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A Study on Synthesis and Biological application of Lanthanide Complex

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Abstract: Lanthanide complex-based medicine, combining organic ligands and individual lanthanide ions, is proving successful in therapeutics, particularly in drug delivery, chemotherapy, and photodynamic therapy. Lanthanide complexes have gained significant attention due to their unique chemical properties and promising biological applications. This project focuses on the synthesis of lanthanide complexes, their structural properties, and their biological relevance in medical diagnostics, imaging, and cancer therapy. Lanthanide complexes have garnered significant attention due to their unique photophysical properties and potential biological applications. This study presents the synthesis and comprehensive characterization of a series of lanthanide complexes stabilized by β - diketonate and phenanthroline derivatives. The photophysical analysis reveals that these complexes exhibit notable luminescence, with emission profiles characteristic of the respective lanthanide ions. Biological evaluations indicate that certain complexes, particularly those incorporating europium, demonstrate enhanced cytotoxicity against cancer cell lines, which may be attributed to lysosomal uptake mechanisms. These findings suggest that such lanthanide complexes hold promise as anticancer agents and merit further investigation for therapeutic applications. This review discusses the coordination chemistry, antenna effect, and chelating ligands of lanthanide complexes, emphasizing their benefits in therapeutic monitoring, such as fingerprint emissions, large pseudo- Stokes shifts, long lifetimes, two-photon excitations, and magnetic resonance responses. Additionally, it highlights their pharmaceutical applications in drug delivery, chemotherapy, and photodynamic therapy. The study identifies challenges and future opportunities in the clinical translation of lanthanide complex-based medicine.

Keywords: Lanthanide complexes, synthesis, characterization, antimicrobial activity, antioxidant properties, anticancer potential, fluorescence, bio-imaging.

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