New loo turns poo into power

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Scientists from Nanyang Technological University (NTU) have invented a new toilet system that will turn human waste into electricity and fertilisers and also reduce the amount of water needed for flushing by up to 90 per cent compared to current toilet systems in Singapore.

Dubbed the No-Mix Vacuum Toilet, it has two chambers that separate the liquid and solid wastes. Using vacuum suction technology, such as those used in aircraft lavatories, flushing liquids would now take only 0.2 litres of water while flushing solids require just one litre.

The existing conventional water closet uses about 4 to 6 litres of water per flush. If installed in a public restroom flushed 100 times a day, this next generation toilet system, will save about 160,000 litres in a year – enough to fill a small pool 10 x 8 metres x 2m.

The NTU scientists are now looking to carry out trials by installing the toilet prototypes in two NTU restrooms. If all goes well, the world can expect to see and even sit on the new toilet in the next three years.

Associate Professor Wang Jing-Yuan, Director of the Residues and Resource Reclamation Centre (R3C) at NTU who is leading the research project, said that their ultimate aim is not only for the new toilet system to save water, but to have a complete recovery of resources so that none will be wasted in resource-scarce Singapore.

"Having the human waste separated at source and processed on-site would lower costs needed in recovering resources, as treating mixed

waste is energy intensive and not cost-effective," Prof Wang said. "With our innovative toilet system, we can use simpler and cheaper methods of harvesting the useful chemicals and even produce fuel and energy from waste."

Aiming to convert all waste to resource, the new toilet system which is part of a project that has received $10 million from Singapore's National Research Foundation's Competitive Research Programme in 2010, will be useful for new housing estates, hotels, resorts, and especially communities not linked to the main sewerage system and so require their own sewerage facilities.

How it works

The No-Mix Vacuum Toilet will divert the liquid waste to a processing facility where components used for fertilisers such as nitrogen, phosphorous and potassium can be recovered.

At the same time, the solid waste will be sent to a bioreactor where it will be digested to release bio-gas which contains methane. Methane is odourless and can be used to replace natural gas used in stoves for cooking. Methane can also be converted to electricity if used to fuel power plants or fuel cells.

'Grey water' (used water from the laundry, shower and kitchen sink) can be released back into the drainage systems without further need for complex waste water treatment, while leftover food wastes can be sent either to the bioreactors or turned into compost and mixed with soil, resulting in a complete recovery of resources.

Assisting Assoc Prof Wang in the project are four other NTU researchers – Asst Prof Chang Wei-Chung, Dr Chen Chia-Lung, Dr Apostolos Giannis and Dr Rajinikanth Rajagopal. This next-generation

toilet and resource recovery system took the team one and a half years to develop and will be showcased to the industry at the upcoming WasteMET Asia 2012, held from the 1st to 4th July this year at Marina Bay Sands' Sands Expo and Convention Center.

Provided by Nanyang Technological University