Filtering and detecting water pollution

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CORROSION of household plumbing, faucets and water fixtures can give rise to contaminated water supply for daily consumption.

This exposes consumers to the dangers of excess copper ion in drinking water, which could lead to acute toxicity and result in illnesses and diseases, such as liver damage, heart and kidney failure, and brain disease.

Therefore, a water filter system that could remove heavy metal or copper in pipe water, as well as detect chemical pollution or toxic in the water, would ideal for safe water usage.

This was what researchers from Universiti Putra Malaysia's (UPM) Institute of Advanced Technology (ITMA) came up with: an outdoor water filter with smart beads — a practical filter-photosensor platform in a water filtration system that can detect the lack of or excess of copper in water supply.

Head of UPM Materials Synthesis and Characterisation Laboratory, Associate Professor Dr Janet Lim Hong Ngee, said her team spent three years to come up with the innovation.

"What we did was fabricate the smart beads — a multi-functional hybrid of cellulose acetate with cadmium sulphide and graphene nanocomposite — onto a three-dimensional electrode.

"The smart beads manifest the abilities to filter and sense contaminants in the two-in-one photosensor platform, which is attached to a water filter," she said, adding that this was the first time ever a proof-of-concept for such a system had been reported.

She said even though residences, offices, restaurants and industries had water filtration devices at their premises, some copper ions were able to pass through the filters.

"As a result, the water that contains unknown amount of copper would be consumed by people.

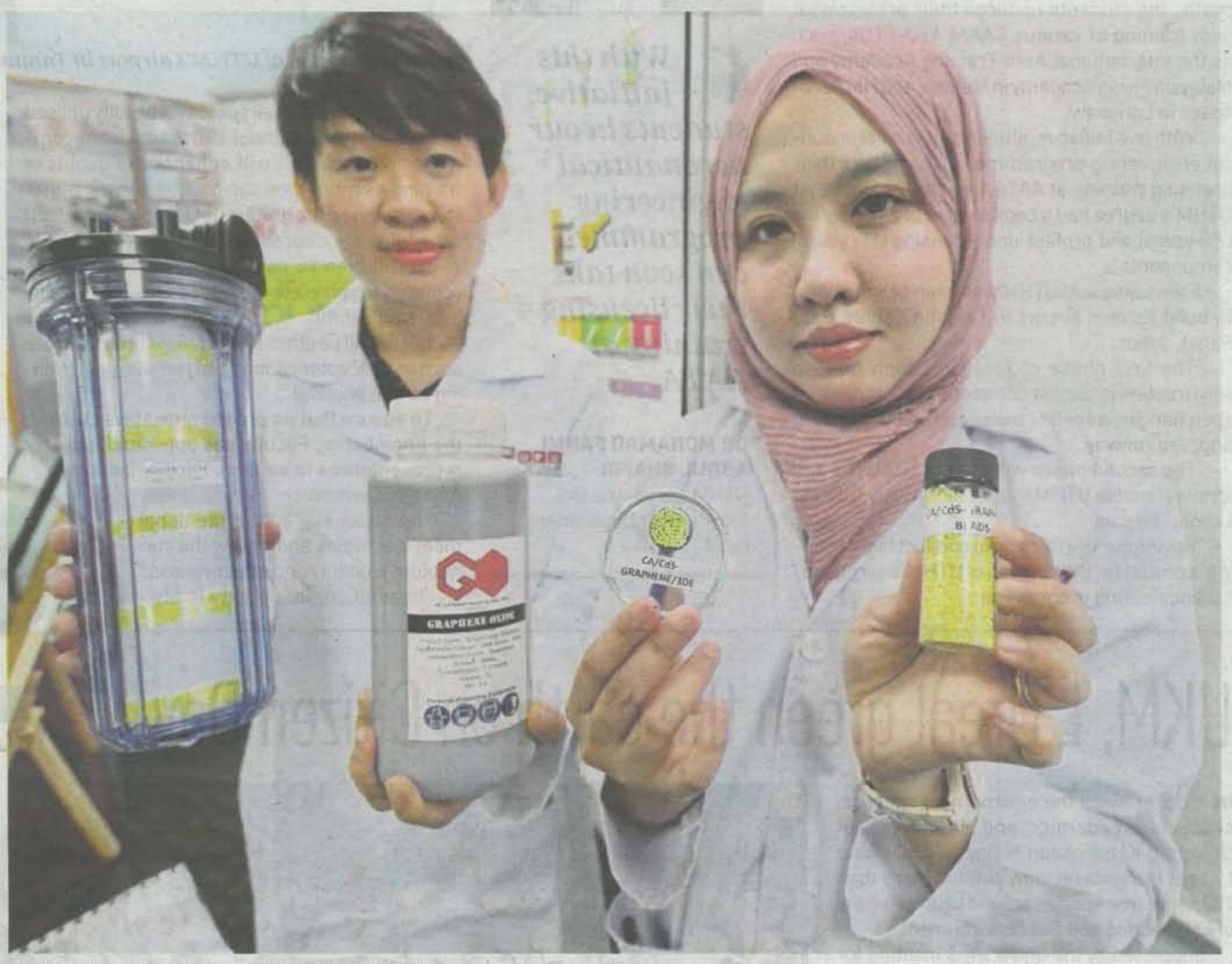
"We have to take note that our body needs a certain level of copper ions to help the body make red blood cells and keep nerve cells and the immune system healthy. Therefore, the sensing device in the water filter is needed to monitor the level of copper being consumed by the body. Hence, our approach to designing a dual-functional photosensor-adsorbent water filtration system that is able to collect molecules from liquids can address the concern about the consumption of copper."

Lim said the modified three-dimensional electrode with smart beads was economical and environment-friendly for the reading of contaminants in water supply.

"The innovation can be applied in water treatment and purification, food and beverages, medicine, pharmaceutical and cosmetics.

"The water filtration system is ready for commercialisation. We are looking for partners for strategic collaboration with any interested company to commercialise and licence UPM's intellectual property/innovation."

The product received Home Decoration Exhibition's Special Award at the International Invention and Innovation Exhibition 2019, Research Entrepreneurial Award, Malaysia Commercialisation 2018, first prize at the National Nanotechnology Innovation Research Project Competition 2018 and the silver medal at the Invention and Innovation Competition of Private Higher Education Institution 2018.



Associate Professor Dr Janet Lim Hong Ngee (left) and co-researcher Dr Izwaharyanie Ibrahim with the outdoor water filter with smart beads — a dual-function water filtration system. PICS BY INTAN NUR ELLIANA ZAKARIA

Lim said the dual-function water filter was a result of a long line of research work.

"I graduated with a Bachelor of Science (Oleochemistry) (Hons) degree from Universiti Kebangsaan Malaysia. Oleochemistrtry is a study of palm-based derivatives. The first two years, we studied basic chemistry. It was a three-year course. During my last year, I focused a bit on palm-based materials as well fundamentals related to the applications of palm materials.

"After the completion of my first degree, I did my master's studies at the same university for two years working on metalysis and synthesis of materials. It was then I discovered I love synthesising materials."

She was a researcher and chemist at a cosmetic company, and started her teaching career at Cyberjaya University College of Medical Sciences (CUCMS). After a year, she decided to do a PhD in UPM — working on a colloidal system.

"I made use of the system to make materials and studied the techniques of making materials. If you can understand your materials, it will bring benefits to the community. You know how exactly to use them and apply them, and how to improve features that are available and add features that are not available in the applications."

> *"The innovation can be applied in water treatment and purification, food and beverages, medicine, pharmaceutical and cosmetics.*
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> UPM Materials Synthesis and Characterisation Laboratory head