Reuse Potential of Grey-water

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Introduction

A large portion of the domestic wastewater is considered grey-water, which is defined as water that has been used for washing dishes, laundering clothes or bathing. Overseas experiences show that it would be possible to reuse grey-water with little treatment at a significantly lower cost compared to traditional wastewater treatment. Grey-water reuse reduces the amount of freshwater needed to supply a household and reduces the amount of wastewater entering sewer or septic system. Other likely benefits include water savings, reduction in wastewater treatment costs and reduction in the threat to groundwater pollution from septic tanks. An ongoing pioneer research project at Sultan Qaboos University (SQU) aims to quantify grey-water production in Omani households, evaluate grey-water quality, design suitable treatment systems and investigate likely impact of grey-water irrigation on crop growth and yield, and on soil properties.

Grey-water Research at Sultan Qaboos University

Four Omani households have been selected and flow meters and sampling devices have been installed. Samples were collected and analyzed for various parameters (Table 1).

Following data and information were collected from a typical Omani household. The family consisted of 6 people (3 adults and 3 minors). The household received groundwater supplied by trucks for all domestic uses except drinking. Approximate usage of water as a percent of total weekly use is as follows: Kitchen – 10%, Washing Machine – 2.5%, Bathroom (shower, washing) – 32%, Toilet – 8%, Garden – 28% and Yard and car washing – 20%. Total water use is nearly 2500 gallons (11.37 m^3) for a week. It shows that approximately, 44.5% water use has resulted in grey-water, and 36% of other uses (Toilet flushing and Garden irrigation) could have used treated grey-water. Provided that the grey-water was treated on-site (Fig. 1) and used for toilet flushing, and gardening, the demand for trucked freshwater would have been reduced by 36% (or more).

All grey-water samples showed presence of large number of Coliform and E. Coli bacteria. Although E. Coli bacteria in Washing machine sample was 25.4/100 ml (MPN), which was significantly lower than other samples. Some trace metals were detected in all samples including freshwater samples. Turbidity was highest for washing machine samples but relatively low for shower and hand basin samples. Variations in quality were observed in kitchen samples collected at different times of the day. Mixed kitchen samples were stored under two different conditions: one container was constantly aerated; the other one was covered with a lid (Table 2). The container, which was aerated, showed significant improvement in quality (reflected in BOD_5 and DO concentration). A preliminary inference is that the preferred source of grey-water for garden would be water derived from the bathroom, shower and hand basins. Washing machine water may be used for toilet flushing. Washing machine water may be used for toilet flushing. Chlorination would be required for disinfection and also to prevent biological growths in the irrigation distribution lines. Removal of suspended solids would be necessary and appropriate filters need to be selected after trials.

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Considering high EC and high Na in washing machine grey-water, agricultural use of such grey-water would require careful planning with regards to soil and plant selection.

Table 1: Basic water quality parameters for collected samples

Source	pH	EC (dS/m)	BOD_5 (mg/l)	Turbidity (NTU)	DO (mg/l)
Fresh water	8.04	1.55	0.7	0.56	6.2
Hand basin	7.63	1.52	70.3	49.0	3.2
Shower	7.84	1.54	99.4	52.1	5.7
Washing machine	8.79	3.18	-	876	2.3
Kitchen (morning)	6.30	1.53	546	213	1.7
Kitchen (noon)	6.25	1.64	315	79.9	1.3
Kitchen (night)	6.68	1.62	386	2.67	1.8

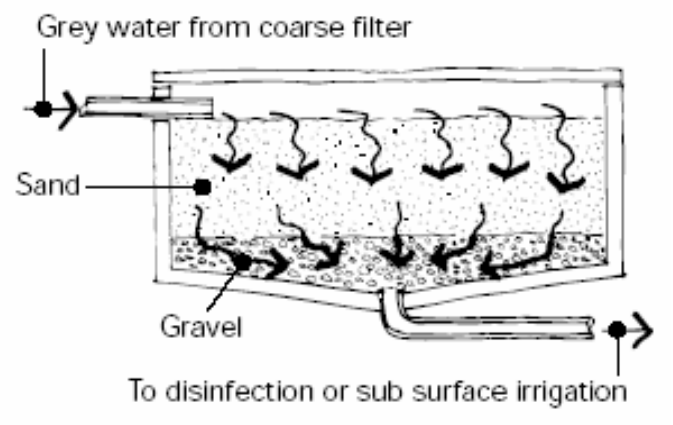

Fig 1: Simple structure for grey-water treatment

Table 2: Effect of aeration process in water

Water Sample	Turbidity NTU	BOD_5 mg/l	DO mg/l	pH
Initial	184	416	2.1	6.89
After 7 days				
Aerated	44.8	141	5.2	7.85
Non-Aer	386	367	1.2	6.39

Conclusions

For arid countries like Oman, grey-water appears to be an alternative source of water for selected uses. Efforts are underway to evaluate the reuse potential of grey-water and to develop guidelines. Overseas experience, in particular experience in arid and semi-arid countries indicate that grey-water can be a cost effective alternative source of water; and it can be used to further sustainable development and resource conservation without compromising public health and environmental quality. To make treated grey-water use a reality in Oman, in addition to developing necessary guidelines and treatment methods, there is also a need to generate interest among public and government organizations.

References

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