Profile

Public Health Implications of Greywater Generation in South Africa: Testing a Greywater Treatment Model

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Introduction

Greywater is wastewater generated from domestic activities such as laundry, dishwashing and bathing that can be recycled on-site for re-use in landscape irrigation and constructed wetlands. Greywater differs from water from toilets, designated sewage or blackwater, which contains human waste.

Greywater is thus domestic wastewater, without any input from toilets, which carries finite concentrations of microorganisms such as faecal coliforms, E.coli and opportunistic pathogens.[1,2] It also contains easily degradable organic matter that can result in microbial re-growth.[3] Re-growth and biodegradation leads to a decrease in the concentration of dissolved oxygen and the evolution of odours and promotion of mosquito breeding.[4,5] Greywater has been shown to contain heavy metals and up to 900 xenobiotic organic compounds.[2]

In situations where the sanitation infrastructure is lacking, such as in informal settlements, greywater disposal is often above ground, leading to ponding and surface run-off, which in turn contaminates nearby streams and potentially even groundwater sources.[6,7] Water resources can, therefore, become contaminated with faecal matter and pathogenic organisms. If water from such sources is utilised for swimming and/or potable purposes without the appropriate minimum treatment, it can have disastrous public health consequences.[8] Further concerns arise from the use of untreated greywater for irrigation of vegetables, mainly in subsistence agriculture, that are consumed raw. Collection of domestic wastewater, which includes greywater, is part of the sanitation infrastructure. Strategies must be developed to help manage the growing volume of greywater and decrease the attendant negative public health and environmental health impacts.

Greywater use and management

Although greywater is produced from similar household activities globally, its composition differs between households and, sometimes, regions.[2,6] These differences are caused mainly by the variation in household chemicals used and hygiene practices, the inhabitants per household and the density and type of buildings in the settlement.[2,6] Greywater re-use without treatment in rural and densely populated communities is a common practice and, on disposal after re-use, accounts for about 60-70% of volume of domestic wastewater.[2,4,9] Health risks to humans will differ from site to site and the management of greywater generated will, therefore, have to be tailored to site-specific conditions. Greywater disposal strategies are often neglected by local government and other relevant stakeholders.

Greywater management strategies can be based on different approaches. Carden et al. have recommended the use of a multi-criteria decision-making tool to identify settlements in a given area where management of greywater may present problems.[6] The authors suggest that if a settlement produces less than 500 litres of greywater per hectare per day, disposal in on-site soak-aways is possible without major detrimental effects to human and environmental health. If a settlement produces between 500 and 2 500 litres of greywater per hectare per day, the on-site disposal strategy should depend on the soil surface properties, slope of the landscape, rainfall intensity and pattern, water table levels, environmental conditions, plant species composition and existing wastewater management practices. Where greywater production exceeds 2 500 litres of greywater per hectare per day, off-site disposal is recommended. International literature indicates that irrigation with greywater can lead to the accumulation of oil and grease, which can in turn decrease infiltration rates.[10] This data was, however, accumulated for greywater with much lower organic and microbial loads than are encountered in South Africa. The choice of a greywater management strategy will, therefore, require assessment of the soil properties.

The Mulch-Tower Treatment System

Much research has been done on greywater treatment possibilities including both conventional methods and decentralised treatment systems.[1,11,12] Decentralised systems are attractive in a South African context because of easy, on-site operation by the local population, even in remote locations. An example of such a decentralised greywater treatment system is the Mulch-Tower Treatment System (MTTS) developed by Zuma et al.[1]

A MTTS is an on-site biological greywater treatment system where greywater filters through alternate layers of materials, including mulch, coarse sand, fine and coarse gravel. The mulch-tower serves both as a filter in removing the suspended solids of greywater and as a site for biodegradation where the filtrate may be broken down by aerobic micro and macro organisms.

In 2009, a MTTS was installed at six houses at the Scenery Park development in the Buffalo Municipality.[13] The design, maintenance and operation of the system was based on a partnership between the local university, a consulting company, the residents and the municipality. The residents were educated about the health risks of greywater and about the function and maintenance of the MTTS. Municipal personnel were trained in mulch-tower maintenance and charged with oversight and fixing major operational problems. The consulting company and university staff provided technical input for system design, support and performance monitoring.

Site visits were conducted by the consultants and university staff to monitor the project. Only two of the six households' MTTS operated effectively. The remaining residents did not take ownership of the MTTS resulting in poor maintenance. At the same time, staffing problems at the Buffalo Municipality had a negative impact on the successful operation of the MTTS. Generally, the performance parameters of the on-site version of the MTTS did not match the laboratory findings.

To ensure the successful launch of any greywater management or treatment system, it is important that an effective and appropriate communication strategy is used.

Conclusions

Despite consensus that potable water conservation is essential, uptake of researchers' findings is hindered by limited knowledge and resources and poor policy implementation. Innovative new ideas around the country often fail as a result of the public being inadequately informed on the importance of the idea and how they should be implemented and maintained.

Recommendations

- The provision of basic sanitation should at all times include domestic wastewater / greywater management. Policy makers must recognise the inseparability of basic water supply and sanitation to enable their simultaneous implementation.
- Public education on domestic wastewater management, including re-use, is crucial.
- Where greywater treatment is decentralised, users must receive technical training on how to use and maintain on-site systems.

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