

## SCHIFF BASES: A SHORT REVIEW OF THEIR BIOLOGICAL ACTIVITIES

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Received on: 17/08/2022

Revised on: 07/09/2022

Accepted on: 27/09/2022

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### ABSTRACT

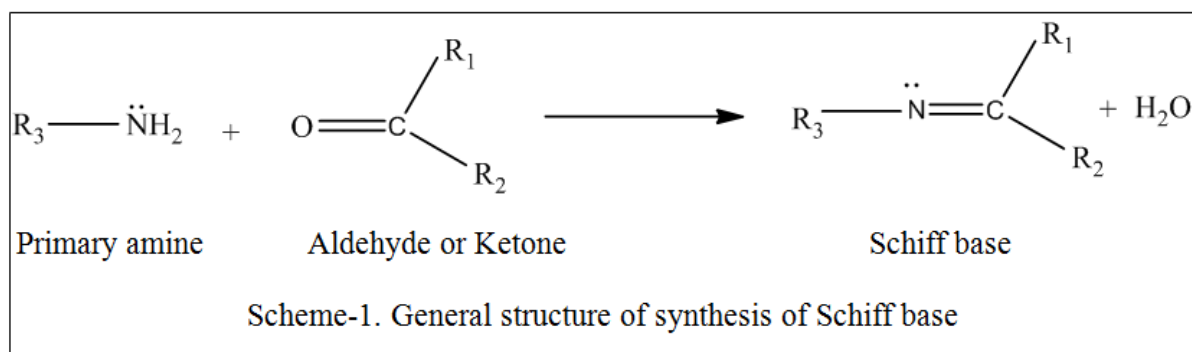
Schiff bases are considered as an important class of organic compounds due to their ability to form complex with transition metal ions. As schiff bases are easily synthesized by condensation reaction between aldehyde derivatives and imines, they act as special ligands. However their preparation method is simple; they have modest preparation technique and also their wide applications in the field of coordination chemistry, analytical chemistry, catalysis, pharmaceutical chemistry etc. make them unique compounds. Various biological activities, such as anticancer, antitumour, analgesic, antifungal, antioxidant, antimicrobial, anti-inflammatory etc. of schiff bases and their metal complexes have been studied. This review outlines the biotic significance and synthesis of various Schiff bases.

**KEYWORDS:** Schiff base, coordination chemistry, catalysis, biological activity, antitumour, analgesic.

### INTRODUCTION

Schiff base was first reported by Hugo Schiff, when he reported the condensation of primary amines with carbonyl compounds.<sup>[1,2]</sup> Condensation reaction of aldehydes or Ketones with primary amines gives product

containing azomethine group (HC=N), such compounds are known as schiff base. They are also known as azomethines or imines and are generally denoted by the formula  $R_1R_2C=NR_3$  where  $R_1$ ,  $R_2$  and  $R_3$  are alkyl or aryl groups.<sup>[3]</sup>



### Importance of Schiff base

Schiff bases are very good chelating ligands and transition metal could form highly efficient schiff base complexes.<sup>[4,5]</sup> The nature of metal ion in schiff base complexes decides the properties of the complexes. Various transition and inner transition metals combines with bi, tri and tetra dentate schiff bases containing nitrogen and oxygen donor atoms to form metal schiff base complexes.<sup>[6,7]</sup> Schiff base and its complexes also finds applications in medicine and catalyst. They are acknowledged to exhibit potent antibacterial, antiulcer and analgesic activities<sup>[8]</sup>. In addition some schiff bases are known which show pharmacologically important activities like anti- tuberculosis, anti-cancer, and

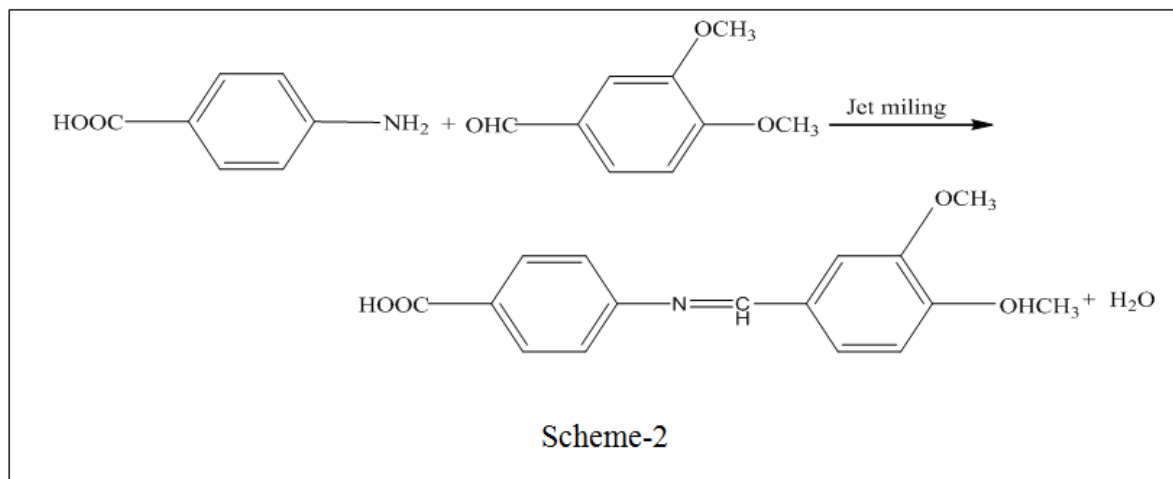
antioxidant activities.<sup>[9]</sup> Schiff bases play important function in biological systems in combination of enzymes such as tryptophan synthase, transaminases etc.<sup>[10-12]</sup> The imine group in schiff base is important in elucidating the mechanism of racemization and transamination reactions in biological system.<sup>[1-3,13-15]</sup> The schiff base compounds and their metal complexes also finds applications in asymmetric addition of cyanide to aldehydes,<sup>[16]</sup> enantioselective cyclopropanation of styrenes,<sup>[17]</sup> enantioselective epoxidation,<sup>[18,19]</sup> asymmetric aziridination of olefins.<sup>[18]</sup> The metal complexes of schiff bases are widely used in radiopharmaceuticals,<sup>[20]</sup> in degradation of organic substances,<sup>[21]</sup> their ability to reversibly bind oxygen<sup>[22]</sup>

and photochromic properties.<sup>[23]</sup> They are also used in polymers,<sup>[24]</sup> dyes<sup>[24]</sup> as well as they are applied in laser,<sup>[25]</sup> nanotechnology.<sup>[26]</sup> They have played essential role in the improvement of inorganic biochemistry and also in the progress of modern coordination chemistry, catalysis as well as in useful materials due to magnetic and optical properties.<sup>[27-29]</sup> As the schiff bases and their metal complexes have different functional groups, they

also plays significant role in the areas of spectroscopy, stereochemistry, and magnetic fields.<sup>[30]</sup>

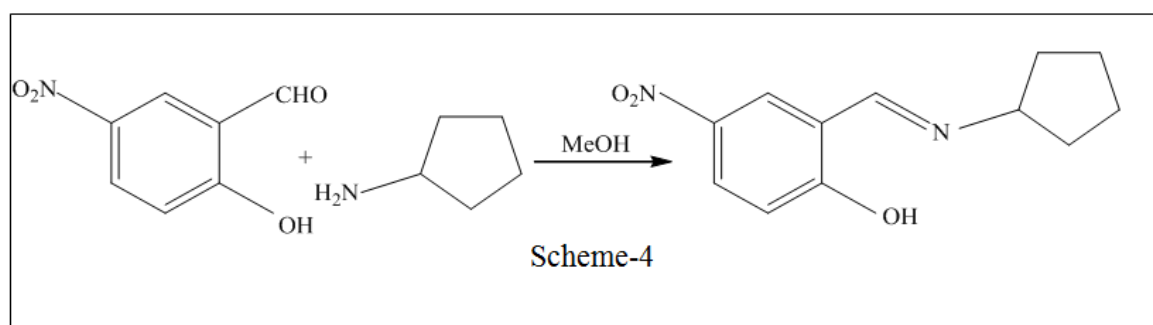
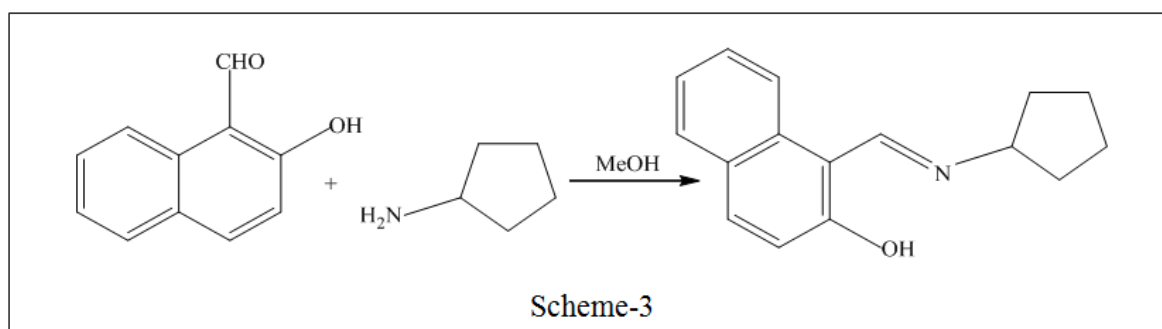
#### Previous Related Studies

Yan-Hua-Cai and Wen Luo<sup>[31]</sup> synthesized new schiff base obtained by the reaction between 3,4-dimethoxybenzaldehyde and *p*-aminobenzoic acid by supersonic speed gas impacting method (Scheme-2).



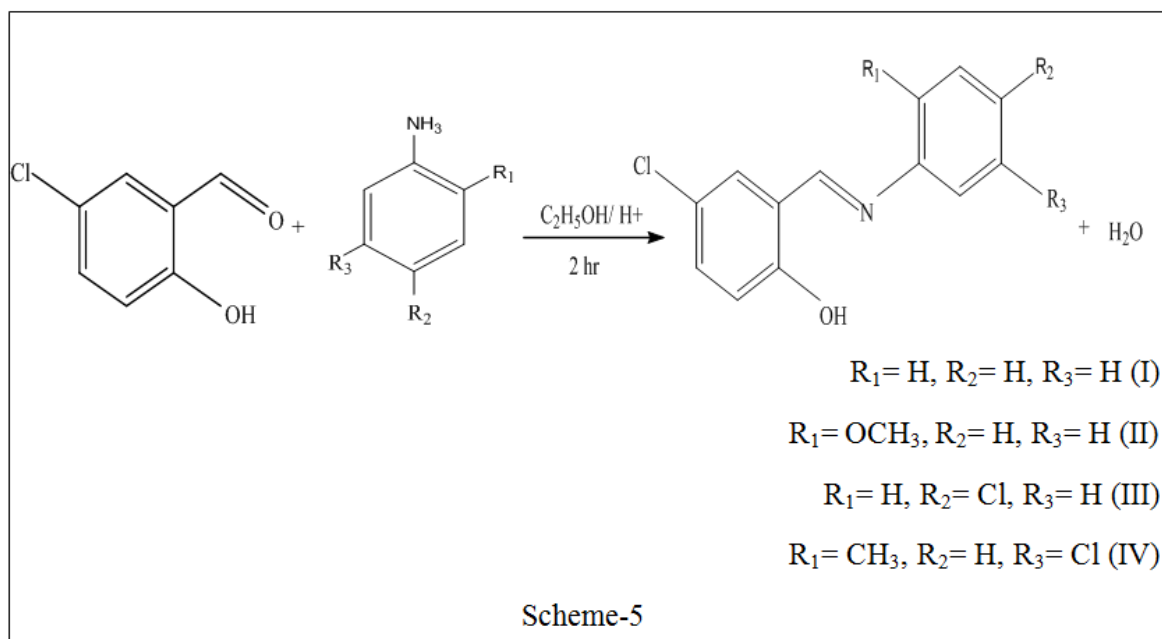
Guo<sup>[32]</sup> has reported the synthesis of two novel schiff base namely 1-(cyclopentyliminomethyl)naphthalen-2-ol and 4-nitro-2-(cyclopentyliminomethyl) phenol (Scheme-3 &4). These schiff bases were prepared by the reaction of cyclopentylamine with 2-hydroxy-1-naphthaldehyde

and 5-nitrosalicylaldehyde, respectively in methanol. The Schiff bases exhibit stronger antibacterial activity against *E.coli* and *P. fluorescens* but weaker antibacterial activity against *B.subtilis* and *S.aureus* than Penicillin.



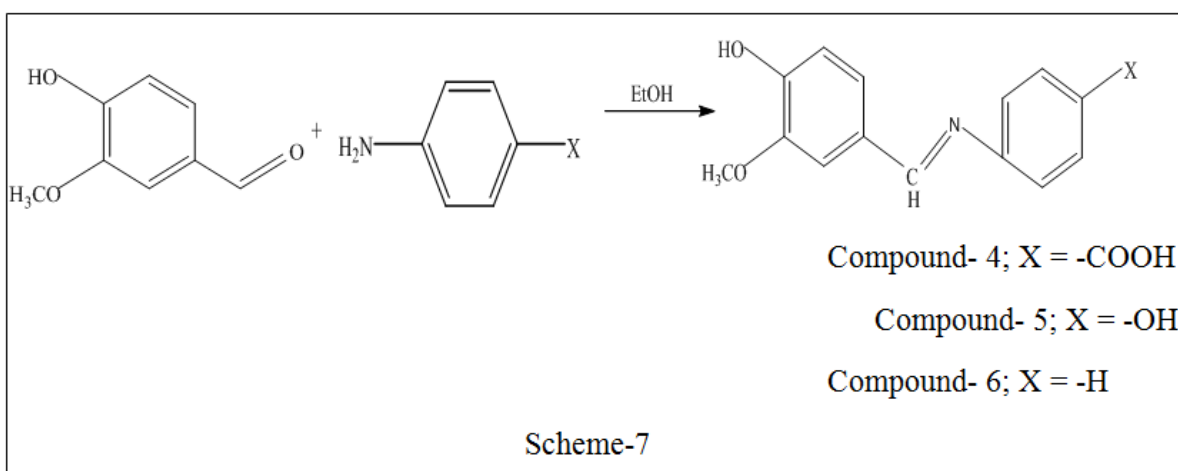
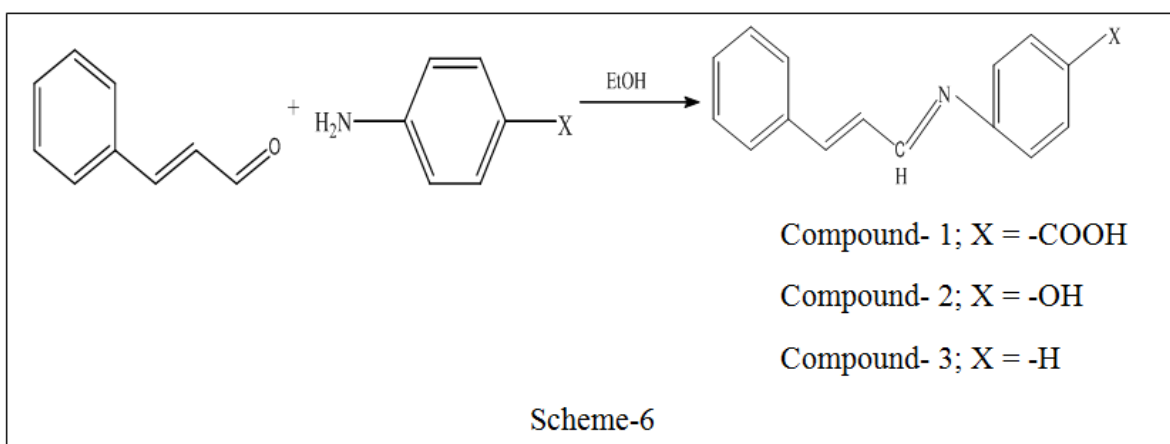
Synthesis and antimicrobial activity of schiff bases derived from 5-chlorosalicylaldehyde with substituted aniline were reported by Abidemi Iyewumi Oloyede-

Akinsulere, Simon Olonkwoh Salihu, Jelili Olalekan Babajide and Helen Shnada Auta<sup>[33]</sup> (Scheme-5).

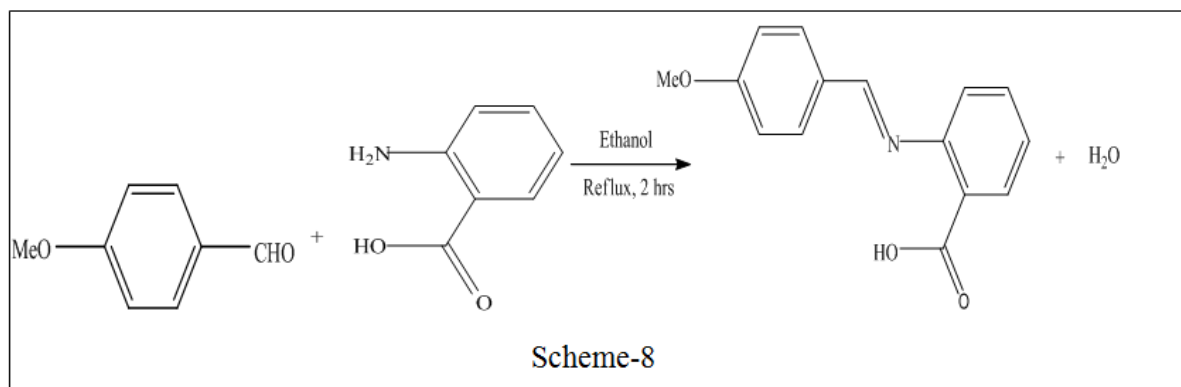


S. Chigurupati<sup>[34]</sup> has reported the synthesis of six new schiff bases (Scheme-6&7). The schiff bases were investigated for in vitro acetylcholinesterase (AChE) inhibition and antioxidant activities. Compound 1 and 4

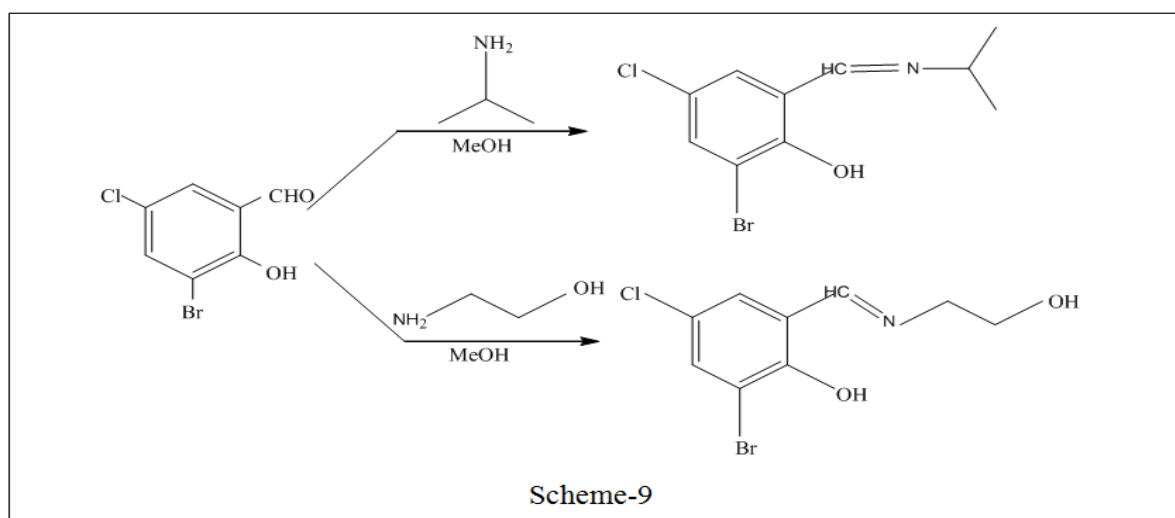
were exhibited better result as compared to other compounds in both AchE enzyme inhibition and antioxidant assays.



Abubakar Abdullahi Ahmed, Hassan Usman Ali, Abdullahi Idi Mohammed<sup>[35]</sup> synthesized schiff base derived from 4-methoxybenzaldehyde and *o*-aminobenzoic acid (Scheme-8).

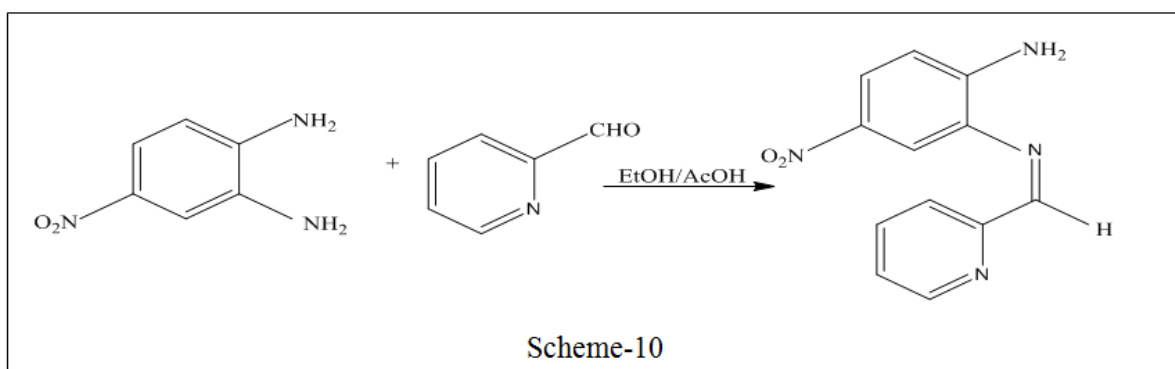


Synthesis of two novel schiff bases was done by Cai<sup>[36]</sup> (Scheme-9).



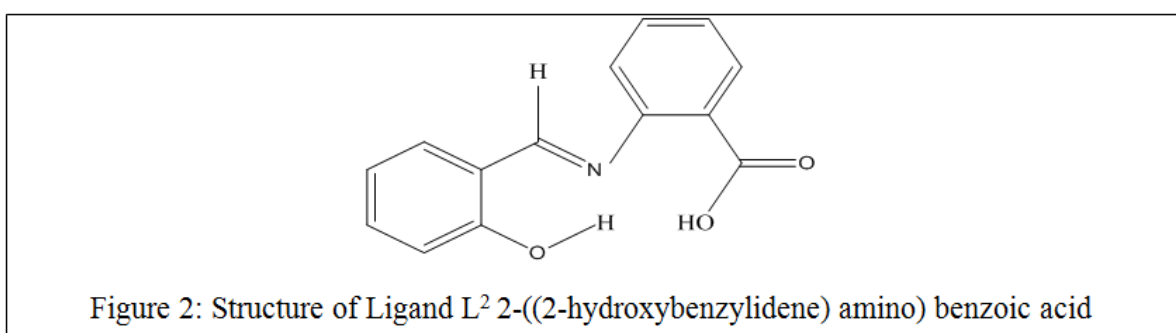
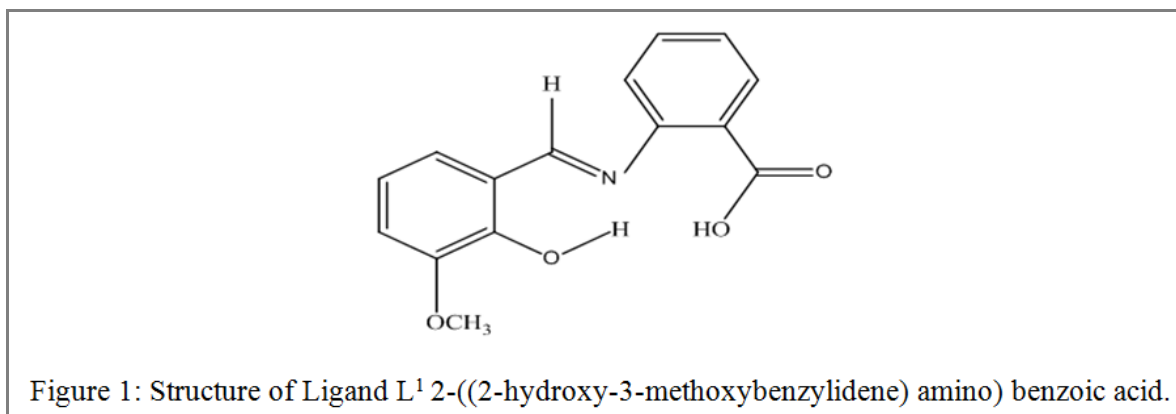
Synthesis of schiff base by the reaction between 2-pyridinecarboxaldehyde and 4-nitro-*o*-phenylenediamine

was reported by Mohammad Habibi<sup>[37]</sup> (Scheme-10). Tridentate nature of schiff base was shown by this study.



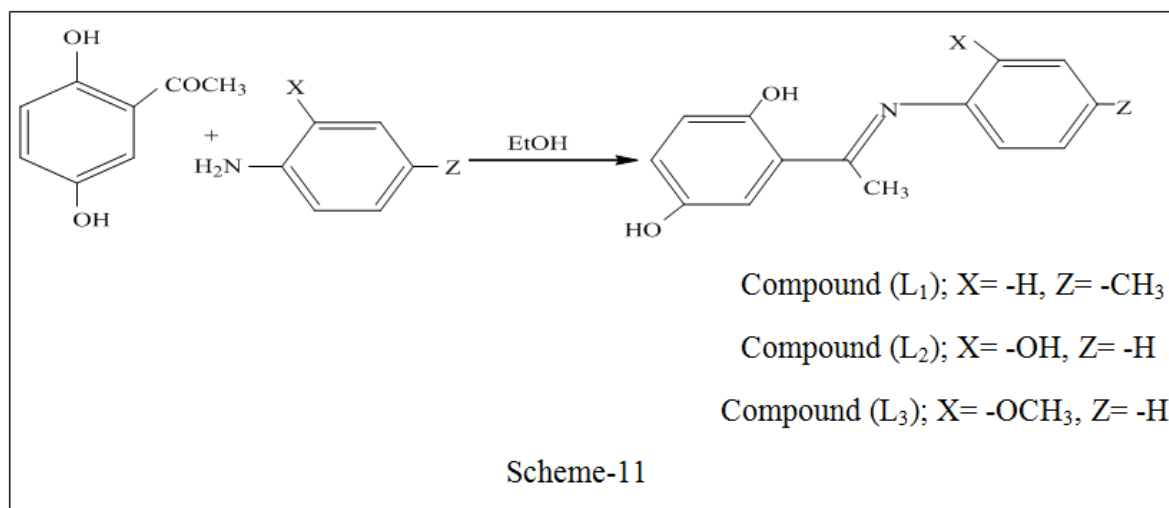
Synthesis, characterization, antibacterial, antifungal and cytotoxic activity of schiff base with substituted benzylidene aminobenzoic acid were reported by

Govindaraj V, Ramanathan S, Murgasen S<sup>[38]</sup> ( Figure-1&2).



Nassar M. Y., Ahmed I. S., Dessouki H. A. and Ali S. S.<sup>[39]</sup> synthesized Three schiff bases from 2,5-dihydroxyacetophenone (Scheme-11). The antibacterial activities of these schiff bases were checked against one gram positive bacteria ( *S. aureus*), three gram negative

bacteria ( *E.coli*, *K. pneumonia* and *P. vulgaris*) and also antifungal activity was checked against one yeast (*C.albicans*). First and second compound showed better activity than the third one.



## CONCLUSION

Schiff bases are the important class of chemical compounds because of their ability to form metal complexes, their pharmacological properties, industrial and medicinal applications. However, these compounds encourage further research due to their biological activities. This literature study proved that schiff bases shows better biological activity. Hence we decided to

synthesize 2-(salicylideneamino) benzoic acid and it's metal complexes for the future study of biological activities such as antibacterial and anti-fungal activities.

## ACKNOWLEDGEMENTS

The authors are grateful to the Principal of Dayanand Science College and Head, Department of Chemistry,

Dayanand Science College, Latur for providing the laboratory facility.

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