

Synthesis, Characterization of Aniline Schiff Base Complexes

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Structured Abstract

Background: Schiff base ligands are widely studied for their potent metal-binding capabilities and versatility. They play a crucial role in coordination chemistry, particularly in the design of biologically active metal complexes. In this study, two bidentate Schiff base ligands were synthesized by condensing aniline with ortho-vanillin and salicylaldehyde, creating SA and SB ligands, respectively. Four distinct Schiff base metal complexes were formed by further complexing these ligands with Mn(II) and Fe(II) metal salts. To achieve successful ligand complexation, this study focuses on structural characterization.

Methods: The ligands SA and SB were synthesized via reflux conditions, a condensation process in ethanol. Complexation with Mn(II) and Fe(II) was achieved by reacting the ligands with their respective metal salts in a 2:1 ligand-to-metal molar ratio. Melting point analysis, elemental analysis (CHN) analysis, Fourier Transform Infrared (FTIR) spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy, and Ultraviolet-Visible (UV-Vis) spectroscopy were utilized to characterize all the compounds to determine their structural properties and confirm successful coordination.

Results: Metal coordination was confirmed by FTIR spectra, which exhibited the presence of azomethine (C=N) stretching bands at about 1658 cm^{-1} and the appearance of metal-oxygen (M-O) and metal-nitrogen (M-N) vibrations in the 538 cm^{-1} and 450 cm^{-1} regions. The presence of imine protons was confirmed by NMR analysis, and UV-Vis results revealed $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ transitions with distinct bathochromic shifts in the complexes, which indicate ligand-to-metal charge transfer. Also, the metal complexes showed higher melting points and consistent CHN values, supporting complex formation.

Conclusion: The successful synthesis and structural characterisation of Mn(II) and Fe(II) Schiff base complexes derived from aniline-based ligands were confirmed through spectroscopic and elemental analysis. This study highlights the ability of the aniline Schiff base to coordinate with transition metals, thereby encouraging further exploration of bioinorganic and greener chemistry applications.

Keywords: Schiff base, aniline, metal complex, FTIR, UV-Vis

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