REINVENT THE TOILET CHALLENGE

The Pollution Research Group

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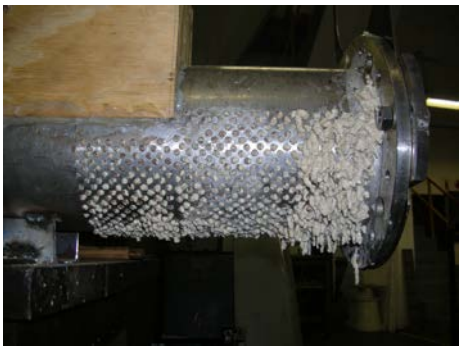
The Pollution Research Group (PRG) in the School of Engineering at the University of KwaZulu-Natal has received a grant from the Bill and Melinda Gates Foundation (BMGF) to participate in the *Reinvent the Toilet Challenge* (RTTC).The Challenge end objective is to produce a new-generation self-sustaining toilet that is able to convert human waste into sterilized fertilizer, potable water, mineral salts and electrical energy. The new-generation toilets will, in contrast to the current standard water-flush toilet, avoid the use of large amounts of clean water and energy to dispose of excreta and instead will treat human waste as a valuable resource. The toilet will be *off-the-grid*, doing away with the need for a connection to large electricity, water or sewerage networks. Affordability is a key goal of the RTTC, with a target combined capital and operating cost for the toilet of less than 10 US cents per person per day.

The toilet will integrate several operations to process the different components of the waste stream (faeces, urine, rubbish and washwater) and recover the useful constituents. The Pollution Research Group's work covers aspects including the design of a pedestal capable of splitting the four waste components at source, characterisation of the waste input streams, and processes for treating the faeces and urine.

The faeces-processing portion of the UKZN toilet design will comprise of an extruder, a dryer and an incinerator. In order for the extruder unit to be designed, rheological data (e.g. viscosity and fluid behaviour type) for fresh human faecal matter as a function of moisture content needs to be acquired for a range of stool intestinal transit times. Similarly, for the design of the drying and the combustor units of the toilet, data on the drying characteristics of fresh human faeces for differing geometric shapes and data on calorific values needs to be obtained. As no database of these properties exists, they will be obtained experimentally. An iterative energy balance will be performed over the three units, optimising the operating conditions of the units in order to minimise the energy consumption of the system and maximise the overall output energy.

Rheometer for analysing the flow properties of faeces



Work on the urine-processing operation is investigating the possible use of different membranes to separate different components of urine, aiming to recover potable water for use in the toilet and nutrients in a form suitable for agricultural applications.

Prototype system for separating faeces and rubbish and extruding faeces for drying