



STRUCTURE OF NEW MIXED LIGAND AQUA-COMPLEX OF 2,5-DICARBOXYLEPIRIDYNE AND 2,2-BIPIRIDYNE WITH CO (II)

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ABSTRACT

A new mixed-ligand aqua complex of Co(II) based on 2,5-dicarboxypyridine and 2,2'-bipyridine ligands was synthesized and structurally characterized. The results indicate that the obtained compound exhibits promising biological activity and may have potential applications as an anticancer agent.

Introduction

In recent years, mixed-ligand coordination compounds have attracted considerable attention in coordination chemistry due to their structural diversity, stability, and potential biological activity. In particular, aromatic ligands containing nitrogen and oxygen donor atoms are capable of forming strong coordination bonds with metal ions, playing an important role in the design of new functional materials [1-2].

Nitrogen-donor ligands such as 2,2'-bipyridine(bipy) possess a planar aromatic structure and can participate in π - π stacking interactions, significantly influencing the electronic properties of metal complexes. Meanwhile, 2,5-dicarboxypyridine contains both nitrogen and oxygen donor sites, allowing for multidentate coordination and the formation of complex spatial architectures [3-4]. Cobalt(II) ions are widely used in the development of biologically active complexes due to their redox properties and ability to adopt various coordination geometries, which are important in bioinorganic and pharmaceutical chemistry [5-6].

Considering these features, a new mixed-ligand aqua complex of Co(II) with 2,5-dicarboxypyridine and 2,2'-bipyridine ligands was synthesized, and its structural characteristics as well as potential biological activity are investigated in this work.

Structure and Discussion

The crystal structure of the obtained complex reveals that the central Co(II) ion is surrounded by a well-defined coordination environment. The metal center is coordinated by nitrogen (N) and oxygen (O) donor atoms, which ensures a high degree of structural stability (Fig. 1).

The 2,2'-bipyridine ligand coordinates to the Co(II) ion in a bidentate manner, forming five-membered chelate rings. This enhances the rigidity of the complex and stabilizes its electronic structure. In addition, the carboxylate groups of the 2,5-dicarboxypyridine ligand coordinate to the metal center in different modes and may also act as bridging groups. Structural analysis shows the presence of coordinated water molecules (aqua ligands), which contribute to additional stabilization through hydrogen bonding interactions. According to literature data, bipyridine ligands help stabilize the metal ion in biological environments, while aromatic systems facilitate membrane permeability. The redox activity of Co(II) may induce oxidative stress in cancer cells. Furthermore, planar bipyridine fragments are capable of intercalating into DNA base pairs.

Therefore, this complex can be considered a promising candidate for antimicrobial and especially anticancer applications.

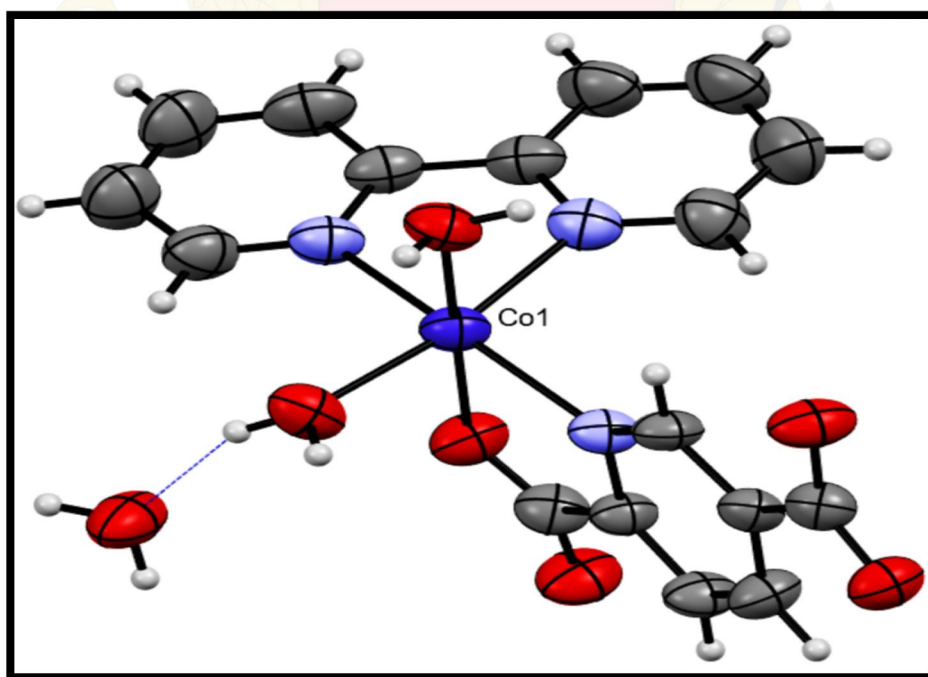


Fig. 1. Molecular structure of the Co(II)-centered coordination complex.

Conclusion

In this work, a new mixed-ligand complex based on Co(II), 2,5-dicarboxypyridine, and 2,2'-bipyridine was successfully synthesized. Structural analysis confirmed the formation of a stable coordination environment. The properties of the ligands suggest that the complex possesses significant potential for biological activity. This compound can be considered a promising candidate for further investigation as an anticancer agent.

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