Actinoid coordination chemistry and its relevance to energy problems

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ABSTRACT

Many countries have traditionally relied primarily on burning fossil fuel to generate electricity, but with the currently stringent carbon-emission reduction targets, their use should be reduced, even though carbon-capture technologies are increasingly developed [1]. Furthermore, fossil-fuel technologies rely on finite and continuously decreasing natural resources. This brings us to nuclear power. Its advantages include continuous supply and practically no CO_2 emissions at the point of use. Its disadvantages are the costs of infrastructure investments and the radioactive products of a nuclear power station. Chemistry has great potential, through fundamental and applied research, to be a useful force in this nuclear age and transform basic science into real and tangible solutions for the benefit of society. Inorganic chemistry comes in action in this field because certain privileged classes of ligands show exceptional selectivity for actinoid ions and also an ability to discriminate between ions of certain actinoid elements.

Through an inorganic chemistry model approach, a central research theme in our laboratory involves: (a) The understanding of the molecular basis of the use of amidoxime-based materials for the selective extraction of the $U^{VI}O_2^{2+}$ ion from the seawater (totally huge amounts of U in the form of UO_2^{2+} exist in the oceans) and the proposal of more efficient extractants [2]; and (b) The development of certain aspects of the coordination chemistry of Th(IV) in terms of the use of this ion as a nuclear fuel [3].

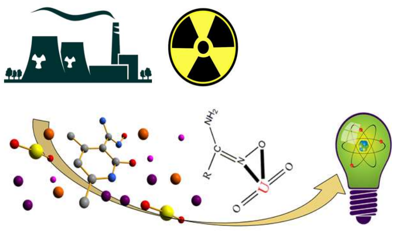

Fig.1 Sketch of the selective binding of the UO_2^{2+} ion by amidoxime-containing agents in seawater for use of U as nuclear fuel.

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