Science Walden: new horizons of combined ecological sanitation with separated urine/feces and treatment wetlands

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ABSTRACT

A new engineering concept, designed with separated urine/feces and graywater recovery, was proposed, and the first steps in taking this concept from the planning stage to implementation have been taken using pilot experiments within a small village. The village employs ecological toilet, equipped with 24 h ventilation, and constructed treatment wetlands consisting of both vertical and horizontal subsurface wetlands for graywater recovery. The quality of recovered graywater was similar to that of the water found in the adjacent stream, which is a concept of zero discharge system with graywater. Separated urine, in either fresh or stored form, was diluted with collected rainwater and with reused water without any detergent from a sink, to be supplied to vegetable garden as fertilizer. Separated dried feces were composted in the garden for approximately 3 months and then used as fertilizer. Dried and composted feces, together with stored urine, were characterized in terms of microbial community using pyrosequencing, to identify the presence of any potential pathogens, in order to confirm the system provides safe hygiene. Hypothesized idea of a micro-algae farm within the village might be proposed with separated urine serving as nutrients for algae that could in turn be cultivated as biofuel (diesel) produced from extracted lipids of algae. Through this pilot village test, we have taken a great stride towards practical realization of experimental concepts, in the form of this new urban water management model with ecological sanitation.

Keywords: Urban water management; Ecological sanitation; Treatment wetland; Urine; Feces; Water recovery

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