Case study of sustainable sanitation projects

Greywater tower
Arba Minch, Ethiopia - draft

Fig. 1: Project location

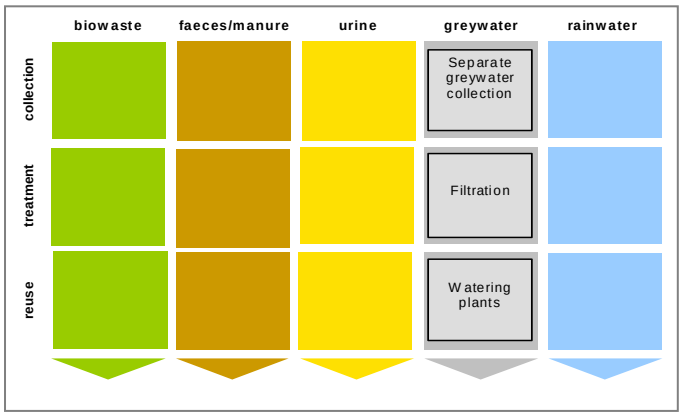

Fig. 2: Applied sanitation components in this project

1 General data

Type of project:
Household sanitation - pilot scale implementation of greywater reuse in peri-urban areas

Project period:
October 2006-March 2010

Project scale:
Number of inhabitants covered: 47

Planning institution:
ROSA Arba-Minch Team: Arba Minch Town Water Supply and Sewerage Enterprise (ARB)
Arba Minch University (AMU)

Executing institution:
ROSA Arba-Minch Team: Arba Minch Town Water Supply and Sewerage Enterprise (ARB)
Arba Minch University (AMU)
Jupiter construction micro and small enterprise
Daylight construction micro and small enterprise

Supporting agency:
European Union (EU)

Resource-Oriented Sanitation concepts for peri-urban areas in Africa

SIXTH FRAMEWORK PROGRAMME

The work was carried out within the project ROSA (*Resource-Oriented Sanitation concepts for peri-urban areas in Africa*; Contract No. 037025-GOCE; duration: 1.10.2006 – 31.3.2010), a Specific Target REsearch Project (STREP) funded within the EU 6th Framework Programme, Sub-priority "Global Change and Ecosystems".

2 Objective and motivation of the project

A greywater tower was selected as one of the methods that can be adopted to treat and safely reuse greywater for Arba Minch town and eight such units were constructed. In this unit the grey water can be used for growing vegetables successfully. The construction of the units does not require skilled labor. Awareness about the unit has been raised in the community of Arba Minch and promising demand has been created.

3 Location and conditions

Arba Minch town with a total population of 75,000 and annual growth rate of 4.5% is one of the fast growing towns in Ethiopia. There are wide ranging sanitation problems in the town. And these are expected to grow even worse with rapid population growth. A baseline study carried out in Arba Minch town by ROSA project in the year 2007 revealed that 73% of the households in the town spill their greywater in their compound, 13% spill it outside their compound, 8% spill it in a pit filled with gravel and only 6% use greywater for gardening. This study indicated that 94% of the greywater is recognized as a waste and is not reused.

4 Project history

The EU-funded project ROSA (Resource-Oriented Sanitation concepts for peri-urban areas in Africa) proposes resources-oriented sanitation concepts as a route to sustainable sanitation and to meet the UN MDGs.
The ROSA project started in October 2006. On the basis of the overall goal of developing and disseminating “Resource-Oriented Sanitation Concepts in peri-urban areas like Arba Minch town, the project conducted research including a baseline study and demand assessment on sanitation, identified different sanitation options (involving safe disposal and re-use) through research conducted by Arba Minch University and other international partners working on the ROSA project.

5 Technologies applied

Since its inception in October 2006, the ROSA project has introduced different resource oriented sanitation systems. One of the objectives of ROSA project is to develop sustainable decentralized solutions for greywater treatment

and reuse. Therefore, a greywater tower was proposed as one of the methods that can be adopted to treat and safely reuse greywater for Arba Minch town and nine such units were constructed in private compounds. Greywater tower is not a new idea. It was tested in South Africa and Kenya before.

6 Design information

The greywater tower is a circular bag which has got soil, ash and compost mixture in it and a gravel column at the center. It is used to treat and reuse greywater, water that has been usedfor bathing, washing clothes and utensils. Leafy plants or vegetables are planted in holes cut in the sides of the bag itself and each day the available greywater from a household is poured directly on the gravel column.

The Material required to construct one greywater tower includes the following

- Bucket with no bottom
- Five poles 2m in height
- 1mX2.5m shade cloth
- 0.05 m^3 soil
- 0.2m^3 compost
- 0.14 m^3 ash
- 0.085 m^3 gravel

Steps followed for the construction

Step 1

Mark out a circle which has a radius of 40 cm using a nail and a thread. (Refer Fig. 3.)

Fig. 3: 1 (left) Marking out the circle and 2 (right) planting the poles

As next step dig out the bottom layer of the tower and plant the side poles firmly into the bottom (Refer Fig. 4.)

Step 2

Wrap the shade cloth around the poles (Refer Fig. 4.)

Fig. 4: 1 (left) wrapping the shade cloth around the poles and 2 (right) Rolling down the sides of the shade cloth

Step 3

Roll the sides of the shade cloth cylinder down out of the way before filling and place the bucket on the ground in the middle of the tower (Refer Fig. 4.)

Step 4

Pack the gravel in the bucket and backfill around the bucket with the soil mixture (3 parts soil, 2 parts compost and 1 part ash). (Refer Fig. 5.). Pull the bucket partially out, leaving the gravel in position and back fill with the soil mixture. Repeat this procedure up to 1m level is reached. The greywater tower should finally look like the picture shown in Fig. 5.

Fig. 5: 1 (left) Mixing soil, compost and ash to fill the tower and 2 (right) Filled greywater tower.

Greywater tower
Arba Minch, Ethiopia - draft

7 Type and level of reuse

Each day the available greywater is poured into the bag directly on the gravel pack and leafy plants/ vegetables are planted in holes cut in the sides of the bag. (Refer Fig. 6.)

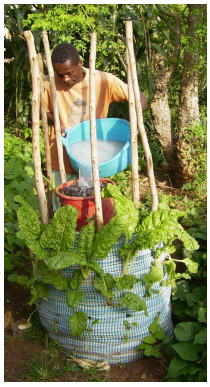

Fig. 6: Pouring greywater in to the tower

The studies conducted by ROSA project revealed that the daily average amount of greywater produced in Arba Minch is 45.7 liters per family.

8 Further project components

The absence of sufficient finance for households interested to construct the demonstrated innovative option has constrained efforts to further scale-up implementation. The project team has recently acquired additional funding from other sources. The SPA –Programme (Sanitation Programme Africa) offers 50 % grant from the Dutch government and 50 % loan arrangements to facilitate credit access to households who will construct any sanitation facilities including greywater towers. The total amount of money is about one million Euro and this money will be used as a revolving fund.

9 Costs and economics

The details on investment costs for constructing one greywater tower are given in the Table 1.

Table 1: Material cost

S.No.	Description	Unit	Qty	Unit price (Birr)	Amount (Birr)	Amount (Euro)
1	Shade cloth	m^2	2.50	5.50	13.75	0.74
2	wire mesh	m^2	2.50	35.00	87.50	4.73
3	Natural compost	Qtl	200.00	1.00	200.00	10.81
4	ash	m^3	0.14	0.00	0.00	0.00
5	soil	m^3	0.05	0.00	0.00	0.00
6	6cm Dia. Eucalyptus poles 2m in height	Pcs.	5.00	6.00	30.00	1.62
7	gravel 02	m^3	0.09	180.00	15.30	0.83
8	bucket	Pcs.	1.00	30.00	30.00	1.62
	Total				**377**	**20**

Two of the greywater towers were built for demonstration purposes. These units were considered as first testing units and the construction costs were covered fully from ROSA project budget. The other seven units were built with cost sharing whereby 75% of the total construction cost was covered by the households and the remaining 25% was covered from ROSA project budget.

10 Operation and maintenance

The units can be operated and managed by the users. There is not any waste emission caused by the unit. The unit can serve for more than one year without any problem. After one year strengthening the unit and planting new leafy plant seedlings may be required and it can all be done by the household.

11 Practical experience and lessons learnt

- Clogging of the gravel column was observed in some of the units. We therefore recommend putting a wire mesh on the gravel to filter bigger matter that may be found in the greywater.
- It is possible to reduce the height of the poles to 1.2m to reduce costs.
- It is observed that the shade cloth gets old and starts tearing after about one year. We suggest that it is better to use the shade cloth in two layers or search for a material which does not tear easily. A satisfactory result was found when a wire mesh was used together with the shade clothe. Refer Fig. 10.
- Further training (?) is needed for safe use.
- The system is successfully adopted in Arba Minch town.
- Additional (fresh) water needed to water the vegetables.

12 Sustainability assessment and long-term impacts

A basic assessment (Table 2) was carried out to indicate in which of the five sustainability criteria for sanitation (according to the SuSanA Vision Document 1) this project has its strengths and which aspects were not emphasized (weaknesses).

Table 2: Qualitative indication of sustainability of system. A cross in the respective column shows assessment of the relative sustainability of project (+ means: strong point of project; o means: average strength for this aspect and – means: no emphasis on this aspect for this project).

	collection and transport			treatment			transport and reuse		
Sustainability criteria	+	o	-	+	o	-	+	o	-
• health and hygiene	X			X				X	
• environmental and natural resources	X				X		X		
• technology and operation	X				X			X	
• finance and economics	X				X		X		
• socio-cultural and institutional	X			X				X	

Sustainability criteria for sanitation:
Health and hygiene: The technology reduce odour and flies.
Environment and natural resources: The excreta collected and reused for watering the seedlings which improves the crop yield, natural resources yield and modify the ver warm weather.
Technology and operation: The technology is accpeted even by small kids and rural residents who are not used any toilets before but construction the whole structure need trained local mason. It is being copied by the local mason.
Financial and economic issues: The toilet owners has farmland and he has started reusing excreta, fruit yield increase his income.

Socio-cultural and institutional aspects: The toilets are accepted by male and female users. There is no complaints and it is expected that they will inform their extended families residing in different part of the zone. The Arba Minch health bureau needs excreta to be treated and safe for handling and as they assured of that, they may accept and institutionalized it. However, this takes time.

With regards to long-term impacts of the project, the main expected impact of the project is improved public health. It is planned to assess this at the end of the project in late 2009.

13 Available documents and references

Arba Minch Town ROSA project booklet,
http://www.amu.edu.et/ROSAfiles/Bl.pdf
General project information:
http://rosa.boku.ac.at

14 Institutions, organisations and contact persons

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