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UCT students explore sustainable water treatment processes

The water crisis in the Western Cape has necessitated for more attention to be placed on the growing need for innovation and research for industrial water treatment. While there are various technologies to treat mining wastewater to produce potable water, University of Cape Town (UCT) researchers are looking at industrial crystallisation which can be used to treat salt water.

Over the past 18 years, researchers in the Department of Chemical Engineering at UCT have conducted research into industrial crystallisation. With the formation of the Crystallisation and Precipitation Unit (CPU), water and brine treatment has become an important focus for a great number of UCT students.

One of those forward-thinking research projects is led by final-year chemical engineering students, Fendi Lin and Anthony McHendrie. To produce potable water, they firstly apply the conventional reverse osmosis technique to desalinate saltwater. The reverse osmosis technique is highly inefficient and produces at least 60% waste. This is where Eutectic Freeze Crystallisation (EFC) comes in, as it can be used to recover almost all the water from the salt brine. Their dual desalination research is still in the early stages – thus, the technology is still too expensive to be rolled out on a larger scale.

This EFC has also been a research focus of Professor Alison Lewis, one of the founding members of the CPU and a pioneer in the field of industrial crystallisation. In 2017 the first commercial EFC wastewater treatment unit was commissioned and has since been successful in transforming brine into clean water at the Tweefontein colliery in Mpumalanga.

Lewis explains: "A briny solution is cooled to its eutectic temperature, which causes the water in the mixture to crystallise as ice, which floats, and then salts to crystallise out as solids, then sink." The plant has a design specification of 500 000 litres of potable water a day, as well as usable salt as a by-product.

During the scaling-up of this novel technology, valuable lessons have been learned – with some issues being simply solved, like the washing of ice, while others like the ice-scaling on the equipment turned out to be more complex.

Almost 40% of CPU postgraduates are currently exploring aspects of EFC. This includes Lerato Motsepe, who is working on Crystal Engineering in EFC, and Benita Aspeling, who is investigating treatment of multi-component brines using EFC.

Mr Hilton Heydenrych, a full-time academic who is also a PhD student, is leading research in the systematic comparison of the effectiveness of water treatment processes. His project is based on the hypothesis that existing wastewater treatment processes are not necessarily the most effective. So far, he has found that water treatment efficiency depends on the nature of the salts found in solutions and their effect on osmotic pressure – hence EFC is probably the better option in the treatment of sea water, while cooling crystallisation could be more effective in the treatment of other wastewater.

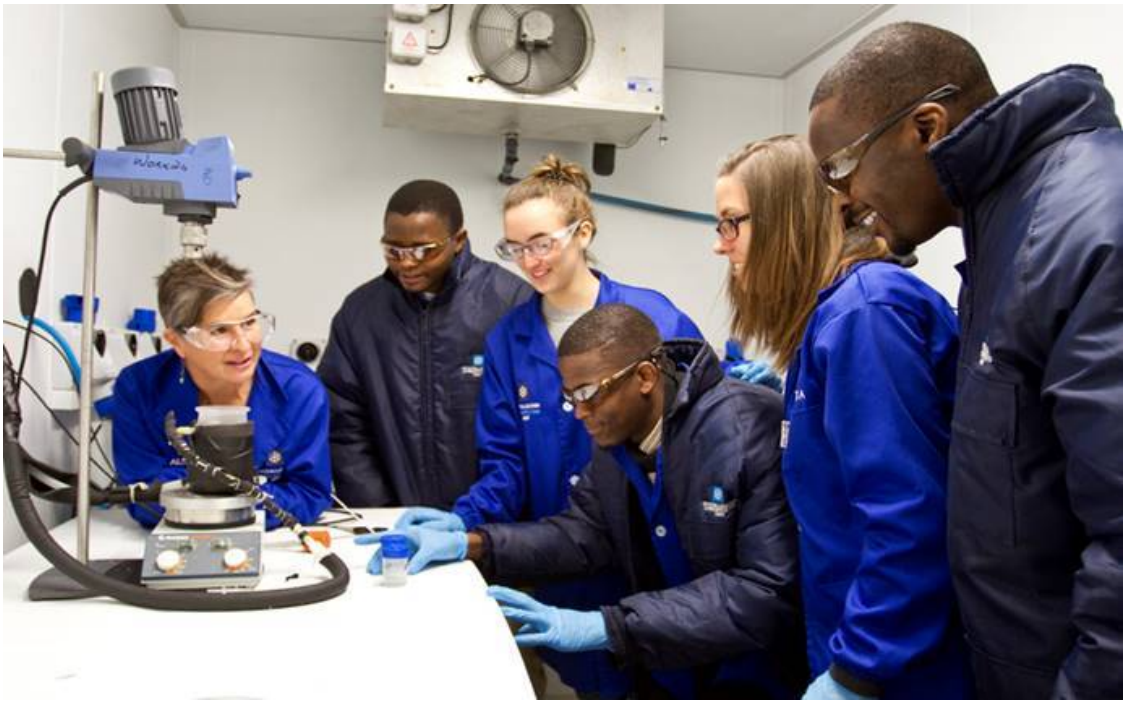
Lewis concludes: "The outlook for water treatment is excellent. The public awareness around the drought has brought a new consciousness to the value of water that is long overdue."

Notes to Editors

Find more information on Fendi Lin and Athony McHendrie's research in this UCT news article.

A list of current projects at the Crystallisation and Precipitation Research unit can be found here.

Caption: UCT Chemical engineering students work with the reverse osmosis plant to desalinate seawater. Credit: Robyn Walker/UCT



Caption: Professor Alison Lewis and Jemitias Chivavava with postgraduate students Genevieve Harding, Senzo Mgabhi, Benita Aspeling and Cledwyn Mangunda. Credit: Robyn Walker/UCT

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