

GREYWATER RE-USE AND BENEFIT

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ABSTRACT

The focus of this paper is to study the characteristics of the black wastewater (wastewater from toilets) as well as the greywater (wastewater other than toilet effluents). For greywater COD, total solids, total coliform, and Fecal coliform did not exceed 51 mg/l, 106 mg/l, 35 cells and 23 cells respectively. The results showed that the greywater could be discharged to streams without opposing the Egyptian Environmental Requirements (EER). The greywater could also be used in agricultural purposes after having a simple treatment. There are two engineering proposals to re-use the greywater for flushing tanks to reduce the water consumption. The first is with pump and the second way by the gravity.

Keywords: Greywater, toilet wastewater, black wastewater, flushing unit, COD, total solids, total coliform, Fecal coliform, greywater re-use.

INTRODUCTION

Grey water is usually described as all sources of domestic water that have been used once, apart from toilet and bidet wastewater which is known as black water. Greywater has, by definition, relatively low levels of microbiological contamination, which has led to it being re-used as a source of non-potable water. Greywater can be used for various tasks but is most commonly used for toilet flushing alone, although care must be exercised even in this use as greywater can quickly degenerate into a hazardous microbial cocktail [1]. However, there are important distinctions between greywater and black water. Greywater contains only about 10% of the nitrogen contained in black water which, as nitrate and nitrite, is the most serious pollutant affecting potable water, and the most difficult to remove. Similarly, black water is the most significant source of human pathogens-those organisms that threaten human health but which do not grow outside the body unless incubated or hosted in human fascies.

Domestic users are increasingly recognizing that reducing water consumption is a necessary component of good environmental practice especially in the rural areas. Thus while the case for investing in household

system may be limited, it is now being recognized that new construction should consider re-use of grey water as part of its environmental assessment. The first objective of this research is the observation that the domestic grey water is not dangerous if re-used for flushing. The second objective is introducing an engineering design for using the grey water in houses either in rural area or at town.

EXPERIMENTAL WORK

The engineering design to reuse the grey water was fabricated with five flushing units (siphon), five floor drains; two small containers and 0.5 HP pump as shown in Figure (1). Tap water was used as a grey water and drained in the floor drains to be collected in the lower tank and then at specific level the pump lifts grey water to elevated tank to feed flushing units by gravity. The excess water from lower tank goes to inspection chamber.

Another way to re-use grey water is developed in Figure (2). In this way the grey water can be re-used by gravity from the fifth floor to fourth floor and so on. Only the top floor will use the water supply for flushing.

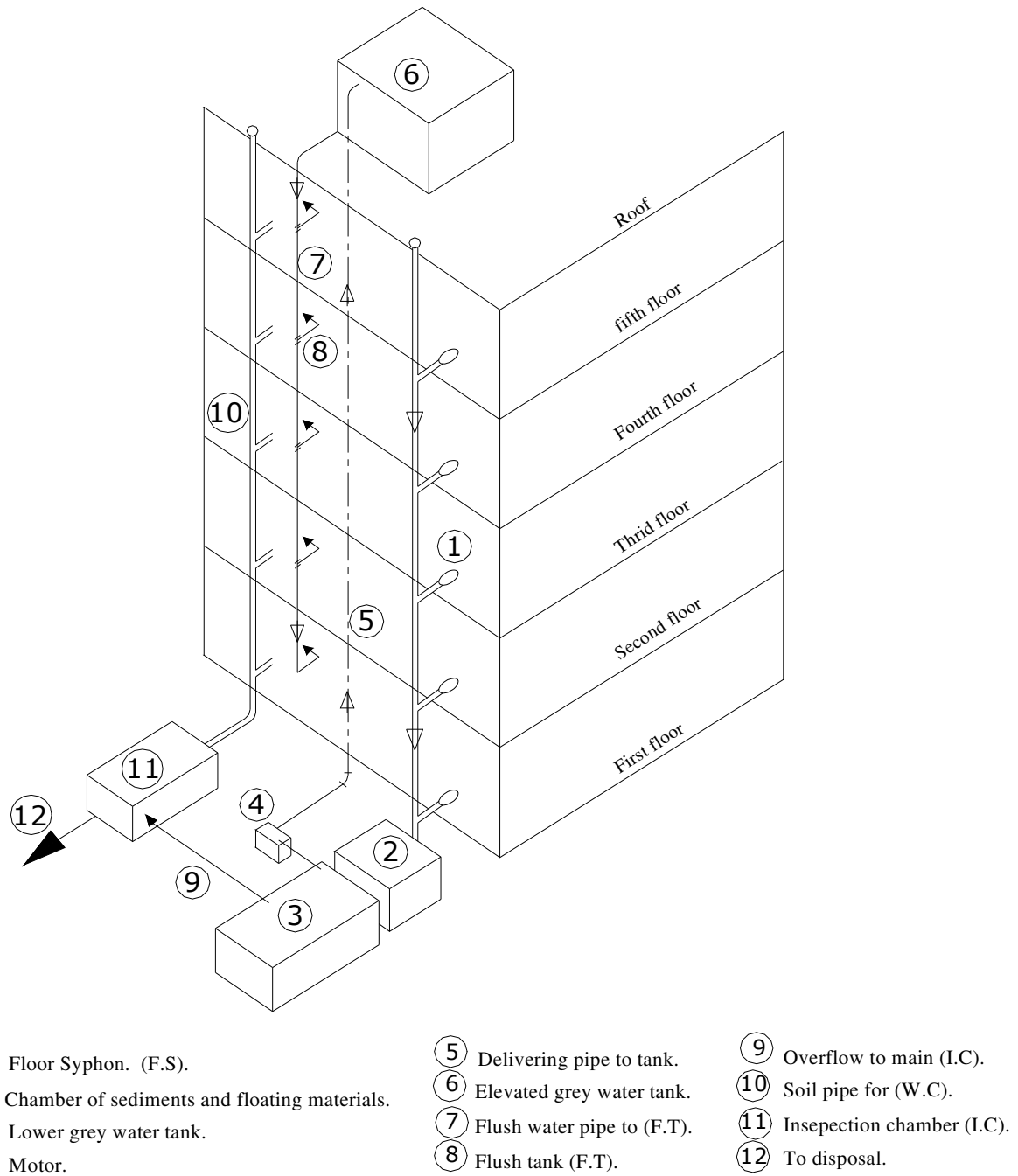


Figure (1). Ruse of grey water from floor syphon (F.S) with pumping.

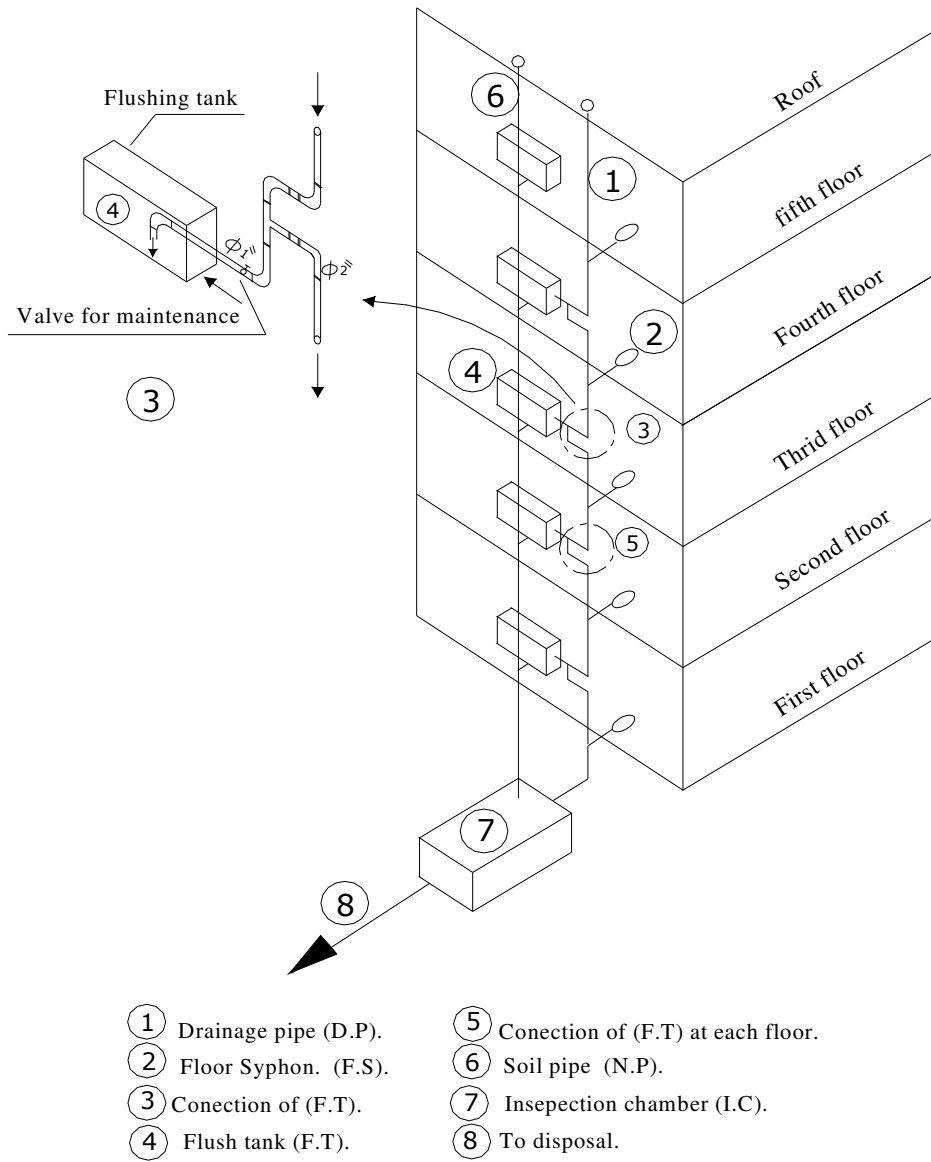


Figure (2). Ruse of grey water from floor syphon (F.S) without pumping.

SAMPLING AND ANALYSIS

Samples were collected from a ten stories building in a residential area. Samples were collected during day timer six samples per day, and then mixed for maintaining representative samples. Samples were taken for each wastewater on four consecutive days from Saturday to Tuesday. Greywater samples were collected from trapgally and the black wastewater samples were collected from the effluent of soil pipe at inspection chamber.

The analysis was done according to Standard Methods [2] for the (greywater and black water) were pH, COD, T.S, Total Coliform and the Fecal Coliform.

RESULTS AND DISCUSSION

Table (1) shows the data collected for black water and greywater. Figures (3), (4) and (5) are constructed from Table (1) to demonstrate the characteristics of both wastewaters. The results show that pH in the range of (7.3-7.4) for greywater while it is the range of (7.2-7.25) for black water. COD for greywater is 37 to 51 mg/l but it is 120 to 143 mg/l for black water. Also total solids for greywater is 85 to 106 mg/l and for black water is 480 to 530 mg/l. the most important is total Coliform and the Fecal Coliform was much lower in greywater than in black water. Fecal coliform was in the ranges of 11×10^6 - 14×10^6 for black water and is 22-35 for greywater. Fecal coliform also is in the ranges of 1300-2000 for black water and is 17-23 for greywater. As for the greywater the results show that with or without any kind of treatment, the final effluent could be reused or discharged directly to a stream. The absence of excreta develops the composition of the wastewater such that the real source of pollution is omitted.

According to the Egyptian Environmental Requirements (EER), law 4/94 and 48/82 allows the discharge of wastewater having a COD of 100, 30, 40 mg/l. The grey water could be discharged into coastal, Nile branches and the main stream. As for the analysis results of the grey water, there is a possibility of discharging this grey water without treatment. A simple treatment may be needed for the grey water for its reuse in agricultural purposes. But if the facilities of re-using the grey water for flushing could be arranged (because it is simple and not coastally), it will be much better because it will reduce the water consumption and leakage from flushing tanks. There are two ways to re-use the greywater for flushing because it is not harmful. The first way as showed in figure (1) can be done for any existed building especially in rural areas. The lower and elevated grey water tank can be fabricated from UPVC or steel sheets, and piping system with all fittings from UPVC or polypropylene (PP). This way is good for any building with any number of floors. The second way is better if

designed with plumbing system, but it is possible to fix it specifically for private buildings and it more economic for multistory building (more than four floors).

Table (1). Characteristics of the grey water and black water

Test	Sample No.	Black water	Grey water
pH	1	7.2	7.4
	2	7.22	7.35
	3	7.15	7.3
	4	7.25	7.33
C.O.D	1	120	51
	2	140	42
	3	135	37
	4	143	40
Total Solids	1	450	106
	2	510	100
	3	480	85
	4	530	90
Total Coliform	1	14×10^6	24
	2	12×10^6	30
	3	13×10^6	22
	4	11×10^6	35
Fecal Coliform	1	2000	15
	2	1500	21
	3	1700	17
	4	1300	23

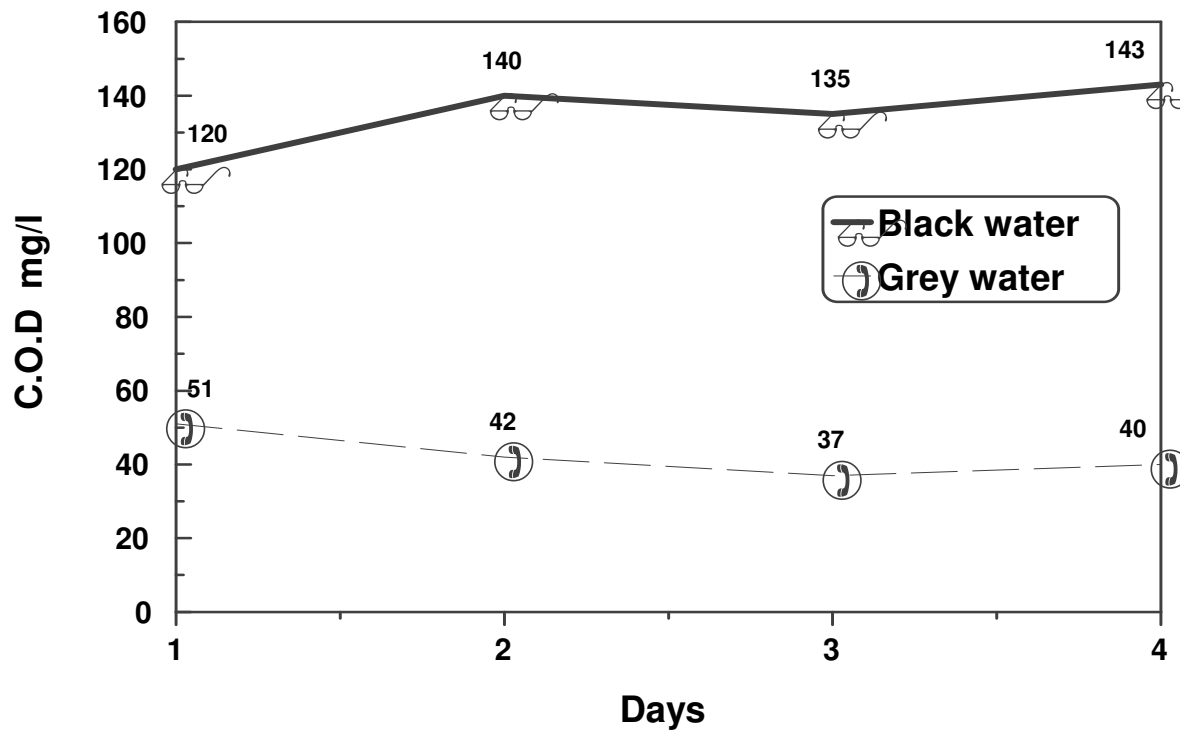


Fig. (3) C.O.D for grey and black water

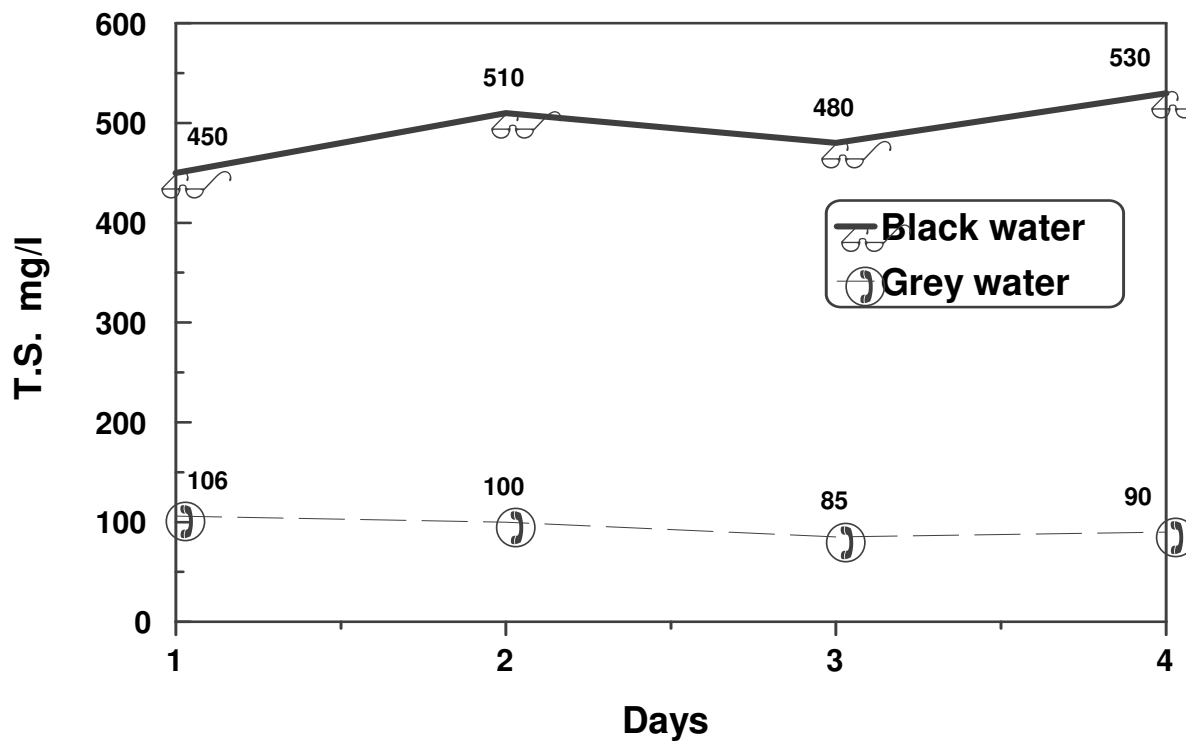


Fig. (4) Total Solids for grey and black water.

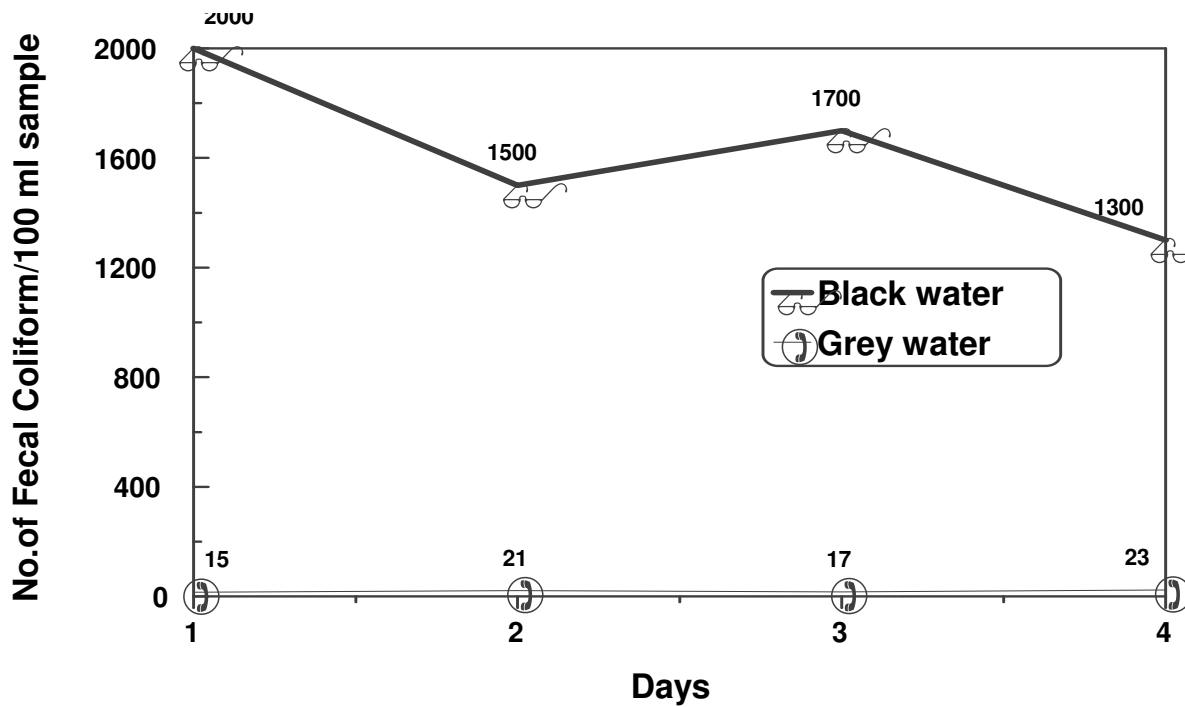


Fig. (5) Number of Fecal Coliform for grey and black water

CONCLUSION

Greywater can be re-used safely for flushing tanks at houses and public buildings. Grey water does not include the harm organisms as black water. COD and total solids were in range of 37-51 mg/l and 85-106 mg/l respectively. Total coliform does not exceed 35 cells and Fecal coliform 23 cells. It can be discharged in to stream or re-used in irrigation. But it is better to be reused for flushing to reduce and save the water consumption.

REFERENCES

- 1- Robert Jackson and Elizabeth ord; Grey water re-use benefit or liability? The UK perspective. Water 21, pp. 38-39, June 2000.
- 2- "Standard Methods for the Examination of Water and Wastewater", 19th Edition, American Public Health Association, Washington, 1995.