

Black and Grey Water Treatment and Reuse Experience In the Palestinian Rural Areas

Abu-Rahma, A.¹ Rabi, A.²

abdalrazzaq@phg.org¹, ayman@phg.org²

*Palestinian Hydrology Group (PHG)

Abstract

Wastewater, if not contained and treated, is a very significant pollution source that has serious adverse impact both on the environment and local residents. In the Palestinian Territory, there is no proper infrastructure for the disposal and treatment of wastewater in the West Bank due to the Israeli restrictions. Therefore, part of the wastewater generated by large cities and almost all wastewater generated by Israeli Colonies in the West Bank is disposed off in wadis or left to infiltrate through cesspits into the underlying vulnerable groundwater aquifers. These aquifers are the only water sources which face severe contamination threats. This has motivated deferent interested local organizations, since 2000, to adopt low-cost and appropriate wastewater treatment and reuse technologies. These technologies were initially acceptable to the public but unfortunately later faced technical problems that led to insufficient treatment efficiency and bad odors. continuous efforts invested in the sector by piloting other more advanced treatment units such as a septic tank up-flow gravel filters and also up flow sludge blankets combined with constructed wetland. Such technologies were applied in black and grey water treatment and are considered not only a cheap wastewater disposal method but also a new water source used for agricultural purposes that can save considerable quantities of fresh water especially since grey water forms about 80% of the total water used at household level. At least 60% of grey wastewater can be recovered, treated and reused thus more than 150,000 liters can be saved annually per household. By introducing a reliable water source poor families will be encouraged to cultivate their home gardens and be engaged in different agricultural activities which will without doubt contribute in the food security of the household in addition to improving their monthly income. Local organizations had successfully managed to provide treatment units to schools and households both in the West Bank and Gaza that have an average treatment efficiency of about 80% with COD values that fall within the acceptable guidelines set by WHO and PWA. The implementation of these units was accompanied by awareness activities about wastewater, the impact of poor disposal practices and the anticipated solutions in addition to training about the operation and maintenance of the units.

Key words: Black water, Grey water, treatment, reuse

1. Introduction

The problem of water supply in the Palestinian territories is one of the most difficult problems facing Palestinian society. The lack of water resources and the competition between different uses i.e. domestic, agricultural and industrial is increasing with time. Indeed, the limitation of water resources for the Palestinians is mainly due to the Israeli occupation authorities' laws and practices. Israeli

settlements control water resources, waste a lot of fresh water quantities, and produce a lot of wastewater which is disposed on Palestinian land contaminating the soil and the limited water resources available for Palestinians.

Cesspits used by Palestinians to dispose their wastewater are another source of pollution to water resources. These cesspits also form a large burden on the income of the Palestinian families, where some families spend about 20% of their monthly income to manage water and wastewater at house level. For that the Palestinian NGOs, especially Palestinian Hydrology Group (PHG) and Palestinian Agricultural Relief Committees (PARC) have implemented about 500 of grey wastewater treatment units and reuse in the West Bank and Gaza Strip that serve about 650 families and 30 schools, treating an average of about 0.5 cubic meter per day per unit. The treated grey wastewater is reused for irrigating the home and school gardens, fruit trees and vegetables eaten cooked. In addition, they implemented nearly 15 wastewater treatment plants using low cost appropriate technologies to serve rural communities in the West Bank. Such technology help improve local environment, economy and hygiene conditions at household level.

2. Methodology

Given the severe water shortage and contamination threats that Palestinian Communities are facing, PHG undertook to develop and adopt techniques for collection, treatment and reuse of wastewater both black and grey water. Among the methods used for black water treatment was the Up flow Sludge Blanket (USB) and constructed wetland while it used a septic tank up flow gravel filter followed by an aerobic filter system to deal with grey water at households and schools level(see Figure 1). PHG implemented these projects aiming to create new sources of water to be used for irrigation in home gardens in addition to making valuable improvements to existing sanitation systems in households and schools, which are threatening fresh water sources and public health. Grey wastewater forms about 80% of the total water used at household level. At least 60% of grey wastewater can be recovered, treated and reused.

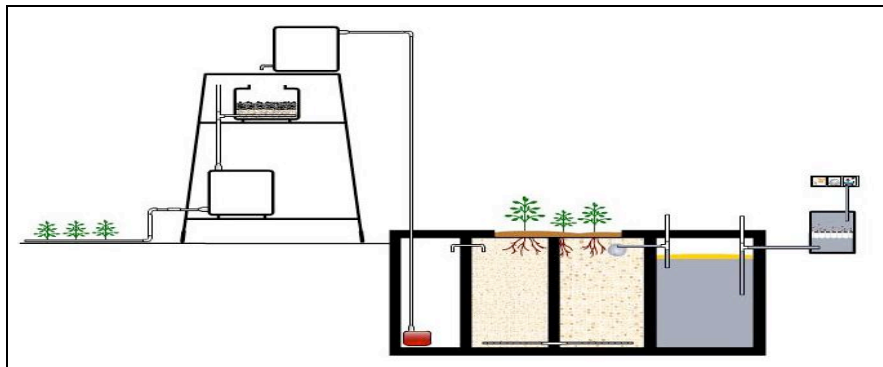


Figure (1): (a) Black and (b) Grey waste water treatment plant schemes used by PHG .

3. Results and Discussion

3.1 Treatment Efficiency

PHG implemented a number of Black water and GWWT projects in different places in Palestine, which all had the main goal of introducing a new source of water for the irrigation and preserving a safe environment. In total PHG has implemented more than 159 units of grey water and 15 black wastewater treatment units in various localities in the West Bank and Gaza. It was realized each household can save nearly 150,000 liters of fresh drinking water following the implementation of grey waste water treatment and reuse systems in the households. This could be more in the schools. We also realized that reusing of treated grey water is more socially acceptable than the treated full wastewater. The treated grey water was efficiently managed, treated and reused in irrigating home gardens. The implemented technology was proven to be efficient in removal of pollutants and also economical since it doesn't use any energy source and all the system is run naturally. Removal efficiency of the black water systems may reach 80%. However, in the case of the grey wastewater treatment units samples were collected from the West Bank and Gaza areas in order to measure the efficiency of the GWWT system. Tables 1 illustrate the results. It is clear that most values fall within the acceptable guidelines set by WHO and PWA (COD= 150–200mg/l). However where they do exceed the permitted limits reasons are due to inadequate operation and lack of maintenance.

Table 1: Characteristics of raw and treated grey wastewater from different sites Ramallah, Bethlehem and Gaza Strip.

Sample #	Location	In-effluent COD(mg/l)	Effluent COD(mg/l)	Efficiency(%)
1	West Bank	462.1	176.1	62
2	West Bank	692.7	475.0	31
3	West Bank	933.1	166.4	82
4	West Bank	702.5	192.4	73
5	West Bank	50.0	30.0	40
6	Gaza	1500.0	270.0	82
7	Gaza	820.0	80.0	90
8	Gaza	1500.0	230.0	85
9	Gaza	590.0	170.0	71

3.2 Treated grey wastewater reuse in the Palestinian rural areas.

The Palestinian rural areas experience a high level of drinking water shortage. There is a lack of water resources for all purposes (industrial, agricultural, and residential uses), and the existing sources of water are controlled by the Israeli occupation. The quantities of available water for the Palestinian people are limited and less than the minimum recommended by World Health Organization (WHO) standards, where the average consumption of the Palestinian per capita is 76 L/day (water for life 2006, PHG).

The Palestinian communities experience a great weakness in their water and sanitary systems infrastructures where most of the water networks experience deterioration and devastation, and most of the Palestinian communities are not connected to sanitary network and treatment plants.

A high percentage of Palestinian families in the villages especially the far-off ones live in poverty and low incomes. Most of these families depend on farming to ensure their basic needs of life. Because of the lack of water many use untreated grey wastewater to irrigate their farms and gardens without taking into consideration health and environmental risks especially to the children and women who are the direct user of this kind of water in addition to the social problems with neighbors because of the foul odors and insects, which ultimately affects the social bonds.

Grey wastewater treatment and reuse in the irrigation of gardens and farms is acceptable by the Palestinian families which helps ensure a good and durable source of water for agricultural use ensuring their basic needs from vegetables which are planted in the house garden with an area of 150 to 200 square meter, in addition to the reduction in pollution and sanitary problems caused by untreated grey wastewater (UNEP 2003). As earlier mentioned in this paper the Palestinian Hydrology Groups has implemented many grey wastewater treatment units in the Palestinian communities in addition to reclaim house gardens through providing the Palestinian families with irrigation networks and vegetable plants which can be irrigated with this kind of water according to the Palestinian and international standards. This helps in improving the healthy livelihood and conditions for poor Palestinian families.

However, reuse in Palestine remains to be very primitive and requires development mainly due to the lack of large scale infrastructure, social obstacles and public unacceptability. Farmers and households must be fully aware of the importance of reuse and how they can benefit from the treated wastewater by increasing the production and saving the costs that would in other case be spent on fertilizers and fresh water (ARIJ, 1994).

4. Conclusions & lessons learned:

- 1) Grey water can be a very significant water source for home gardens.
- 2) Treated grey wastewater is more acceptable for re-use than other kinds of treated water, due to religious and cultural beliefs.
- 3) Grey water treatment can contribute to improving the socio-economic conditions of poor families in rural areas by saving a considerable portion of their income spent on water supply and wastewater disposal.
- 4) Using treated grey water for agricultural activities protects the public from the risk of being infected with water borne diseases.
- 5) Grey water treatment also contributes in preserving the food security of these families by providing a reliable water source to produce a vegetable basket for the household.
- 6) Due to the poor condition of the sanitation infrastructure, the political situation and the deteriorating economical condition, PHG strongly believes that grey water treatment can be an effective solution to the wastewater management problem especially in the marginalized rural areas.
- 7) Through its experience, and that on a regional level, PHG has concluded that the up flow gravel filter is an acceptable technology that is low cost and easy to operate and maintain.
- 8) The concrete chambers developed by PHG are better than infiltrations ponds and parallel barrels previously used.
- 9) The mixed system consisting both aerobic and anaerobic processes overcomes many of the problems encountered in the previously implemented units especially due to the generated odors.

5. Recommendations: *It is recommended that:*

1. Grey and black wastewaters are separated for the purpose of on-site treatment and reuse.
2. On-site treatment through a septic tank and upflow gravel filter system (the system used by PHG) is provided for the reuse of grey wastewater for gardening.
3. Black wastewater must be directed to modified cesspit for safe and cheap disposal.
4. Alternative treatment options for the on-site reuse of wastewater should be investigated.
5. Such systems must be introduced in poor marginalized areas especially those classified as sensitive groundwater recharge zones.
6. Awareness and training activities related to the topic must be organized in these areas.

References

PHG, Water for Life 2006, WaSH Monitoring Program Report.

UNEP (2003), Desk Study on the Environment in the Occupied Palestinian Territories.

Palestinian Water Authority (2003), Rural Sanitation Report.

ARIJ, (1994). A Palestinian Vision of Environmental Protection and Sustainable Development.