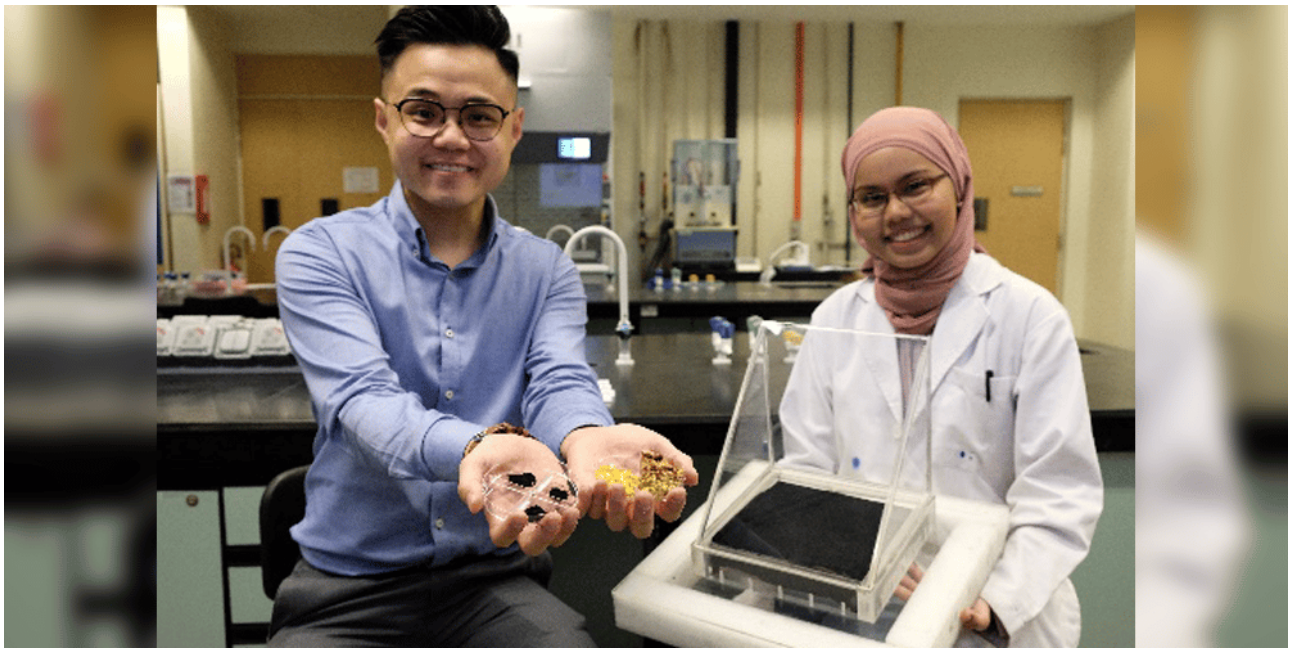


Asst Prof Edison Ang Huixiang (L) and his PhD student, Marliyana Aizudin (R) who has assisted the Asst Prof Edison with the work. (Photo credit: Nanyang Technological University)

Singapore scientist develops method to produce ultra-thin material from fruit waste for solar-powered water purification

17/02/2023 by The Online Citizen

A scientist from Nanyang Technological University in Singapore has developed a new ultra-thin material made from recycled fruit waste that has exceptional light-to-heat conversion efficiency and can be used in equipment to purify dirty water.

Assistant Professor Edison Ang used common fruit waste such as coconut husks, orange peels, and banana peels to make MXenes, which are electrical-conducting

compounds with similar properties to graphene. He has previously managed to synthesise graphene-related materials from recycled plastic.

Unlike graphene, MXenes are made from other elements besides carbon, giving them better light-to-heat conversion properties.

MXenes are outstanding electrical conductors, hundreds of times stronger than steel, and extremely light. Their exceptional properties enable them to replace conventional materials in industrial applications such as energy storage, optical, and sensors. However, as raw materials need to be mined for their synthesis, MXenes are expensive and complicated to process.

This is where Asst Prof Ang comes in with his simple method to have fruit peel carbonised to make MXenes.

"Our synthesis process is three times cheaper than commercial methods because the original source that we use (fruit waste) is free of charge," he said in an earlier interview with the Straits Times.

As for fruit waste solicited from the refuse collection, he stated to TOC that as long as the waste containment is organic in nature, the conversion into MXene material is still possible.

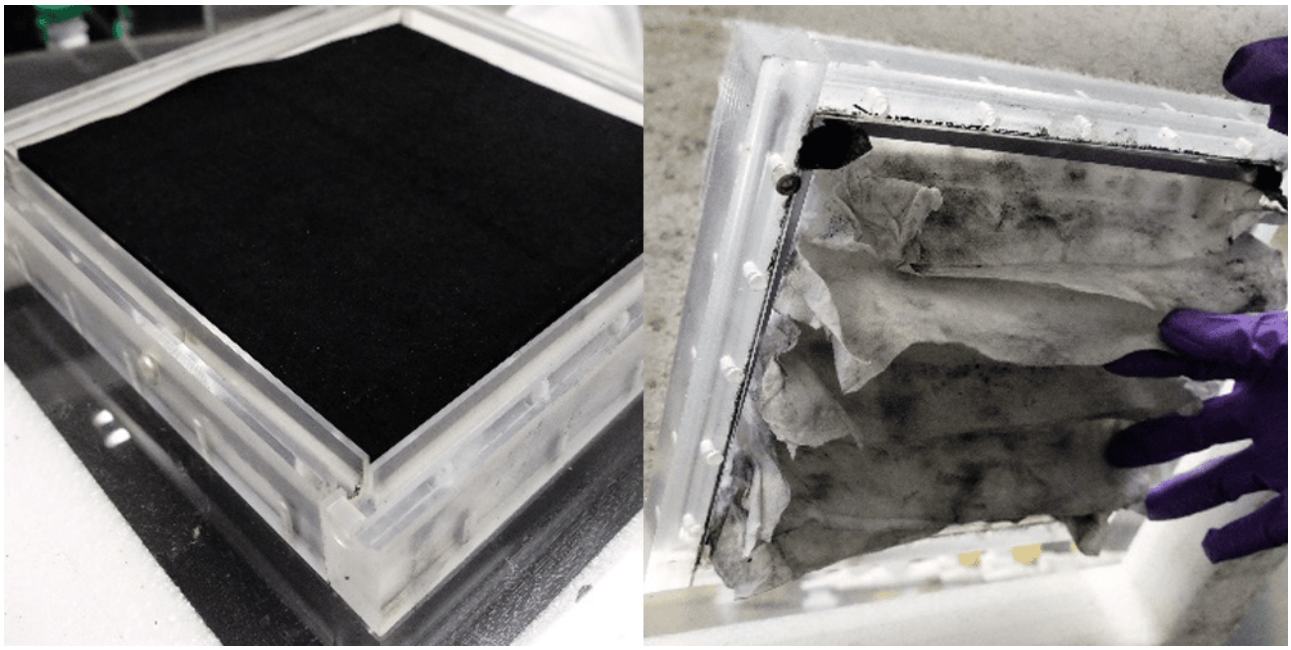
For now, Asst Prof Ang plans to use his MX[illegible]s in solar stills, which use sunlight to distil dirty water. Traditional distillation requires well-established infrastructure, significant energy costs, and thus is only affordable in developed countries. Asst Prof Ang's solar still is cheaper, more portable, and environmentally friendly than existing methods of distillation. The solar stills can be used in disaster zones and rural areas, where fuel and clean water are usually scarce.

Asst Prof Ang also plans to use his MXene in applications such as energy storage and battery manufacturing. He is currently unable to disclose which companies he is working with due to confidentiality clauses.

The prototype solar absorber that Asst Prof Ang has created is made of MXenes derived from fruit waste has an average light-to-heat conversion efficiency of 90%, which is ~30% higher than that of the commercial solar absorber, and as a result, the water production rate is ~50% higher than that of the commercial ones.

The MXenes material can be reused as it is not directly in contact with seawater, rather only a thin layer of MXenes material is needed to deposit on top of the water

absorber (i.e., air-laid paper), as shown in the picture below.



MXenes materials (L) that are deposited on the water absorber (i.e., air-laid paper), as shown in the picture on the right (Nanyang Technological University)

The air-laid paper is like “tissue paper”, which is cheap. Typically, during the day, where there is sunlight, the salt in the seawater will crystallize out onto the air-laid paper, but at night, those crystallized salt will dissolve back to the sea, therefore making the solar still device environmentally sustainable. He also noted that the energy cost for membrane filtration is typically two times the distillation process.

The advantages of solar stills are that they are electricity-free and portable, you can use them anywhere as long as there is sunlight.

Asst Prof Ang mentioned to TOC that there is currently no industry interest yet in large-scale distillation due to challenges like space utilization and the technology not working at night due to no solar energy, but should the industry approach him, he will be keen to discuss with them.

He has demonstrated his solar still prototype at a local primary school and held workshops on “advanced technology for sustainable development” via online and face-to-face teaching. He has also managed to meet with primary school teachers on a regular basis to discuss the advancement and integration of sustainability topics in primary school science curricula.

The work and workshop are also aligned with the Singapore Green Plan 2030 and Eco Stewardship Programme.