

Synthesis, Characterization of Copper(II) and Manganese(II) Schiff Base Complexes Derived from Carbohydrazide

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Structured Abstract

Background: Schiff bases, which contain azomethine group (-CH=N-) were originally discovered by Hugo Schiff in 1864 through condensation reaction between carbonyls and primary amines. These compounds have the ability to coordinate with transition metals, resulting in the formation of metal complexes. Schiff bases are widely used in pharmaceutical and coordination chemistry, and their biological properties, including antibacterial, have been extensively studied and evaluated.

Methods: Schiff base ligands, namely ST1 and ST2, were synthesized by mixing carbohydrazide and 2,4-dihydroxybenzaldehyde/ 2,4-dihydroxyacetophenone in an ethanolic solution with the presence of acetic acid. Same procedure was applied to the synthesis of metal complexes, Cu(II) and Mn(II) complexes, with some modifications, which is the addition of triethylamine (TEA) in the MnST1 synthesis. They were refluxed for 4 hours and evaluated via various characterization techniques, including melting point, CHN elemental analysis, FTIR and UV-Vis spectroscopy and magnetic susceptibility

Results: The results revealed that the ligands' melting points were below 300°C while the metal complexes above 300°C. Next, ligands posed elemental (carbon, hydrogen and nitrogen) contents close to theoretical values. As for metal complexes, there is an approximately loss of 7% and 20% in nitrogen and carbon content respectively. Furthermore, IR spectra showed an overlapping of $\nu(\text{O-H})$ and $\nu(\text{N-H})$ peaks within all the spectra. $\nu(\text{C=N})$ also appeared in the ligands' spectra in the range of 1622-1626 cm^{-1} and shifted to lower wavenumbers (1581-1609 cm^{-1}) upon chelation as well as shifting of $\nu(\text{C-O})$. Besides, UV-Vis spectra showed $\pi-\pi^*$ (C=N) and $n-\pi^*$ (C=N) transitions in all spectra. Upon chelation these bands shifted to longer wavelength (redshift). Lastly, the measured magnetic moment, B.M. of all complexes suggested tetrahedral shape.

Conclusion: In summary, two tetradentate Schiff base ligands were successfully synthesized from carbohydrazide and 2,4-dihydroxybenzaldehyde/2,4-dihydroxyacetophenone, along with their Cu(II) and Mn(II) complexes. Moreover, the compounds' structures were effectively interpreted through elemental analysis, FTIR, UV-Vis, and magnetic susceptibility. It was concluded that the metal complexes are tetrahedral in nature.

Keywords: , N, O donors ligand, Schiff base, carbohydrazide, metal complexes, FTIR, UV-Vis

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