

## Dongting Lake contaminated sediment: an unignorable pollution issue but can be tackled by the ubiquitous zeolite

Dongting Lake is one of the biggest natural water resources in South China. Due to developed economy in the adjacent area, the river has suffered from high loads of untreated wastewater which contains high amounts of heavy metals, such as Cd, Pb, Cu, Zn, Hg, and Ni, etc. However, little effort has been made to remediate the contaminated sediment by reducing the total amount or the mobile fraction of these metals that could be directly harmful to human beings.

A normal way of minimizing the toxic effects of metals in the environment, including sediment, is to stabilize them using stabilizers such as fly ash, ground granulated blastfurnace slag, iron/manganese oxides, phosphates, etc. Nevertheless, some of these stabilizers may be potentially toxic (e.g. red mud), some may lack efficiency thus requiring huge demands. However, all these problems will be eased by a ubiquitous and even not eye-catching material-zeolite. Zeolite, with its special physicochemical property, accessible source, and low cost, has successfully caught scientists' attention in the field of industry, agriculture and pollution control.

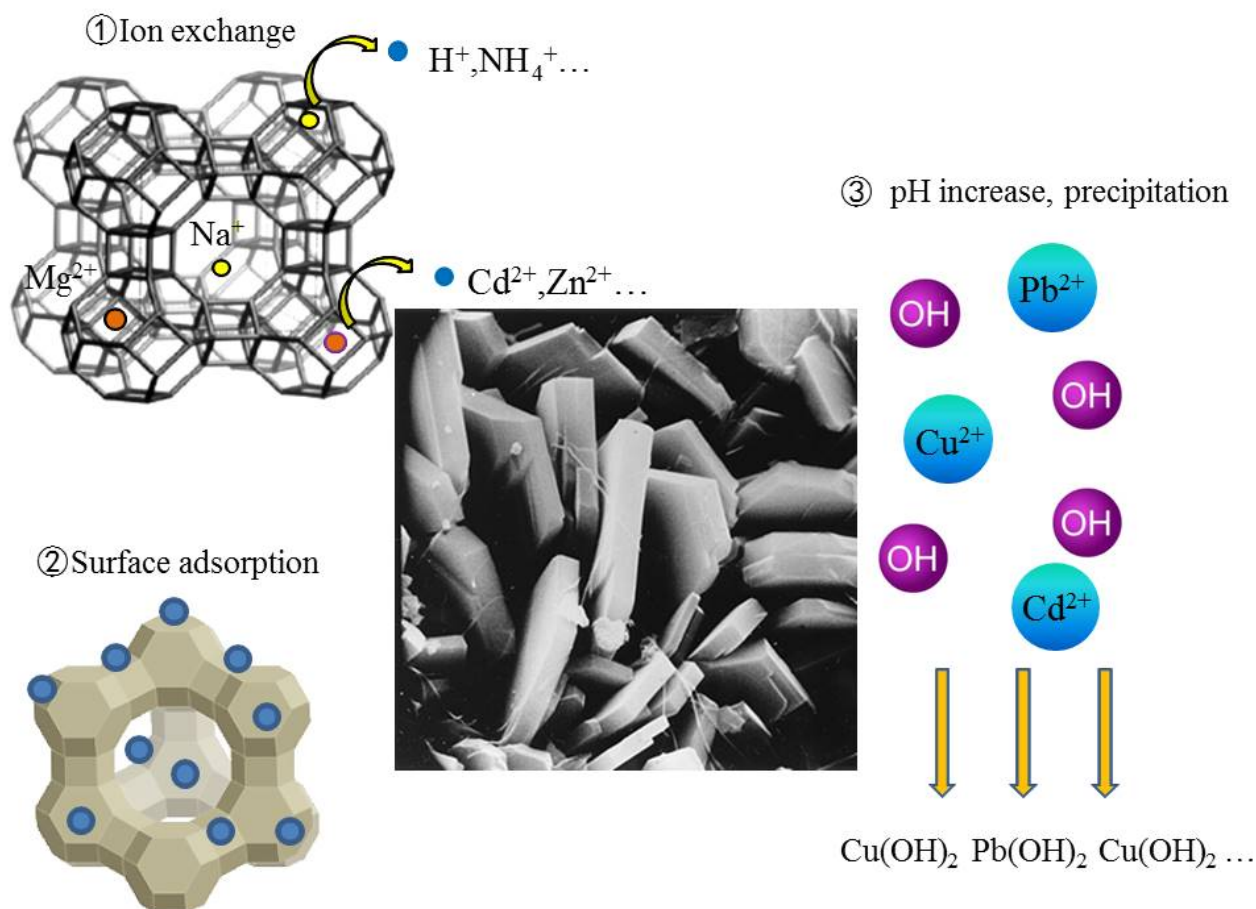


Fig. 1. Mechanism of zeolite stabilizing metal

Zeolite, occurring in forms of zeolitic-rich tuffs and normally found in sedimentary rock, has a crystal structure that is made by silicon (aluminum) oxygen tetrahedron arranged into three-dimensional lattice. Various holes and channels give rise to the great openness of the material, making it selectively absorb molecules of appropriate size. Besides, this material has an ion exchange capacity that  $\text{Na}^+$ ,  $\text{K}^+$ , and  $\text{Ca}^{2+}$ , etc. could be replaced by heavy metals. These properties make zeolite an ideal stabilizer for remediation purpose.

In order to improve the stabilization effect of the material, modifications using mineral acid or base treatment are to increase the surface areas and porosity. We chose a range of zeolite varying in particle size and used acid(HCl), base(NaOH), and salt(NaCl) for modification. Therefore, the aim of our study is to investigate the impact of modification on the performance of metal stabilization in sediment. Our results showed that the granulated zeolite with NaCl conditioning had the highest metal sorption. Consequently, the selected modified zeolite effectively stabilized Pb, Cu, Zn and Cd in sediment to different extents. Best stabilization result was seen for Cd that the acid exchangeable fraction (i.e. the mobile fraction) was greatly reduced, while the reducible and residual fractions (i.e. the stable fractions) were increased. For the other three metals, stabilization effect was also obvious where the mobile fraction was reduced and one stable fraction was increased. It means that the application of zeolite successfully stabilized the four metals by reducing their mobile/bioavailable portion, thus alleviating the direct toxicity of the metals to biota.

Considering that Dongting Lake is currently Cd-rich, it seems necessary to apply the modified zeolite as a possible solution to alleviate the hazards likely posed to the lake and the surrounding environment.

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## **Publication**

[Effects of modified zeolite on the removal and stabilization of heavy metals in contaminated lake sediment using BCR sequential extraction.](#)

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