Grey water characterisation and pollutant loads in an urban slum

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Abstract

On-site sanitation provisions in urban slums rarely prioritise grey water management, yet it forms the largest fraction of wastewater. This study was carried out to characterise grey water and quantify its pollutant loads in Bwaise III (Uganda) and to provide data for grey water management in urban slums of developing countries. Samples were collected for analysis from ten representative households as well as from four tertiary drains and the main drainage channel for 7 months in two dry seasons. Grey water production was found to comprise 85 % of the domestic water consumption. The chemical oxygen demand (COD) concentration in the grey water generated by laundry, in the kitchen and in the bathroom was 9,225 ± 1,200 mg L^{-1}, 71,250 ± 1,011 mg L^{-1} and 4,675 ± 750 mg L^{-1}, while the BOD_5 (biochemical oxygen demand) to COD ratio was 0.24 ± 0.05, 0.33 ± 0.08 and 0.31 ± 0.07, respectively. The maximum concentration of Escherichia coli and total coliforms was 2.05 9 10^7 cfu (100 mL)$^{-1}$ and 1.75 9 10^8 cfu (100 mL)-1, respectively, in grey water from the bathroom, while that of Salmonella spp. was 7.32 9 10^6 cfu (100 mL)$^{-1}$ from laundry. Analysis of variance (ANOVA) showed a significant difference in the concentration of COD, total suspended solids (TSS), total organic carbon (TOC), dissolved organic carbon (DOC), total phosphorus (TP), sodium adsorption ratio (SAR), oil and grease, and Salmonella spp. in grey water from laundry, bathroom and kitchen ($p < 0.05$). The high loads of COD (>500 kg day^{-1}), TSS (>200 kg day^{-1}), nutrients (8.3 kg TKN day^{-1} and 1.4 kg TP day^{-1}) and microorganisms (10^6 to 10^9 cfu c^{-1} day^{-1}) originating from grey water in Bwaise III show that grey water poses a threat to the environment and a risk to human health in urban slums. Therefore, there is a need to prioritise grey water treatment in urban slums of developing countries to achieve adequate sanitation.

Keywords: Grey water, Environmental pollution, Sanitation, Slums