



# MONASH University

**Department of Chemical Engineering**

## **SEMINAR**

### **Novel Nanostructured Zeolite Adsorbents for Water Treatment**

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**Abstract:**

Zeolites as adsorbents for water treatment have been extensively researched over last two decades. However, most of the research has been concentrated on the application of natural zeolites, such as clinoptilolite, chabazite and mordenite, for the removal of ammonia from municipal/industrial wastewaters, radioactive isotopes from nuclear aqueous solutions, and heavy metals from industrial wastewaters. The natural zeolites, although cheap, have disadvantages, for their use depends on the deposits of zeolitic minerals in a given country, and their exchange capacities are low and depend on the content of the zeolite in the rock and on the character of the compounds present in the natural material. Therefore, there is a developing demand for new ion exchange and sorbent materials which are readily achieved with sufficient quantity and, more importantly, have high exchange capacities and purities. Synthetic zeolites which have attractive ion-exchange and adsorptive properties are of special interest as such candidate materials. In this project, synthetic zeolites (such as zeolite A, X and Y, etc.) nanocrystals will be used to construct the novel hierarchical zeolite adsorbent for water treatment.

The primary goal of this research is to develop novel synthetic methods for the synthesis of zeolite nanocrystals with well-controlled size distributions. A novel synthesis method has been developed to synthesize dispersible zeolite nanocrystals through conversion of colloidal silica nanoparticles in a mesoporous carbon matrix. Colloidal silica nanoparticles serving as the silica source and the hard template were embedded in the mesoporous carbon via in situ polymerization of furfuryl alcohol in the presence of triblock copolymer (Pluronic P123), and then reacted with an alkaline aqueous solution ( $\text{Na}_2\text{O}-\text{Al}_2\text{O}_3-\text{H}_2\text{O}$ ) infiltrated through the mesoporous channels of carbon matrix. The synthesis of zeolite NaA nanocrystals was demonstrated. The morphologies and sizes of the zeolite NaA nanocrystals obtained are similar to those of the starting silica nanoparticles. As a result, this novel synthesis method allows one to control nanocrystal size and size distribution simply by choosing colloidal silica nanoparticles with a desired particle size distribution. It shows high potential for large-scale production of dispersible zeolite nanocrystals, which will further serve as fundamental building units for the preparation of hierarchical zeolite adsorbents in this project.

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