Revolutionary graphene filter could solve water crisis

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A new type of graphene-based filter could be the key to managing the global water crisis, a study has revealed. The new graphene filter, which has been developed by Monash University and the University of Kentucky, allows water and other liquids to be filtered nine times faster than the current leading commercial filter.

According to the World Economic Forum's Global Risks Report, lack of access to safe, clean water is the biggest risk to society over the coming decade. Yet some of these risks could be mitigated by the development

of this filter, which is so strong and stable that it can be used for extended periods in the harshest corrosive environments, and with less maintenance than other filters on the market.

The research team was led by Associate Professor Mainak Majumder from Monash University. Associate Professor Majumder said the key to making their filter was developing a viscous form of graphene oxide that could be spread very thinly with a blade.

"This technique creates a uniform arrangement in the graphene, and that evenness gives our filter special properties," Associate Prof Majumder said.

This technique allows the filters to be produced much faster and in larger sizes, which is critical for developing commercial applications. The graphene-based filter could be used to filter chemicals, viruses, or bacteria from a range of liquids. It could be used to purify water, dairy products or wine, or in the production of pharmaceuticals.

This is the first time that a graphene filter has been able to be produced on an industrial scale – a problem that has plagued the scientific community for years.

Research team member and PhD candidate, Abozar Akbari, said scientists had known for years that graphene filters had impressive qualities, but in the past they had been difficult and expensive to produce.

"It's been a race to see who could develop this technology first, because until now graphene-based filters could only be used on a small scale in the lab," Mr Akbari said.

Graphene is a lattice of carbon atoms so thin it's considered to be two-

dimensional. It has been hailed as a "wonder-material" because of its incredible performance characteristics and range of potential applications.

The team's new filter can filter out anything bigger than one nanometre, which is about 100,000 times smaller than the width of a human hair.

The research has gathered interest from a number of companies in the United States and the Asia Pacific, the largest and fastest-growing markets for nano-filtration technologies.

The team's research was supported by industry partner Ionic Industries, as well as a number of Australian Research Council grants.

Ionic Industries' CEO, Mark Muzzin, said the next step was to get the patented graphene-based filter on the market.

"We are currently developing ways to test how the filter fares against particular contaminants that are of interest to our customers" Mr Muzzin said.

Co-author of the research and Director of the Center for Membrane Science, Professor Dibakar Bhattacharyya, from the University of Kentucky, said: "The ability to control the thickness of the filter and attain a sharper cut-off in separation, and the use of only water as the casting solvent, is a commercial breakthrough."

More information: Abozar Akbari et al. Large-area graphene-based nanofiltration membranes by shear alignment of discotic nematic liquid crystals of graphene oxide, *Nature Communications* (2016). DOI: 10.1038/ncomms10891

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