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TRANSITION METAL COMPLEXES AND THEIR ROLE IN BIOLOGICAL SCIENCE- A REVIEW

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Metal complexes play an essential role in agriculture, pharmaceutical and industrial chemistry. Ligand, a metal surrounded by a cluster of ions or molecule, is used for preparation of complex compounds named as Schiff bases1, which are condensation products of primary amines and aldehydes or ketones (RCH=NR′, where R & R′ represents alkyl and / or aryl substituents).This paper reviews uses of Schiff bases and their metal complexes as catalysts, in various biological systems, polymers and dyes, besides some uses as antifertility and enzymatic agents.

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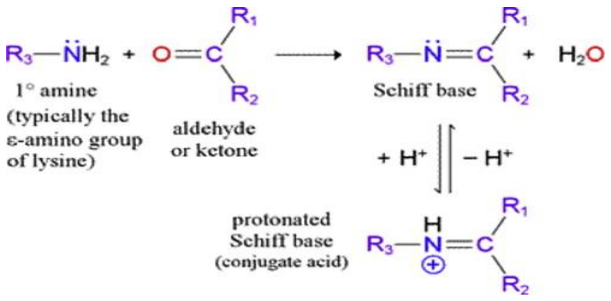
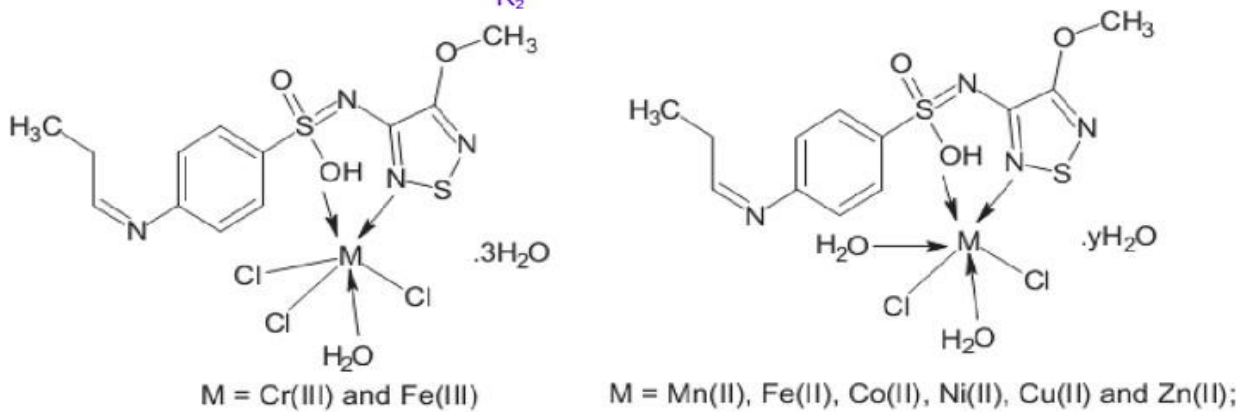
INTRODUCTION:

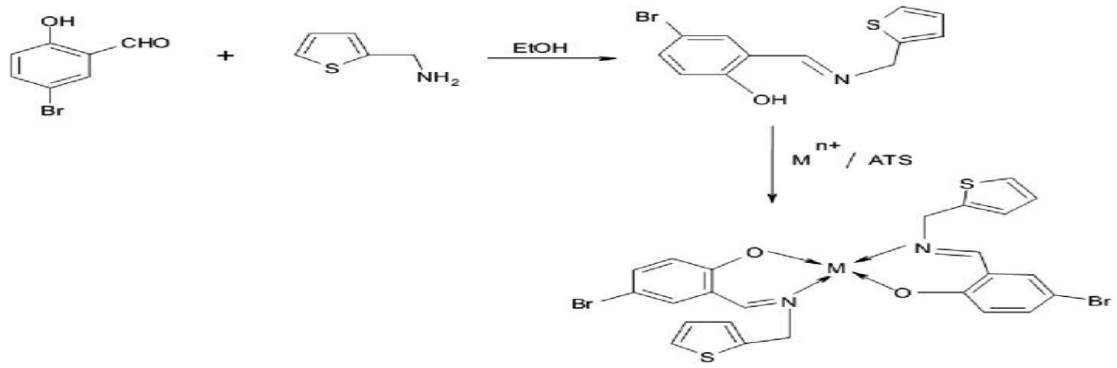
Schiff bases and their complexes are versatile compounds synthesized from the condensation of an amino compound with carbonyl compounds and widely used for industrial purposes and also exhibit a broad range of biological activities including antifungal, antibacterial, antimalarial, antiproliferative, anti-inflammatory, antiviral, and antipyretic properties[1-5]. Many Schiff base complexes show excellent catalytic activity in various reactions and in the presence of moisture. Over the past few years, there have been many reports on their applications in homogeneous and heterogeneous catalysis [6-8]. The high thermal and moisture stabilities of many Schiff base complexes were useful attributes for their application as catalysts in reactions involving at high temperatures. The activity is usually increased by complexation therefore to understand the properties of both ligands and metal can lead to the synthesis of highly active compounds. Schiff bases are formed when any primary amine reacts with an aldehyde or a ketone under specific conditions [9]. Structurally, a Schiff base (also known as imine or azomethine) is a nitrogen analogue of an aldehyde or ketone in which the carbonyl group (CO) has been replaced by an imine or azomethine group (Fig. 1).



Metal complexes of Schiff base derived from 2-thiophene carboxaldehyde and 2-aminobenzoic acid (HL) and Fe(III) or Co(II) or Ni(II) or UO_2(II) showed a good antibacterial activity against *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus pyogenes*. Fe(III), Cu(II), Zn(II) and UO_2(II) complexes caused inhibition for *E. coli*. The importance of this lies in the fact that these complexes could be applied fairly in the treatment of some common diseases caused by *E. coli*. However, Fe(III), Co(II), Cu(II), Zn(II) and UO_2(II) complexes were specialized in inhibiting Gram-positive bacterial strains (*Staphylococcus pyogenes* and *P. aeruginosa*)[10-11].

The synthesized Schiff base and its metal complexes seem to be able to combine with the lipophilic layer in order to enhance the membrane permeability of the Gram-negative bacteria. The lipid membrane surrounding the cell favours the passage of only lipid soluble materials; thus the lipophilicity is an important factor that controls the antimicrobial activity. Also the increase in lipophilicity enhances the penetration of Schiff base and its metal complexes into the lipid membranes and thus restricts further growth of the organism (Tumer et al., 1999, Imran et al., 2007 and Raman et al., 2009). The Schiff base and its metal complexes are more toxic on *S. aureus* than on *E. coli*, probably due to the sulphonic OH, OCH_3, S and CH_3CH_2CH groups, which might interact with the double membrane (Mohamed et al., 2010). This activity is related to the nature and structure of the complexes[12-13] (Fig. 2).





The antibacterial activity has been explained on the basis of chelation theory. Also, the results indicated that tested complexes were more active against Gram-positive than Gram-negative bacteria. It may be concluded that antibacterial activity of the compounds is related to cell wall structure of the bacteria. It is possible because the cell wall is essential to the survival of many bacteria and some antibiotics are able to kill bacteria by inhibiting a step in the synthesis of peptidoglycan (El-Sherif and Eldebss, 2011)

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