins

and enzymes . The research field dealing with metal complexes is very broad and includes a number of interdisciplinary areas such as
bioinorganic chemistry, catalysis, photochemistry and magneto chemistry . The advances in inorganic chemistry provide better opportunities to use metal complexes as therapeutic agents. Research has shown significant progress in utilization of SB transition metal complexes as drugs to treat several human diseases. The use of SB
transition metal complexes as therapeutic compounds has become more and more pronounced. Synthetic SB metal complexes are an emerging class of compounds with varying chemistry, different molecular topologies and sets of donor atoms. It is a known fact that N atom plays a key role in the coordination of metals as the active site of numerous metallobiomolecules . These complexes offer a great diversity in their action; as antibacterial , antifungal , anticancer and anti-inflammatory agents . Due to the demand of new metal-based antibacterial compounds, metallorganic chemistry is becoming an emerging area of research . Important characteristics that can be correlated with good antimicrobial activities are the lipophilicity and penetration of complexes through the lipid membrane. Microorganisms have existed on the earth for more than 3.8 billion years and exhibit the greatest genetic and metabolic diversity. For the maintenance and
sustainability of the ecosystem these microorganisms have an important role and thus they are considered as an essential component of the biosphere . Currently, antimicrobial resistance among bacteria, viruses, parasites, and other disease-causing organisms is a serious threat to infectious disease management . The actions of antimicrobial agents are studied by understanding its mechanism of resistance. Antimicrobial agents show a minimal effect or no effect on host function when it's acted upon vital microbial functions. Different antimicrobial agents act in different ways. The mechanism of action of antimicrobial agents can be categorised on the
basis of the structure of bacteria or the function that is affected by the agents and these include the following:

_ Inhibition of the cell wall synthesis.
_ Inhibition of ribosome function.
_ Inhibition of nucleic acid synthesis.
_ Inhibition of folate metabolism.
_ Inhibition of cell membrane function.

Resistance can be described in two ways:
a) intrinsic or natural resistance whereby microorganisms naturally do not possess target sites for the drugs and therefore the drug does not affect them or they naturally have low permeability to those agents because of the differences in the chemical nature of the drug and the microbial membrane structures especially for those that
require entry into the microbial cell in order to effect their action or

b) Acquired resistance whereby a naturally susceptible microorganism acquires ways of not being affected by the drug. Overall, the activities of all the complexes obtained were found to be moderate even though higher concentrations were applied. In order to survive,

microorganisms were increasingly becoming more resistant against the arsenal antimicrobial agents to which they were being targeted .

Test methods in detecting antimicrobial resistance

Selection of the appropriate method will depend on the intended degree of accuracy, convenience, urgency, availability of resources, availability of technical expertise and cost. Many antimicrobial susceptibility testing methods can be followed but each has their own advantages and disadvantages. Different methods are available to estimate the antimicrobial activity of metal complexes, for example, automated methods Mechanism-specific tests such as beta-lactamase detection test and chromogenic cephalosporin test. Genotypic methods such as PCR and DNA hybridization methods.

The two most commonly used methods in laboratories are the agar disk diffusion method and the broth microdilution method .

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