Practical ACTION

COMPOST TOILETS
Low -cost eco-sanitation solutions

TECHNICAL BRIEF

Many types of compost toilets are available today. They are designed to suit a variety of customs, cultures and climates, and vary enormously in price. Composting of human faeces is as old as the hills - it is Nature's way of safely reintegrating human waste with the soil. All compost toilets, however simple or complex, are devices for helping Nature achieve this. Contrary to popular opinion compost toilets can be very clean and hygienic and do not smell. They save huge quantities of water in a world where water is becoming an increasingly precious resource. For example, a family with a water flush toilet would use at least 100,000 litres of water a year for flushing. They protect surface and ground water from sewage pollution and, unlike water flush toilets, compost toilets do not produce sewage and do not smell. This technical brief looks at low-cost compost toilets that are effective in areas where other types of toilet may not be suitable such as water-logged areas. They do not require electricity or great investment. Built using local materials, it is a self-contained unit that produces good compost and protects the soil and water from any contamination.

Figure 1: Rabi Lal Gurung outside his newly constructed toilet in Thimura, Nepal. Photo: Anna de la Vega / Practical Action.

The selection of the most appropriate type and design of compost toilet will depend on many factors which include social and cultural norms, attitude to faeces, existing hygiene and sanitation practices, sources of drinking water, availability of organic residues, climate, soil types, patterns of habitation and local construction materials etc. Note that, in dry climates, desiccating or drying toilets may sometimes be more appropriate than composting toilets because the dry ambient air can be encouraged to flow through the faeces chamber removing any moisture, thus rendering the faeces dry and odourless.

It is important to realise that any compost toilet programme also requires an education programme to ensure that the principals
of use and maintenance are clearly understood and accepted by the user group.

Introduction

In waterlogged and high water table areas, pit latrines and septic tanks can, and often do, contaminate well water with human faeces. This is a common occurrence in coastal areas with high population densities. In such places where open defecation on the sea shore and derelict land is the normal practice, many families want to have their own, or at least, a community latrine. In a crowded village, the wells and latrines would be forced to lie close together. If septic tanks, soakaways and pit latrines are used, the well water will inevitably become contaminated.

Figure 2: With urine separation one option is to collect the urine so that it can be used as a liquid fertiliser later on. Photo: Practical Action, South Asia.

Water contaminated with human faeces puts people at a high risk of cholera, dysentery, diarrhoea, jaundice, typhoid, polio and intestinal worms. A dry composting toilet protects water and soil and therefore helps protect the people in the community.

Big change starts small

Coupled with an effective hygiene awareness programme this can result in significant reductions in the occurrence of diseases.

Compost toilets are often built with two chambers for simplicity of construction and operation. The two chambers are used alternately; decomposition continuing in the full one until it is emptied just prior to the other one becoming full. Each chamber has its own opening for removal of mature, non-odorous compost. Some types of compost toilet batch the waste in movable receptacles on trolleys or turntables whilst others generate the compost slowly and continuously as the material progresses through the device. Some require electricity for small heating elements (in cold climates) or fans (to ensure a positive airflow through the system).
Some compost toilets combine the urine and faeces whilst others separate them. The compost formed by the combination of urine and faeces is better as the urine contains valuable nutrients but these toilets are more likely to smell if used carelessly and they require much greater quantities of carbonaceous residues like sawdust and straw. However, urine can be used on its own as a liquid fertiliser so that the nutrients are not lost. It is collected and stored for a time before being used on agricultural land. It is relatively safe to handle and store. More complex types of compost toilet design require dry access under the toilet via a basement or cellar room.

Appropriate use

The compost toilet described here is a highly effective solution to sanitation in high water table and waterlogged areas. However, it can be used as a reliable and low-cost water conserving technology in many other areas as well. It can be built beside or as part of a house in rural, urban or peri-urban areas and can even be established inside a house or apartment. It has the potential to make a significant contribution to domestic water conservation in towns and cities as well as rural areas. Also, since there is no need to connect it to sewerage systems, there is no extra burden on often already overloaded services.

The compost toilet is suitable for use by a family, or it can be built in clusters for institutions, schools, hostels and so on. However, it is recommended that the use of compost toilets is managed within the community and that very good education and awareness raising is done before building begins. Open access community compost toilets are not recommended other than in well-educated and highly motivated communities.

Location

Any toilet would usually be located on the down-wind side of a dwelling and the same applies for compost toilets. However, when built and designed well with good education, the compost toilet does not give any bad odours and be within the owners plot to prevent disputes later, especially important in very crowded communities. A significant advantage of compost toilets is that their location is not dependent on the location of sewers or gradients. They can be established in a confined space either within or beside a human dwelling, whether it is a thatched hut or high rise apartment block.

Construction

The compost toilet comprises a raised slab over two chambers. The chambers are built on the ground, not in it. In very waterlogged areas, or those prone to flooding, a slightly raised plinth can be made. The chambers are plastered with cement internally in order to waterproof them and make compost removal tidier. Over each chamber there is a hole in the slab for faeces and a funnel to receive the urine. In some toilets there is a trough in the centre of the slab, between the two chambers over which the anal cleansing is performed. The anal cleansing water trough and urine funnel is inter-connected and flow to an evaporative plant bed outside the latrine.

Big change starts small

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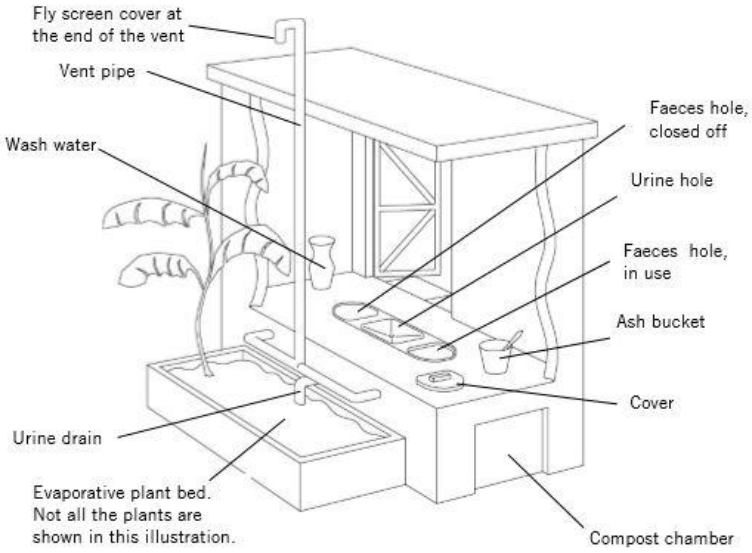

Figure 3: Double chamber compost toilet with cut away wall to show interior, Sri Lanka design. Illustration: Neil Noble / Practical Action.

In the simplest version, the chamber doors are closed by bricks and mud mortar, both of which can be reused to close it again. However, ferrocement, timber, marine ply or other materials may also be used where they are appropriate locally.

The chambers are designed to have an accumulation time of about nine months to allow thorough composting of the contents and elimination of pathogens. The compost produced is an almost dry, crumbly, black product having a light, pleasant, earthy odour. There is no fly nuisance or any odour problem and the toilets remain clean and pleasant to use. The plant bed needs almost no maintenance and the only requirement is to cut back excessive growth which can be chopped up and added to the compost chamber if required.

Operation and maintenance

Before starting to use the latrine, each chamber is half filled with straw, twigs or dry leaves. These provide the necessary additional carbon to the composting process and along with the faeces will compost down to a fraction of their original volume. Occasionally additional straw may be added through the faeces hole if the contents of the chamber start to become wet or slightly odorous. After each use, a spoonful of dry cooking ashes or lime should be sprinkled down the faeces hole which is then closed using a simple cover.

When one chamber is full its defecation hole is sealed and use of the second chamber begins. Once the second chamber is full the first is opened, the compost is removed and the chamber is re-primed with straw. The compost can be put around flowers, plants or trees. The urine and wash water go directly to the plant bed where flowering plants grow. The plant bed does not leak to the ground because it is sealed. Being diluted by the wash water, the urine does not smell and is quickly absorbed by the soil in the plant bed and feeds the plants. The plant bed area depends on local climate and the number of users.

Using the compost toilet

- Remove the cover.
- Squat and defecate in the defecation hole and urinate in the urine funnel. (A pedestal seat and urine catcher can be arranged if the culture favours sitting rather than squatting.)
- Wash over toilet area or washing trough.
- Instead of flushing, simply sprinkle a spoonful of dry cooking ashes, lime or sawdust into the defecating hole and replace the cover.
- Wash hands with soap and water.

Awareness raising

Adequate awareness raising and training needs to be given to the users in the early stages of establishing the compost toilet. It is essential that the toilet is correctly designed and built and that there has been a very interactive

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and participative approach to its introduction. If these steps are taken, there is a far greater chance of the compost toilet being "owned, understood and accepted" by the community which is essential if it is to be successful.

The need for interactive training and awareness raising is to unravel and dispel the misunderstandings and confusion that often surrounds sanitation, health, hygiene, water and the environment. For example, in one project the main interest in the compost toilet was for the privacy it gave rather than because it was safer and more hygienic than open defecation. At the same time, the greatest fear of the users and neighbours was that it would smell. By knowing the fears and misconceptions, the hygiene awareness raising can be tailored to suit the needs of a specific community.

Training of the awareness team must also be done very carefully and interactively as they may have the same misconceptions as the community. It is often beneficial to build the team from amongst women and youths already active in development in the community and who are held in good regard locally. Some methods that have been effective in reaching the community are the performance of street dramas explaining the many faecal-oral routes that give rise to disease and relating them to every day events and habits. Illustrated leaflets can be distributed, games played and songs sung with children and adults, both in school and leisure time. House visits should be made to follow up the messages and discuss the dramas and leaflets. These visits can be particularly effective since people are generally more willing to express any doubts in private.

Cost

The cost of a toilet will vary for each location. Roughly the compost toilet depicted in Figure 3 can be built in Sri Lanka for around $400 (2013) using fired bricks, cement mortar, a reinforced concrete slab and a ferrocement roof. While in Nepal compost toilets are being built for around $130 (2013) up to the plinth level, the superstructure is generally built by the owner at no cost. The cost can be higher or lower depending on the complexity and permanence of the construction, the materials used and the level of refinement of the details sought by the owners. The roof, superstructure, internal finish and the door are the chief variables and can significantly affect the cost.

Benefits of compost toilets

The use of compost toilets means that cities and peri-urban areas do not need to extend capital intensive sewerage networks and sewage treatment plants. The recurring cost of maintaining additional infrastructure is also avoided. Both these factors represent a huge saving. Also, in areas where toilets would be flushed with municipal water there is an enormous saving in water requirements. Cross contamination between water mains and sewers is eradicated where compost toilets are well established as the standard sanitation technology. Soils are steadily improved by the regular addition of good quality compost. Conventional sewage treatment invariably leaves a dangerous sludge that still needs further treatment or incineration whereas compost toilet systems produce a useful product.

In water logged areas where there was previously no satisfactory sanitation system operating, the benefits that compost toilets provide are clear. They can prevent ground and surface water contamination and protect people's health in areas where open defecation on the ground or directly into water bodies has been the norm. The production of safe compost and effective use of the urine and wash water are also a significant benefit.

The technology also lends itself extremely well to areas with hard rocky soils where excavation of pits is difficult, expensive or inappropriate. Again the compost is valuable and can help to provide a better chance of establishing plant cover on thin and fragile soils.

Summary-advantages of the compost toilet

- No need to dig pits.
- No need for sewers and treatment plants.
- No need for external infrastructure.
- Safe and affordable for anywhere but especially high water table and or water scarce areas.
- Does not pollute the ground or surface water or the soil.
- Does not produce flies or smell.
- Uses less water than any other toilet. A water flush toilet for a family can use 100,000 litres of water a year for flushing; the compost toilet saves all this water.
- Totally self-contained sewage treatment on site. There are no sewage pipes, no septic tanks, and no dangerous emptying of hazardous sludge.
- No mosquitoes. Septic tanks and pit latrines often have poorly fitting covers or the covers are not carefully replaced after emptying. These places then become prime breeding sites for mosquitoes. In a compost toilet there is no place for mosquitoes to breed.

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- Produces safe, useful, non-odorous compost.
- The evaporative plant bed can support growth of attractive flowers, fuel wood, vegetable or plantain.

References and further reading

- *Ecological Sanitation in Sri Lanka*
  Video: This video explores the options, and shows how the EcoSan toilet can provide an answer. Each stage of construction is shown in detail
- *Low-cost sanitation technology - Zimbabwe*
  Video: EcoSan toilets built in Zimbabwe.
  Ecological Sanitation: a concept Practical Action Technical Brief
- *Reuse of faeces and urine* Practical Action Technical Brief
- *Training Manual for Eco-toilet Construction* Commitment Consultants, SPACE, BASA, and Practical Action Bangladesh.
- *Low-cost Sanitation*; A survey of practical experience, J. Pickford, Practical Action Publishing
- *The Challenges of Urban Ecological Sanitation*: Lessons from the Erdos Eco-Town Project, China. Arno Rosemarin, Jennifer McConville, Amparo Flores, Zhu Qiang, Practical Action Publishing
- *Toilets That Make Compost: Low-cost, sanitary toilets that produce valuable compost for crops in an African context* Peter Morgan, Practical Action Publishing
- *Environmental Sanitation*, S.A. Esrey, U. Winblad et. al. 1999 SIDA. Sweden. Also available at the website www.gwpforum.org www.compostingtoilet.org.
- *Ecological Sanitation in India and Sri Lanka*, Paul Calvert, Ajith Seneviratne, D.G.J. Please visit http://www.ecosanres.org/ for more information.
- *Composting Toilets – LifeWater* www.lifewater.org/resources/san1/san1o6.pdf
- *The Humanure Handbook for composting toilets*. http://www.weblife.org/humanure/default.html

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Website: http://www.lboro.ac.uk/well (WELL)

WELL Factsheets
- Ecological Sanitation
- On-site sanitation in areas with a high groundwater table

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This technical brief was originally written by Paul Calvert of Eco-solutions, based on his experience of designing and building compost toilets and hygiene awareness programmes in India. It was updated by Practical Action in 2013 based on work in Sri Lanka and Nepal.

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