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S'pore scientists find new method of removing phosphorus from waste water using bacteria

Professor Stefan Wuertz says that algae blooms are caused by changing environmental conditions. PHOTO: SCELSE

Cheryl Tan

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SINGAPORE - Local scientists have developed a new method of removing phosphorus from waste water using bacteria.

This paves the way to preventing deadly algae blooms caused by the mineral, particularly in the warm waters of tropical countries such as Singapore.

It is important to remove phosphorus from waste water as algae blooms deplete the oxygen levels in water and can release high levels of toxins that kill fish and other aquatic animals. Algae blooms in fresh water could also affect Singapore's drinking water supply.

Nanyang Technological University's (NTU) Professor Stefan Wuertz, who is the deputy centre director of the Singapore Centre for Environmental Life Sciences Engineering (SCELSE), said on Wednesday (July 13) that algae blooms are caused by changing environmental conditions such as warmer waters and changing rainfall patterns which may cause nutrients like phosphorus - typically found in fertilisers - to leach into freshwater ponds.

The phosphorus, a nutrient that supports algae growth, is devoured by the algae, which duplicates drastically.

The Straits Times understands that phosphorus removal from waste water treatment is not widely practised here.

This is because excess treated waste water from water reclamation plants is discharged into the sea and thus has no ecological impact. The treated waste water cannot be released into freshwater bodies as the discharge must be of drinking water quality.

Mr Yong Wei Hin, director of PUB's Water Reclamation (Plants) Department, said that current research and methods on phosphorus removal are more focused on temperate regions and are not known to be suitable for warmer tropical waters.

Phosphorus removal methods typically involve chemicals that produce a lot of sludge that has to be treated or disposed afterwards.

PUB, however, noticed at its waste water treatment plants that some naturally occurring biological activity at temperatures of 28 deg C and above had unexpectedly resulted in some degree of phosphorus removal.

To better understand this mechanism, PUB worked with researchers from NTU and SCELSE to identify the bacteria and figure out their role in phosphorus removal.

Dr Rohan Williams, head of SCELSE's Integrative Analysis Unit, said that as the waste water treatment plants have a diverse microbial community of over 5,500 types of microbes, the team used DNA sequencing to zero in on the type of bacteria responsible for this removal.

Known as the Candidatus accumulibacter, the bacteria are not harmful to humans or the environment and can remove and absorb phosphate from waste water at temperatures ranging from 30 deg C to 35 deg C, said Prof Wuertz.

"This would ensure that our technique remains effective even when Singapore and other countries experience warmer waters due to climate change," he added.

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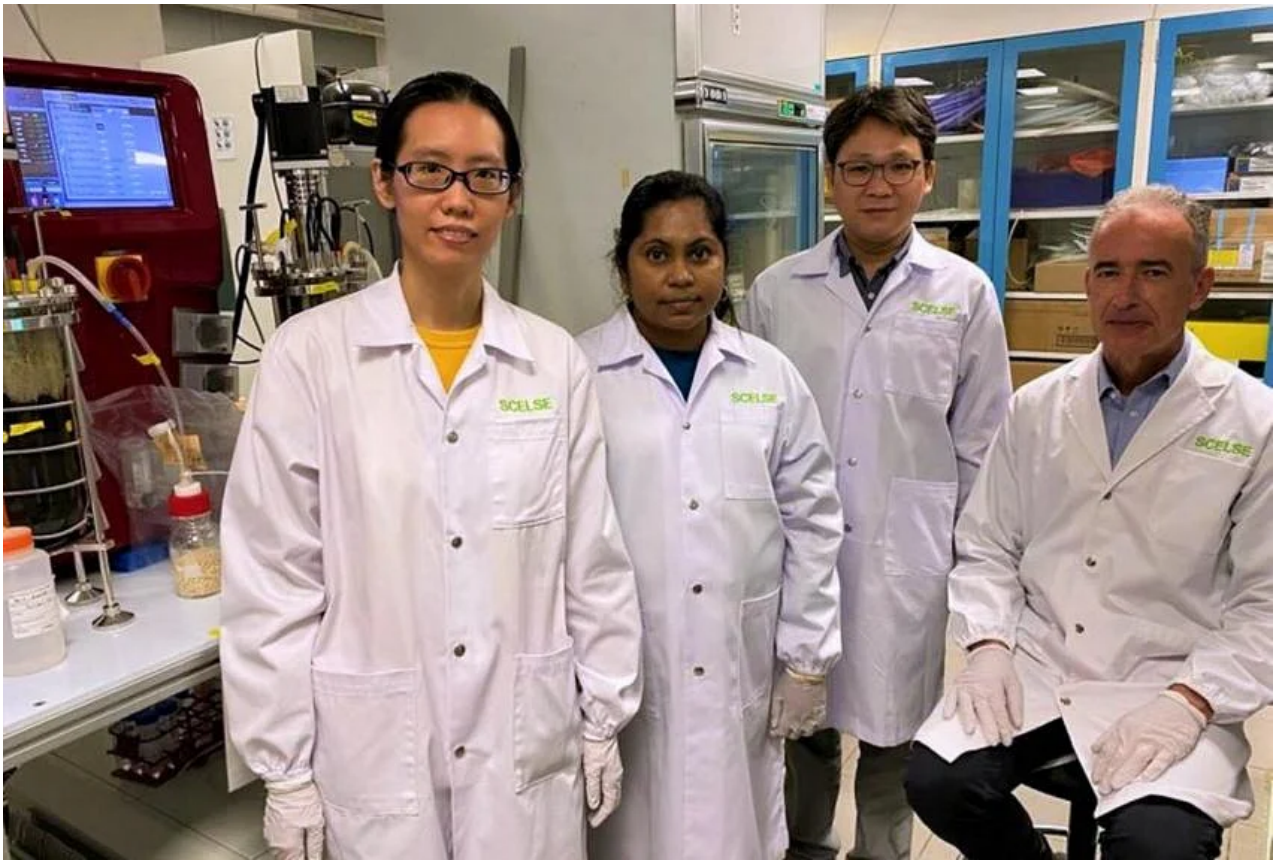
To allow the accumulibacter bacteria to flourish, the scientists used a variety of techniques, such as limiting the carbon intake of competing bacteria.

Over a testing period of more than 300 days in the lab, the researchers found the bacteria effective in removing phosphorus.

PUB's Mr Yong said that the findings validated the observations of phosphorus removal and will be considered in the design of future water reclamation plants.

Moving forward, the researchers will be looking to improve the effectiveness of their current method and to use the bacteria for capturing and storing phosphorus - which could be depleted globally within 50 to 100 years.



Prof Wuertz said: "Nearly all the phosphorus that farmers use today... is mined from a few sources of phosphate rock, mainly in the United States, China and Morocco. Our solution could not only help future-proof biological phosphorus removal but also store the element and then reintroduce it into agricultural systems."

Professor Shane Snyder, executive director of the Nanyang Environment and Water Research Institute at NTU, who was not involved in the study, said that the findings are "vitally important" not just for tropical countries but also in hot arid environments such as deserts. This is especially key as climate change and increasing urbanisation hamper nature's ability to utilise waste phosphorus, which in turn, gives rise to algae blooms when the water enters lakes and ponds.

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