Treat waste water – and generate power

NUS team wins grant for work on potential source of clean energy

By Amresh Gunasingham

THE next time you are using the toilet, consider this: You could soon be helping to power the city.

Researchers here are fine-tuning technology that generates electricity cheaply while cleaning used water flushed down the loo.

The work on microbial fuel cells by National University of Singapore (NUS) scientists has won a $2.3 million grant from the Environment and Water Industry (EWI) Development Council.

These cells, also known as biological fuel cells, use bacteria to generate electricity from organic matter.

Bacteria is added to the water as it is treated, consuming the pollutants and shedding electrons in the process. The electrons flow through a circuit and generate electricity.

"Used water contains a huge amount of energy due to the presence of organic matter in it," said Assistant Professor Ng How Yong of the Division of Environmental Science and Engineering at NUS, who led the research effort.

The technology not only has potential as a source of clean energy, but is also useful as a treatment for used water.

In current methods of used water treatment, half the operating cost is taken up by aeration, a process that introduces air to water. "This technique also creates a sludge by-product that is costly to dispose of," said Prof Ng.

His team's breakthrough involves developing a technique for treating waste water without aeration, and which removes half the bacteria present. "Up to 25 per cent less waste sludge is created in this process," said Prof Ng, 36, who won the Singapore Young Scientist Award last year for his research in membrane processes and microbial technology.

Prof Ng and his team will use the $2.3 million grant to develop a prototype fuel cell for large scale use. PHOTO COURTERSY OF NG HOW YONG

Technology relating to microbial fuel cells is widely researched in Singapore and many countries such as the United States and Australia, but has yet to be commercialised.

The power generated by current microbial fuel cells is too low to be useful, and the technology of extracting energy from domestic waste water is still inefficient, said Prof Ng.

According to Professor Ong Say Leong, an expert in used water treatment from the Department of Civil Engineering at NUS, most research on such cells is currently restricted to small-scale laboratories. "To be viable for full-scale application, researchers need to develop an optimised design prototype," he said.

Another problem is that platinum is used in the cathode design, which makes the process expensive and not economically viable unless a low-cost alternative can be found.

Prof Ng's team is using the grant to develop a prototype fuel cell suitable for large-scale application. "The cell will be less costly and increase power generation, while at the same time recover more of the energy as electricity," he said.

The team recently succeeded in developing a cheaper cobalt substitute for platinum, and have also applied for a patent in the US for a cathode design that possesses greater power-generating capacity.

Mr Harry Seah, director of technology and water quality at national water agency PUB, said the technology's greatest potential application was in used water treatment, and could be readily adopted by local agencies and industries.

He said the microbial fuel cells could potentially save up to 25 per cent of current energy consumption at the PUB's six water reclamation plants.

Apart from Prof Ng's work, 12 other projects were awarded a further $14.7 million under the EWI grant, which aims to advance technology in water treatment.

Singapore hopes to position itself as a global technology leader in the water and environment industry. It has targeted value-added contribution from the water sector to reach $1.7 billion (or 0.6 per cent of gross domestic product) by 2015. Jobs generated by this sector are expected to double to about 11,000 by then.

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