Complexes of Macrocyclic Ligands

Schedule:

Week 1: Historical aspects of macrocyclic ligands: the discovery of macrocyclic complexing agents and the history of their preparation. Types and nomenclature of macrocyclic compounds.

Week 2: Comparative overview of synthetic methods used for the formation of macrocyclic rings (high-dilution technique, Richman–Atkins synthesis, template synthesis, peptide synthesis, zip reaction, etc.).

Week 3: Preparation of C- and N-functionalized and substituted macrocycles; derivatization reactions applied in their synthesis.

Week 4: Synthesis of mono-, bis-, tris-, and tetra-substituted triaza and tetraaza macrocyclic chelators.

Week 5: Types of bifunctional ligands, their preparation and comparative characterization. Effect of the position of the linker functional group on the key properties of the complexes.

Week 6: Complex-forming properties and structures of macrocyclic compounds (crown ethers, cryptands and macrocycles bearing functional groups).

Week 7: Methods for investigating macrocyclic ligands and their complexes.

Week 8: Selectivity of ligands and the macrocyclic effect. The role of functional groups attached to the macrocycle in selectivity and complex stability.

Week 9: Factors influencing the stability of complexes (cavity size, quality of donor atoms, etc.). Formation and decomposition kinetics of complexes of macrocyclic ligands. Fine-tuning of kinetic parameters through the selection of the macrocycle and side chains.

Week 10: Formation and dissociation kinetics of complexes of macrocyclic ligands. Fine-tuning of formation and dissociation kinetic parameters through appropriate selection of the macrocycle and side chains.

Week 11: Practical applications of macrocyclic complexing agents I: analytical applications (determination of metal ion concentrations, separation/extraction of metal ions etc.), procedures based on selective complexation (removal of toxic metal ions, influencing metal ion homeostasis etc.), organic chemistry applications (phase-transfer catalysts, ionophores etc.).

Week 12: Practical applications of macrocyclic complexing agents II: biomedical applications (MRI contrast agents, NMR shift reagents, radiopharmaceuticals, contrast agents for optical imaging methods).

Week 13: Fundamentals of supramolecular chemistry. Molecular legos.