Case study of sustainable sanitation projects

Greywater tower for peri-urban areas Arba Minch, Ethiopia

Fig. 1: Project location

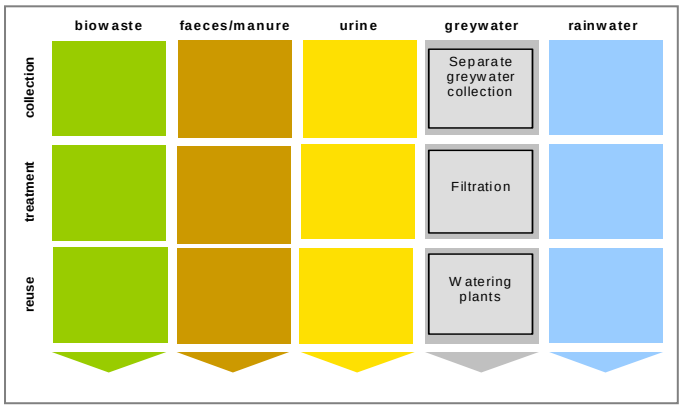

Fig. 2: Applied sanitation components in this project

1 General data

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

Project period:
1 April 2007 – 30 March 2009

Project scale:
Number of greywater towers built for households: 9
Number of inhabitants covered: 47
Total investment (in EUR) 180

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)

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 in Arba Minch town. Nine such units were constructed in which the grey water can be used for growing vegetables successfully. The construction of the units does not require skilled labor. The aim was to raise awareness about the unit in the community of Arba Minch and promising demand has been created.

Fig 3: Greywater tower with leafy plants. Source: ROSA project document in 2007-2009.

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 worsen owing to rapid population growth. A baseline study carried out in Arba Minch town by the ROSA project (Resource-Oriented Sanitation concepts for peri-urban areas in Africa) 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 recognised as a waste and is not reused.

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4 Project history

The EU-funded project ROSA 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. The project team also 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 the 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.

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 used for 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 included the following

- Bucket without bottom
- Five poles 2m in height
- 1m x 2.5m shade cloth
- 0.05 m^3 soil
- 0.2m^3 compost
- 0.14 m^3 ash
- 0.085 m^3 gravel

Fig. 4: Left: Marking out the circle. Right: Planting the poles.

Steps followed for the construction

Step 1

A circle is marked out which has a radius of 40 cm using a nail and a thread (refer Fig. 4). As the next step the bottom layer of the tower is dug out and the side poles firmly planted into the bottom (refer Fig. 4).

Step 2

The shade cloth is then wrapped around the poles (Refer Fig. 5).

Step 3

The sides of the shade cloth cylinder are rolled down out of the way before filling and placing the bucket on the ground in the middle of the tower (Refer Fig. 5).

Fig. 5: Left: Wrapping the shade cloth around the poles. Right: Rolling down the sides of the shade cloth.

Step 4

Gravel is then packed in the bucket and soil mixture (3 parts soil, 2 parts compost and 1 part ash) is then backfilled around the bucket (refer Fig. 6).

Fig. 6: Left: Mixing soil, compost and ash to fill the tower. Right: Filled greywater tower.

The bucket partially pulled out, leaving the gravel in position and backfill with the soil mixture. This procedure is repeated up to 1m level is reached. The greywater tower should finally look like the one shown in Fig. 6.

Greywater tower for peri-urban areas Arba Minch, Ethiopia

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. 7.)

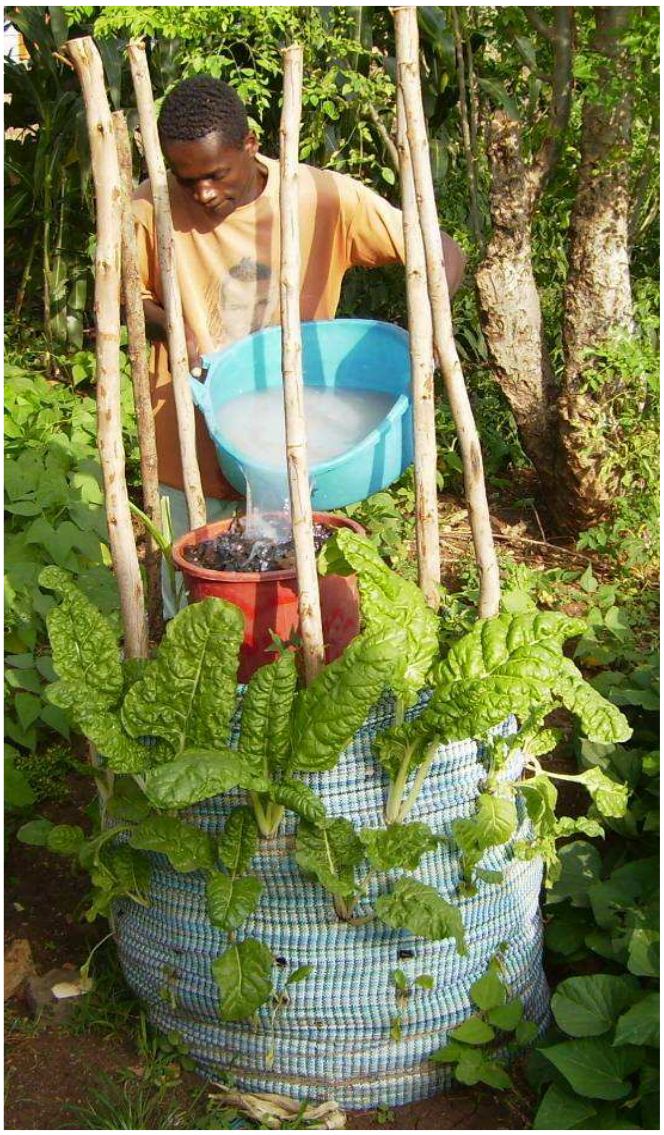

Fig. 7: Pouring greywater in to the tower.

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 would like to construct sanitation facilities including greywater towers. The total amount of available money is about one million Euros 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

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	Eucalyptus poles (Height: 2m; Dia: 6cm)	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. This can all be done by the household.

11 Practical experience and lessons learnt

This project provided critical insight in the construction grey water towers.

- Clogging of the gravel column was observed in some of the units. Putting a wire mesh on the gravel was therefore recommended to filter bigger particles that may be found in the greywater.
- It is possible to reduce the height of the poles to 1.2m to reduce costs.
- It was observed that the shade cloth gets old and starts tearing after about one year. Therefore it was recommended 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 cloth.
- The system is successfully adopted in Arba Minch town.

- Additional (fresh) water was 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 emphasised (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 include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.
Environment and natural resources involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.
Technology and operation relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.
Financial and economic issues include the capacity of households and communities to cover the costs for sanitation as well as the benefit, such as from fertiliser and the external impact on the economy.
Socio-cultural and institutional aspects refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" (www.susana.org).

With regards to long-term impacts of the project, the main expected impact of the project would be improved public health but this has never been assessed.

13 Available documents and references

1. ROSA AMU, ROSA ARB (2009) Arba Minch Town ROSA Project booklet, Arba Minch, Ethiopia, http://www2.gtz.de/Dokumente/oe44/ecosan/en-rosa-project-booklet-arba-minch-2009.pdf
2. General project information: http://rosa.boku.ac.at

14 Institutions, organisations and contact persons

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Case study of SuSanA projects
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