

## Harnessing the Power of Mixed Ligand Complexes: Enhancing Antimicrobial Activities with Thiosemicarbazones

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**Abstract :** Thiosemicarbazones (TSCs) have garnered significant attention in coordination chemistry due to their versatile coordination modes and pharmacological properties. Mixed ligand complexes of TSCs represent a promising area of research, offering enhanced antimicrobial activities compared to their parent compounds. This review provides an overview of the synthesis, characterization, and antimicrobial properties of mixed ligand complexes incorporating thiosemicarbazones. The synthesis of mixed ligand complexes typically involves the reaction of a metal salt with TSC ligands and additional ligands, such as nitrogen- or oxygen-based ligands. Various transition metals, including copper, nickel, and cobalt, have been employed to form mixed ligand complexes with TSCs. Characterization techniques such as spectroscopy, X-ray crystallography, and elemental analysis are commonly utilized to confirm the structures of these complexes. One of the key advantages of mixed ligand complexes is their enhanced antimicrobial activity compared to pure TSC compounds. The synergistic effect between the TSC ligands and additional ligands contributes to increased efficacy, possibly through improved metal-ligand interactions or enhanced membrane permeability. Furthermore, mixed ligand complexes offer the potential for selective targeting of microbial species while minimizing toxicity to mammalian cells. This selectivity arises from the specific interactions between the metal center, TSC ligands, and biological targets within microbial cells. Such targeted antimicrobial activity is crucial for developing effective treatments with minimal side effects. Moreover, the versatility of mixed ligand complexes allows for the design of tailored antimicrobial agents with optimized properties. By varying the metal ion, TSC ligands, and additional ligands, researchers can fine-tune the physicochemical properties and biological activities of these complexes. This tunability opens avenues for the development of novel antimicrobial agents with improved efficacy and reduced resistance. In conclusion, mixed ligand complexes of thiosemicarbazones represent a promising class of compounds with potent antimicrobial activities. Further research in this field holds great potential for the development of novel therapeutic agents to combat microbial infections effectively.

**Keywords :** metal complex, thiosemicarbazones, mixed ligand, selective targeting, antimicrobial activity

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