Dry sanitation solutions

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Introduction

Every day the world's six billion people produce over a million tons of faeces (Peasey 2000) and current waste management methods are not coping, either in terms of protecting human health or the environment. There is a lot of interest in dry sanitation as an alternative to conventional methods and a review of the subject indicates that it really does work.

What is Dry Sanitation?

Dry sanitation is defined as the disposal of human waste without the use of water as a carrier. Often the product is then used as fertilizer (Pacey 1978; Lachapelle 1995). In developed countries, dry sanitation toilets were initially designed for use in remote areas for practical and environmental reasons. However, increasing environmental awareness has led to some people using them as an alternative to conventional systems. In developing countries they can be a low-cost, environmentally acceptable, hygienic option.

With *dehydrating* toilets, the urine is diverted away and the faeces collected in a chamber(s). Lime, ash or soil is added each time. When full, it is sealed and after some months the product is used as fertilizer or buried (Pacey 1978). Examples are the Vietnamese double vault toilet, which has been used widely in Vietnam since 1954, and adapted models in Mexico and Guatemala.

With *composting* toilets, the faeces are broken down by bacteria and fungi. Other organic matter such as coconut husks, straw or vegetable scraps are added. Temperature, airflow and moisture content are all carefully controlled to maintain aerobic conditions. Excess urine is drained away or evaporated (Del Porto 2000). Examples are the SIRDO, a prefabricated Mexican toilet, the Swedish Malthus and prefabricated and homemade Pacific Island versions.

Environmental Aspects

Advantages are:

- Vastly reduced water use – limited to what is needed for cleaning body and toilet.
- Minimal groundwater contamination.
- Recycling of biowaste.

Disadvantages are:

- Composting stops below 5 °C, and is slow below 20 °C.
- Solar heating panels are dependent on clear weather.

Hence dry sanitation toilets may be unsuccessful in more temperate areas. The solar toilets on the Routeburn Track in New Zealand are one such example (Chapman, pers. com.).

Public Health Aspects

Advantages include:

- Faeces inaccessible to animals such as pigs and rats.
- Faeces isolated from the groundwater, in contrast to conventional pit latrines.
- Breeding of flies discouraged by faeces isolation (lids, meshes over vents, etc.).
- Minimal concentration of pathogens in the end product.

Disadvantages include:

- Sufficient time and correct usage are essential to kill pathogens.
- Handling of partially infectious material (if removed from chamber for sun drying).

- Handling urine carries a risk if user has *Ascaris* or schistosomiasis.

Only a limited amount of research has been done on pathogen survival in faecal material. *Ascaris* (roundworm) eggs are a good marker of contamination since they can survive for many months. The Engelberg guidelines can be used for acceptable levels of faecal coliforms (<1000/l) and nematode eggs (<1/kg wet weight) in fertilizer to be used in agriculture (Peasey 2000).

Dehydrating toilets

North Vietnamese, who commonly use dehydrating toilets, have a 90% infestation rate with *Ascaris*, whereas South Vietnamese, who defecate over fish ponds, have only a 45-60% rate, which suggests that the former process might not be killing *Ascaris* ova (Peasey 2000). Studies of the Vietnamese toilets found that the most significant factor for pathogen die-off was high pH, caused by the addition of ash or lime, and time away from the host, rather than desiccation or pile temperature, which was not significantly higher than ambient. *Salmonella* survived up to five months and *Ascaris* eggs almost six months (Pacey 1978). However, in studies the Vietnamese toilets fulfilled the Engelberg guidelines after six months while Guatemalan ones did not. In Guatemala it was suggested that the material be sun-dried for several months afterwards since this rapidly reduces egg viability.

Composting toilets

If composting temperatures of 50-60 °C can be reached, all pathogens and worm eggs die in a few days, however, these temperatures are rarely achieved. In the SIRDO toilet, only fertilizer from the solar toilets fulfilled the Engelberg guidelines. Prefabricated units worked best, with no pathogens at all after six months (Peasey 2000).

Cultural and Social Acceptability

Experiences in Mexico, Vietnam and many areas have shown that a slow introduction is better, with good training of future users and community education (Pacey 1978; Clark 1997). It is better to keep the projects small-scale as then good follow-up can be provided, otherwise people give up. In Mexico and Pacific Islands, it was found to be useful to install toilets for willing influential people in the community, so that others who came to observe or to try them then became interested themselves (Papaport 1995; Clark 1997). In this way the technology was not imposed on them. Using such toilets requires the cooperation of the community and appropriate service coordination to ensure regular inspection, collection and distribution of the fertilizer. This is occasionally difficult to achieve as an experience in Tanzania demonstrated (Mara 1982). Csar Anove in Mexico made the valid point that not everyone is going to be willing to alter habits or make the required effort (Clark 1997).

Advantages are:

- If the toilets are made locally and from local materials, they are inexpensive and provide work.
- The fertilizer increases agricultural production (shown in Vietnam).
- Less dependency on centralized high technology and government.

Disadvantages are:

- Users need to understand the basic principles and be motivated.
- Men must sit to urinate (not always popular).
- May conflict with cultural beliefs about defecation. Some religions require the use of water for anal cleansing.

Dry sanitation toilets have a lot of potential. They have clear environmental, social and public health advantages. Their main disadvantage is that there is often insufficient reduction in pathogens. A point often omitted in pro-composting toilet literature. Obviously, more research is needed about pathogen die-off and further modifications in methods.

People in developed countries live in a throwaway society – our rubbish gets whisked away by the rubbish truck, our faeces vanish down the toilet hole and we do not have do deal with them after that. Using dry sanitation toilets would help make people more responsible for their waste and help keep them aware of the balance our world requires. Did not Freud talk about young children suffering anxiety after being separated from their faeces? Perhaps having to deal with it ourselves will help us be more well balanced people!

References

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