ENHANCING STABILITY AND FUNCTIONALITY OF MACROCYCLIC SCHIFF BASE LIGANDS WITH SALICYLALDEHYDE-DERIVED COMPOUNDS

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ABSTRACT

ENHANCING STABILITY AND FUNCTIONALITY OF MACROCYCLIC SCHIFF BASE LIGANDS WITH SALICYLALDEHYDE-DERIVED COMPOUNDS

This review explores the stability and functionality of macrocyclic Schiff base (MSB) ligands and their salicylaldehyde-derived compounds. Acyclic ligands used in metal-ligand complexation suffer from kinetic lability and weak structural rigidity, making them inefficient for long-term applications such as heavy metal removal, medicinal chemistry, and chemosensing. Macrocyclic Schiff base ligands offer a promising solution by enhancing stability and selectivity through their pre-organized cyclic structures and azomethine (-C=N-) functional groups. However, further improvements in solubility, metal affinity, and structural adaptability are required for broader industrial applications.

The main objectives of this review are to analyze the properties, synthesis methods and modifications of MSB ligands and their salicylaldehyde-derived compounds to enhance ligand stability and to explore their effectiveness in medicinal, water treatment, and chemosensor applications. Drawing from an extensive collection of literature, this review provides insights into how macrocyclic structures and Schiff base functionalities synergistically improve ligand performance. Salicylaldehyde-derived MSB ligands, with strategic structural modifications, exhibit enhanced stability, solubility, and structural diversity. Key findings highlight the applicability of these ligands in fields such as medicinal chemistry, water treatment, and chemosensors, demonstrating their effectiveness in practical applications.