Synthesis, Characterization and Catalytic Activity of Metal Complexes of Flavone based Schiff Bases

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Abstract
A novel Schiff base ligand was achieved from the chemical transformation of flavone derivatives with o-phenylenediamine and its Co(II), Cu(II) and Ni(II) complexes were prepared and structurally elucidated by elemental analysis, magnetic and spectroscopic techniques. The spectroscopic and analytical data confirm square planar geometry of metal complexes and 1:1 metal to ligand stochiometry.

The compounds were tested to ensure their ability to act as antimicrobial agents and catalyst in the aerial oxidation of benzaldehyde to benzoic acid. The result shows that the copper complex is excellent at its antimicrobial activity and also catalytic activity.

Keywords: Flavone, o-phenylenediamine, Schiff base, Catalytic activity, Aerial oxidation.

Introduction

Bioinorganic chemistry is a rapidly developing field of chemistry. The preparation of newer inorganic compounds/ complexes having innovative applications is the major concern of inorganic chemists. The development of inorganic medicinal chemistry emerging with the structural and pharmacological efficiency of cisplatin motivates inorganic chemists to search for innovative structural molecule and their metal complexes. Among the innovative structural core, Schiff base plays a vital role in pharmacological applications especially >C=N moiety[2,17].

Generally, the Schiff base moiety is achieved by the condensation of aromatic/ aliphatic aldehydes/ ketones and amines. During the chemical transformation, the novel chemical scaffold was obtained as azomethine (aldehyde involved)/ imine (ketone) group[10] and forms stable complexes with metal ions through nitrogen coordination.

Schiff bases and their various metal complexes display boundless pharmacological activities including antimicrobial, antibacterial, antiviral, antifungal, anti-inflammatory, antidiabetic, antimycobacterial, antitumor, analgesic, antiproliferative, anticancer, antioxidant and anticorrosive activities[7,8,16]. In our work, flavone is used as the precursor for the synthesis of Schiff bases. Flavones were prepared in an environmental amiable manner without using solvents[19]. They are notable for their biological activities. Herein, we detailed the synthesis of two new flavone based Schiff base ligands and their Co(II), Cu(II) and Ni(II) complexes having unique properties and novel reactivity. They are characterized with the help of a range of analytic, magnetic and spectroscopic methods. The catalytic activities of the synthesized compounds were evaluated for the oxidation of benzaldehyde to benzoicacid in presence of atmospheric oxygen.

Material and Methods

Materials and Measurements: All the chemicals were acquired from Sigma and utilized for synthesis. The solvents had been purified and distilled before its use. TLC and elemental analysis were used to ensure the purity of synthesized compounds. Infra-Red spectrum of the Schiff bases and metal chelates had been recorded using Shimadzu FTIR spectrometer. UV-visible spectra have been analyzed using Jasco V 630 UV-vis spectrophotometer in DMSO in 200-1100 nm. The NMR spectra have been analyzed on Varian-NMR-Mercury 300 MHz using solvent DMSO-d and internal standard TMS.

The elemental evaluation and metal percentage have been decided by using standard methods. Magnetic moment measurements were done using Gouy balance. Mass spectra (MS) were recorded on BRUKER ESQUIRE HCT spectrometer. ELICO conductivity meter (Model CM-180) has been used to measure molar conductance of the synthesized compounds at room temperature using the solvent DMF.

Procedure for synthesis: The complete procedure for the synthesis was explained along with its schematic representation. The first step in the synthesis procedure was the synthesis of chalcone. A slight modified methodology used by Ali et al[1] was adopted for the preparation of chalcones and flavones respectively.

Synthesis of Ligand: The Schiff base was synthesised by the mixing of 2:1 concentration of flavone derivative and o-phenylenediamine. The procedure for the synthesis was adopted from the work of Nagashri[12] with slight modifications. 40 mL ethanolic solution of flavone and amine mixture was prepared followed by the addition of 1.0 mL acetic acid. The solution was stirred upto the precipitates formed. The precipitate was filtered, washed and purified using column chromatography.

Synthesis of metal complex: Equimolar amounts of ligand and metal acetate(s) were dissolved in ethanol. Stir for 6 hr at heating condition and then pour it into water. The coloured complexes obtained are filtered, washed with water and recrystallized.