

# Ultrathin water-stable metal-organic framework membranes for ion separation

## PHYSICAL SCIENCES: Processing

The Challenge	A filtration membrane that can remove inorganic ions, salts and bacteria by size-exclusion.	
The Solution	Using metal-organic frameworks (MOFs) as a nanoporous separation system.	
Key benefits	<ul style="list-style-type: none"> <li>High selectivity compared to other membranes</li> <li>Water stable</li> </ul>	<ul style="list-style-type: none"> <li>Highly useful in desalination applications</li> <li>100% rejection rate of inorganic ions</li> </ul>
Development Stage	Technology Concept completed.	
Brief Description & Differentiation	<p>This technology uses exfoliated 2D nano-sheets, Al-MOFs, which are water stable and have high porosity. A key aspect is that it creates channels perpendicular to the membrane substrate. Figure 1 shows a single layer of our Al-MOF nano-sheet. Water is able to move in a y-axis direction through the pores in this nanosheet.</p> <p>The size of the pores in the nano-sheet are such that it blocks the hydrated diameters of ions from passing through. We have shown a 100% rejection rate of measured ions. Figure 2 shows the ion permeation rate in the red columns which demonstrates that there is minimal ion transport in comparison to water flux.</p> <p>Figure 3 compares the performance of the current work to other nano-filtration materials such as Graphene oxide and reduced Graphene oxide. It can be seen that the selectivity of the current work outperforms all reported nano-filtration materials and also maintains a high water flux.</p>	
Research Team	Prof. Xiwang Zhang and Meipeng Jian, Department of Chemical Engineering.	
Intellectual Property	Australian Provisional Patent application filed.	
Key Publications	<a href="https://advances.sciencemag.org/content/6/23/eaay3998">https://advances.sciencemag.org/content/6/23/eaay3998</a>	

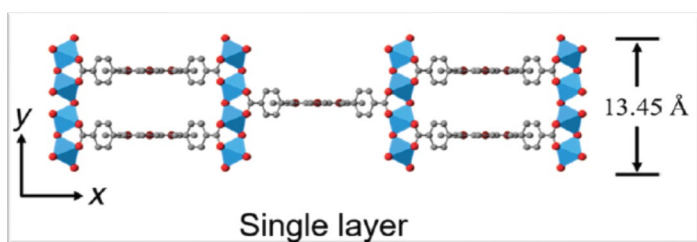


Figure 1. Single layer of Al-MOF nanosheets - water is able to move in a y-axis direction through the pores.

Figure 2. Ion permeation rate (red) demonstrates that there is minimal ion transport in comparison to water flux.

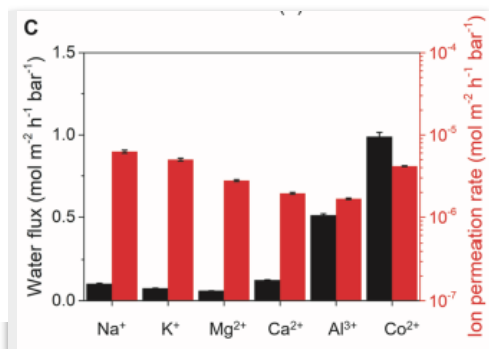


Figure 3. Comparison with other nano-filtration materials such as graphene oxide and reduced graphene oxide. Selectivity of Al-MOFs outperforms all reported nano-filtration materials and also maintains a high water flux.

