

The uranyl ion (UO_2^{2+}) is a foundation of actinide chemistry, yet its "hidden" electronic and bonding characteristic remains a major challenge for chemists to precisely ascertain. The hidden and factual chemistry of UO_2^{2+} ion remain under investigations and presents major challenges for chemists to be precisely ascertained. Integrating inorganic, organic, and biological functionalities into a single donor system is a refined way to probe how different chemical environments influence the UO_2^{2+} core. Addressing the challenges associated with uranyl ion (UO_2^{2+}) is critical for managing decades of accumulated, unsafe nuclear waste.

Keeping the established views on uranyl ion chemistry and further to advance the understanding, the current research in the form thesis entitled "***Studies on Uranyl (UO_2^{2+}) Ion Activity with (N,O) Based Acyclic Organic Donor Species***" was undertaken for further exploration. This research aims to advance understanding of how acyclic ligands, specifically those containing both Nitrogen (N) and Oxygen (O) donor interact with the linear uranyl ion in non-aqueous solvent medium. These results allow one more basic understanding of the trends in chemistry and structural diversity of alteration products of primary (or first formed) uranium compounds is important for predicting long-term behavior of radioactive wastes in geological repositories and their geochemical migration. Since, some of the uranyl species as a consequence of chemical processes provide alteration phases that may incorporate radionuclides into their structures. These compounds, mainly peroxy-uranium species, are often considered as transporting agents both in geological media and in deposits of spent nuclear fuel. Consequently, the study of uranyl compounds is essential for both developing more efficient, sustainable nuclear energy systems and for environmental remediation.