

Removing Heavy-Metal Ions from Water

A nature-inspired hydrogen-bonded complex removes copper ion from water.

Copper is one of the most widely used heavy metals in the world, and is found in various water streams and food webs. It has an essential role in our physiology but is toxic to human beings when uptaken in large quantities. A copper imbalance can impact the hematopoietic function and lipid metabolism and cause inflammation. The World Health Organization suggests that the guideline value for copper is 2 mg/L, but the concentration of copper reported in drinking water can range from ≤ 0.005 to > 30 mg/L. It is hence important to seek a highly efficient way to remove copper from drinking water. ZIF-8, a zeolitic imidazolate framework, was recently reported to have an extremely high capacity for copper adsorption.¹

Jeffrey J. Urban (Lawrence Berkeley National Laboratory, US) recently found that zinc imidazole salicylaldoxime supramolecule (ZIOS), a hydrogen-bonded organic-inorganic

framework, exhibits an excellent performance for copper removal, better than ZIF-8.² ZIOS exhibits rapid adsorption kinetics, 30–50 times more rapid than ZIF-8. Urban recorded X-ray-absorption fine-structure (XAFS) spectra at **TPS 44A** to investigate the local structure of ZIOS. According to the XAFS spectra (**Fig. 1**), copper adsorption does not significantly change around the Zn²⁺ node in the ZIOS structure. Urban postulated that the framework expands to some extent on gradually inviting water molecules to “assimilate” themselves into the framework through the propagation of a hydrogen-bonding network. To support this hypothesis, Urban studied the behaviour and stability of the ZIOS framework in an aqueous environment both computationally and experimentally, and found evidence that this exploration is essential to confirm such hopping behaviour. (Reported by Jeng-Lung Chen)

This report features the work of Jeffrey J. Urban and his collaborators published in Nat. Commun. 11, 3947 (2020).

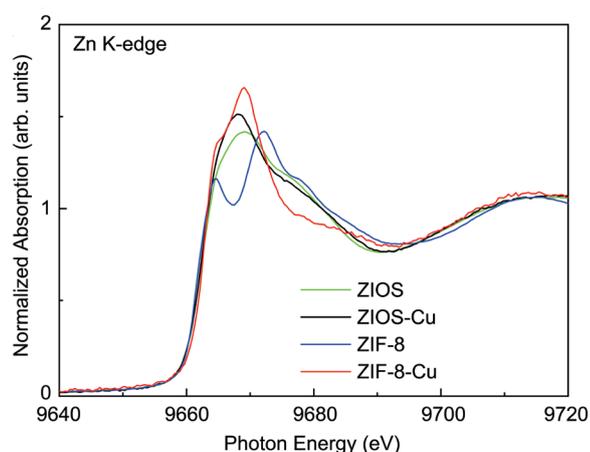


Fig. 1: Zn K-edge spectra of ZIF-8 and ZIOS before and after copper adsorption. [Reproduced from Ref. 2]

TPS 44A Quick-scanning X-ray Absorption Spectroscopy

- XANES, EXAFS, *In-situ/Operando*
- Materials Science, Chemistry, Physics, Environmental Science

References

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