Sci. Educ. Innov. Context Mod. Probl. P-ISSN: 2790-0169 E-ISSN: 2790-0177
Issue 1, Vol. 8, 2025, IMCRA

Article

Synthesis, antimicrobial activity of 2-hidroxi-naftaldehyde Shiff base of 3-aminoprophanol and metal complexes

Rahimova Aysel.R.,
ANAS Institute of Chemistry of Additives named academician A.M.Guliyev,
rahimova_aysel@mail.ru, Azerbaijan

Nangyal H.,

Department of Botany Hazara University Mansehra Khyber Pakhtoonkhwa Pakistan

UOT 547, 64:621,892
Received date: 21.01.2025; Accepted date: 11.03.2025; Publication date: 03.04.2025
doi: 10.56334/sei/8.1.44

Abstract

Shiff bases and metal complexes have been synthesied by the condensation of 2-hidroxi-naftaldehyde and 3-aminoprophanol.The structure of the synthesied compounds assigned on the basis of elemental analysis, IR, HNMR spectral studies.All the products were evaluated for their in vitroantimicrobial activity against various strains of bacteria and fungi.

Keywords: Shiff's bases,aromatic compounds, antimicrobial activity, metal complexes,cup-plate methods, water treatment.

Citation. Rahimova A., Nangyal H., (2025). Synthesis, antimicrobial activity of 2-hidroxi-naftaldehyde Shiff base of 3-aminoprophanol and metal complexes. *Science, Education and Innovations in the Context of Modern Problems*, 8(1), 686-691. doi: 10.56352/sei/8.1.44. https://imcra-az.org/archive/356-science-education-and-innovations-in-the-context-of-modern-problems-issue-1-volviii-2025.html

1. Introduction.

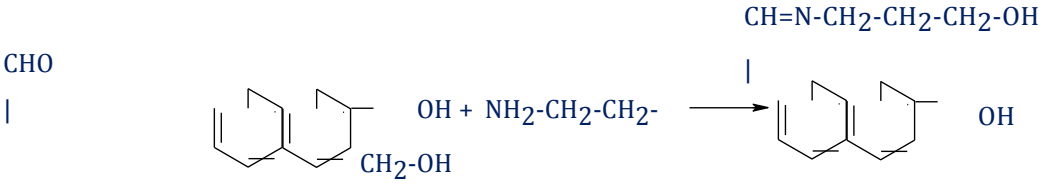
Shiff Bases are condentation of primary amines with carbonyl compounds and they were first reported by Schiff in 1864[1]. Ugo (Hugo) Joseph Schiff (Figure 1), one of the founders of modern chemistry, was born in Frankfurt on the 26 April 1834, into a wealthy Jewish family of merchants, Joseph Moses Schiff (1784–1852) and Henriette Trier (1798–1888). He was the eighth son out of ten, of which only four, Moritz, Hugo, Bertha and Clementine reached adulthood.He studied chemistry and physics in Frankfurt with Professors Böetteger and Löwe, and continued his studies in Göttingen, where he got his degree in 1857 under the supervision of professor Wölher. Professor Wölher was, in turn, student of Berzelius in Stockolm and was the first chemist to synthesize urea, an organic molecule, starting from inorganic compounds: the birth of modern organic chemistry is taught to start from this experiment, which, once and for all, excluded the presence of "vis-vitalis" (vital strength residing in the organic matter) demonstrating that there is no metaphysical difference between organic and inorganic substances. This was the origin of organic chemistry and the beginning of a new type of scientific research. Professor Schiff was used to say to his pupils: "Remember that you descend from Berzelius, because Berzelius taught Chemistry to the old Wöhler and the old Wöhler taught me. In 1856 Ugo Schiff moved out of Germany because of his Jewish origins and political ideas and spent six years in Bern before reaching Italy where he remained for the rest of his career. On this base Professor Schiff must be fully considered an Italian Chemist. Schiff retained his liberal views and was a cofounder of the socialist Italian newspaper L'Avanti in 1894 .

The common structural feature of these compounds is the azomethine group with a general formula RHC=N-R1, where R and R_1 are alkyl, aryl, cyclo alkyl or heterocyclic groups which may be variously substituted.These compounds are also knows as anils, imines or azomethines.Several studies showed that the prescence of a lone pair of electrons in an sp2 hybridized orbital of nitrogen atom of the azomethine is group of considerable chemical and biological importance.Because of the relative easiness of preparation, synthetic flexibility, and the special property of C=N group.Schiff bases are generally excellent chelating agents, especially when a functional group like –OH or –SH is present close to the azomethine group so as to form a five or six membered ring with the metal ion verstality of Schiff base ligands and biological, analytical and industrial applications of their complexes make further investigations in this area highly desirable[3].

Nowadays, the research field dealing with Schiff base coordination chemistry has expanded enormously.The importance of Schiff base complexes for bioinorganic chemistry, catalysis and material science, separation and encapsulation processes, and formation of compounds with unusual propertiesand structures has been recognized and reviewed[4].

2. Experimental. Preparation of the ligand

The ligand was synthesied by the condensation of 2-hidroxi-naftaldehyde with 3-aminoprophanol in 1:1 molar ratio using absolute alcohol as the reaction medium. The mixture was refluxed on a water bath for 1 and a half hour and then allowed to stand overnight at room temperature. The product were crystallized from the same solvent, yield 65%.



3. Preparation of the complexes.

The complexes of Cu (2), Ni (2) have been prepared by reacting ethanolic solution of metal acetates with ethanolic solutions of the ligand in the molar ratio 1:2. The solid coloured complexes which is sperated on cooling were filtered, washed with ethanol, dried in oven, yield in all cases 60 %.

4. Results and Discussion.

I.R Spectra.

The IR spectra of the ligand exhibit strong and broad at 1650 sm^{-1} assignable to $\nu_{C=N}$ .The band is shifted to lawer wave number after complex formation proposes involvement of azomethine N in the banding with metal ions. The linkage with N atom is further supported by the appearance of a band in far IR region at 425-395 sm^{-1} in the complexes assignable to $\nu_{M=N}$. This band undergoes to shift after complex formation propose coordination of metal ion throughcarbonyl oxygen. It is further supported bythe appearance of a new far IR band at 525-505 sm^{-1} in the complexes which is assignable to ν_{M-O}.

5. Antimicrobial activity

In literature, it is maintained that ligands and their metal complexes are considerably active against Baccilus megaterium and Candide tropicals, but that the effect of metal complexes is stronger than that of lgands.It was also reported that ligands and their metal complexes are active against Fuherica Coli, Barilum sp and Pseudomanan acurtuginan, while that Cu are more effective.Morever, Cu complexes of ligands were reported to be inhibiting active agents against bacteria and fungus.It was also determined that ligands could produce an inhibiting effect on the development of Aspergillus niger, Penisilum rubium and Augergillus ferreus.Furthermore, it was also established that ligands had an actibacterial effect at 100ppm concentration and they had and antifungisid effect.

Antimcrobial activity of the compounds of tested against using Pseudomonas Aeruginosa, Mycobacterium lacticolium, Aspergillus niger, Cladasporium resinale, Penicillium Chrosegenum, Chastomium gloloodium Trichoderma viride. The sterilized (autoclaved 121^0 C for 15 min) medium (40- 50^0) was poured into the Petri dishes to give a depth of 3-4 mm and allowed to solidfy. The suspension ofthe microorganism the steaked on plates.The paper discs impregnated with the test compounds was placed on the solidified medium.The plates were pre-incubated forth at room temperature and incubatedat 37^0 C for 24 hour.

Table 1: (I-III) Researching of functional properties of compounds.

	Ligand and complexes	Concentration %	Bactericidial	Fungicidial
	Ligand	0,5 1	3,0-3,0 2,5-2,5	3,3-3,3 2,4-2,4
	Complex of Cu	0,5	3,2-3,2	3,2-3,2

		1	2,6-2,6	2,2-2,2
	Complex of Ni	0,5 1	3,3-3,3 2,6-2,6	3,0-3,0 2,3-2,2

6. Conclusion.

From the result of antimicrobial effect we can conclude that all compounds exhibited strong to moderate activity. Metal complexes have been found to be more effective then their ligands as the process of complexation dominantly affects the overall biological behavior of. The compound also the zone of inhibition increases with the concentration.The result suggest to chemical entities with potential for clinical use.

References.

1. Althagafi, I., Farghaly, T. A., Abbas, E. M. H., & Harras, M. F. (2019). Benzosuberone as Precursor for Synthesis of Antimicrobial Agents: Synthesis, Antimicrobial Activity, and Molecular Docking. Polycyclic Aromatic Compounds, 41(8), 1646–1666. https://doi.org/10.1080/10406638.2019.1692877

2. Arisoy, M., Temiz-Arpaci, O., Yildiz, I., Kaynak-Onurdag, F., Aki, E., Yalcin, I., & Abbasoglu, U. (2008). Synthesis, antimicrobial activity and QSAR studies of 2,5-disubstituted benzoxazoles. SAR and QSAR in Environmental Research, 19(5–6), 589–612. https://doi.org/10.1080/10629360802348738

3. Celik, S., Albayrak, A. T., Akyuz, S., Ozel, A. E., & Sigirci, B. D. (2020). Synthesis, antimicrobial activity, molecular docking and ADMET study of a caprolactam-glycine cluster. Journal of Biomolecular Structure and Dynamics, 39(7), 2376–2386. https://doi.org/10.1080/07391102.2020.1748112

4. Desai, N. C., Jadeja, D. J., Khasiya, A. G., Dave, B. P., & Khedkar, V. M. (2023). 4-Thiazolidinone Based 5-Arylidene Hybrids: Design, Synthesis, Antimicrobial Activity, and Molecular Docking Studies. Polycyclic Aromatic Compounds, 44(4), 2715–2732. https://doi.org/10.1080/10406638.2023.2220867

5. Desai, Nisheeth. C., Joshi, S. B., & Khedkar, V. M. (2020). Synthesis, Antimicrobial Activity and Molecular Docking of Pyrazole Bearing the Benzodiazepine Moiety. Analytical Chemistry Letters, 10(3), 307–320. https://doi.org/10.1080/22297928.2020.1785325

6. Kaplancikli, Z. A., Altintop, M. D., Turan-Zitouni, G., Ozdemir, A., Ozic, R., & Akalın, G. (2011). Synthesis, antimicrobial activity and cytotoxicity of novel oxadiazole derivatives. Journal of Enzyme Inhibition and Medicinal Chemistry, 27(1), 51–57. https://doi.org/10.3109/14756366.2011.574132

7. Kaplancikli, Z. A., Yurttaş, L., Turan-Zitouni, G., Özdemir, A., Özic, R., & Ulusoylar-Yıldırım, Ş. (2011). Synthesis, antimicrobial activity and cytotoxicity of some new carbazole derivatives. Journal of Enzyme Inhibition and Medicinal Chemistry, 27(6), 868–874. https://doi.org/10.3109/14756366.2011.622273

8. Peddapaka, J., Nasreen, A., Sanam, T., Shaik, M. G., Swain, B., Sanwer, S., … Nerella, S. G. (2025). Facile synthesis, antimicrobial activity, and molecular docking analysis of 8-hydroxyquinoline-4-thiazolidinone hybrids. Future Medicinal Chemistry, 17(4), 435–447. https://doi.org/10.1080/17568919.2025.2463876

9. Rishu Katwal,Harpreit Kaar and Brij Kishore Kapur, Scientific Reviews, Chemical Communications:

3(1), 2013 1-15 ISSN 2277-2669.

10. Schiff H.Mittheilungen aus dem universitatslaboratorium in Pisa: Eine neure reihe organischer basen.Justus Liebigs Ann Chem 1864:131(1):

11. Sediek, A. A., Kassem, A. F., Abdel-Aziz, M. S., & Younis, A. (2024). Synthesis, antimicrobial activity, and biofilm inhibition studies of 1,2,3-triazole-containing 2,3-dihydrothiazole. Synthetic Communications, 54(16), 1376–1387. https://doi.org/10.1080/00397911.2024.2387121

12. Tolba, M. S., Hamed, M. M., Sayed, M., Kamal El-Dean, A. M., Abdel-Mohsen, S. A., Ibrahim, O. A., … Saddik, A. A. (2022). Design, Synthesis, Antimicrobial Activity, and Molecular Docking of Some New Diclofenac Derivatives. Polycyclic Aromatic Compounds, 43(6), 5437–5452. https://doi.org/10.1080/10406638.2022.2102661

13. Wenling Qin, Sha Long, Mauro Paneenzio and Stefano Biondi, Molecules, 2013,18, 12264- 12289; doi: 10.3390/ molecules 181012264.ISSN 1420-3049. 3.Dhar D.N, Toploo Cl.Schiff bases and their applications.J.Sci Ind Res 1982; 41(8): 501-6.