Highly selective and efficient extraction of targeted metal ions from (sea)water using advanced porous materials: Quest for clean energy and safe drinking water

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In terms of significant impact, the World Economic Forum documented water crisis as the largest worldwide risk. Due to accelerating urbanization along with rapid industrialization, an ever growing number of toxic contaminants are entering the fresh water supplies. In the priority list, the U.S. Environment Protection Agency (EPA) listed metal-based oxo-anions as potential toxic inorganic pollutants in waste water. [1] Both environment and human health concerns are driving efforts to develop various efficient technologies to disinfect and de-contaminate wastewater. Among them, adsorption followed by ion exchange based purification techniques are emerging, and are considered as promising over other conventional methods. Although several adsorbents have been devoted to remove waste from wastewater, the poor selectivity towards isolating trace toxic ions, in the presence of a high concentration of coexisting salts and slow removal kinetics limits the overall efficiency of the materials. In my talk, I will discuss about advanced porous materials for highly selective and efficient extraction of various hazardous oxoanions such as, $HAsO_4^{2-}$, SeO_4^{2-}, ReO_4^-(surrogate for radioactive TcO_4^{2-}), CrO_4^{2-} etc. from water, in the presence of excess of other coexisting ions. I will also discuss about highly selective and efficient Uranyl ion extraction, from natural seawater for potential applications of Uranium as renewable and clean nuclear energy source and also, from ground water for safe drinking water. [2-5].

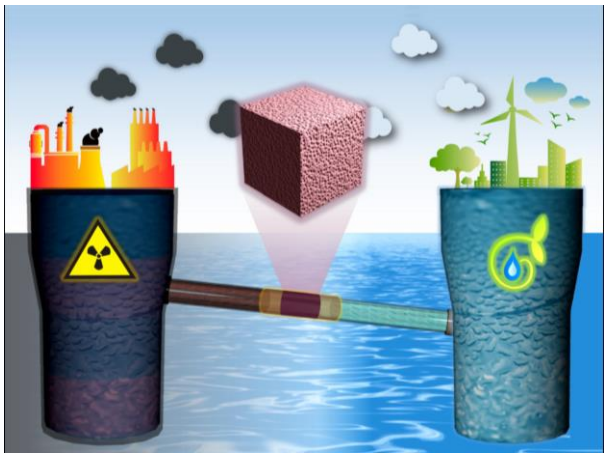


Figure: Advanced porous materials as efficient scavenger of metal ion based pollutants.

References: 1) Book: ***Metal-Organic Frameworks (MOFs) for Environmental Applications*** 1st Ed. (Ed.: S K. Ghosh), **Elsevier**, **2019**, https://doi.org/10.1016/C2017-0-01721-4.
2) Mollick, S. ; Fajal, S, ; Saurabh, S. ; Mahato D. ; and **Ghosh, S. K**.
ACS Cent. Sci. **2020,** *6*, 1534.
3) Fajal, S.; Mandal, W.; Mollick, S.; More, Y.D.; Torris, A. ; Saurabh, S. ; Shirolkar, M.M. ; and **Ghosh S. K.**
Angew. Chem. Int. Ed. 2022, 61, e202203385.
4) Mollick, S.; Saurabh, S.; More, Y.D.; Fajal, S.; Shirolkar, M. M.; Mandal, W.; **Ghosh, S. K**.;
Energy & Environmental Science **2022**,15, 3462-3469.
5. Fajal, S.; Hassan, A.; Mandal, W.; Shirolkar, M. M.; Let, S.; Das, N.; Ghosh S. K.
Angew. Chem. Int. Ed. 2023, 62, e202214095.