



Centre for  
Alternative  
Technology

# Composting Toilet Design

Information Service, Centre for Alternative Technology, Machynlleth, Powys, SY20 9AZ.

Tel: 01654 705989; email: [info@cat.org.uk](mailto:info@cat.org.uk)

<http://info.cat.org.uk/water-and-sewage>

Composting toilets provide complete sewage treatment without using water for flushing. They can be completely water-free if alcohol gel is used for hand cleansing.

## *How they work*

Human excreta falls into a composting chamber beneath the toilet pedestal. Naturally occurring bacteria, fungi, worms and other organisms thrive on this organic matter as a food source, and break it down into humus, or compost. The use of an appropriate 'soak' material is necessary, as is controlling moisture through urine separation, and a ventilation system.

Human excreta can contain pathogenic bacteria, viruses and protozoa, and may be dangerous to human health. Composting kills these human pathogens - the finished compost is safe and free from odour. Compost is usually removed once per year, and is an excellent soil conditioner, ideal for use on ornamental flowers and shrubs.

## *Twin chamber compost toilets*

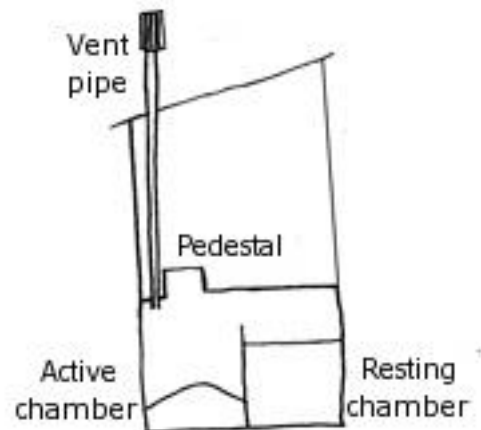
There are many types of composting toilet, from expensive proprietary systems to simple self-build units. A reliable and robust approach for the UK climate is to two separate chambers beneath the toilet pedestal - one is in use and the other resting, with the two alternated each year.

The pedestal sits above the active chamber, and the resting chamber is capped-off. Over the course of the first year the active chamber fills with excreta and 'soak', and when it reaches capacity the pedestal is moved across to the resting chamber for the second year. During this time the contents in the first chamber have a full year to compost with no fresh additions. At the end of the second year the contents of the original chamber are fully composted and can safely be removed. The pedestal is moved back above the empty chamber while the other matures - and so the cycle

continues. This batch processing means there is no contamination of mature compost with fresh faeces.

## *Venting the Chamber*

Appropriate venting is essential for effective and odour-free operation. A vent is designed to draw air across the top of the chamber to speed the compost process, and to draw air from inside the toilet cubicle (down toilet pedestal) to prevent bad odours. Passive venting is possible with careful design. Alternatively, a low watt fan gives excellent results and costs only £5 per year to run.



## **Basic twin-chamber design with vent**

To prevent bad odours it is essential to stop air being blown from the chamber up into the cubicle - this can occur in inadequately designed toilets on windy days. A totally sealed compost chamber is required - so it is wise to seek detailed design advice from a competent installer.

There is considerable scope for creativity in the design of the toilet cubicle. Timber frame structures are popular and attractive. For a robust and vandal-proof loo you might consider a metal clad unit.

### *Fly control*

The risk of a fly infestation is minimised if compost is kept fairly dry - and urine separation ensures this. A well-sealed chamber and protected vent prevents flies entering. Flies inside the chamber can be attracted to a dedicated fly-trap or to the light shining down a vent pipe, so becoming trapped at the fly screen at the top.

### *Soak*

A soak material is added to the compost chamber to aid the composting process. In our experience, wood-shavings are best for public toilets.

Conventional wisdom has been to add soak after every toilet use (as an alternative to the flushing ritual). The problem with this is that the public, not used to compost loos, do not know the procedure. Typically they put too much soak down a toilet with the result that soak occupies most of the chamber volume. The toilet cubical also tends to become scruffy, with sawdust scattered about. To keep the chamber size as small as possible, the minimum amount of soak should be added. Our experience at CAT is that a daily or even weekly addition of soak by 'the operator' is better than leaving users to add soak indiscriminately.

### *Urine separation*

For effective odour-free composting in the UK climate it is essential to divert the urine from the compost chamber. Urine separating toilet pedestals are available that intercept urine on a metal plate and divert it to a drain. Separation only works when users are sitting down.

Gentlemen won't sit to pee unless forced, so it may well be best to install a separate urinal (which can be waterless) that leads to the same drain.

**Image: A urine separating plate that fits inside a compost toilet pedestal**



Urine separation systems can be self-built, or proprietary urine separating compost toilet pedestals are available. Urine is sterile, so safe to handle - it is an excellent plant food containing just the right balance of plant nutrients (Nitrogen, Phosphorus, and Potassium). Alternatively, pipe the urine to a soakaway outside the building. A typical soakaway could be 4 meters long, 500mm wide, 500mm deep and filled with rubble or large (40-50mm) stone.

### *Routine Maintenance*

Once per week the toilet operator needs to open the access hatch and inspect the compost chamber. If a large 'peak' is accumulating under the pedestal this needs to be levelled by raking forward. An appropriate quantity of soak is added.

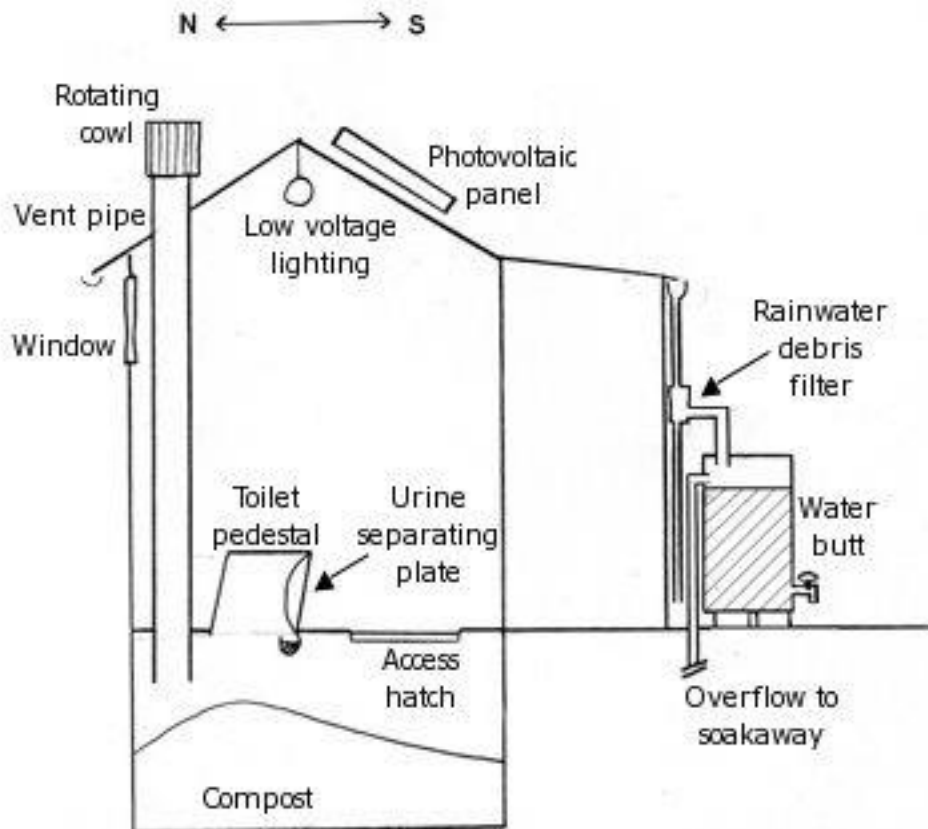
### *Harvesting Compost*

This is done once a year. For completely odour-free toilets, we recommended that the access hatches be situated inside the toilet cubicles (see diagrams) to protect against smells from back-drafts into the toilet. This arrangement makes removing compost a slightly more awkward procedure than locating access hatches on the outside of the building. It is simple to design a toilet that is full access.

### *Lighting inside toilets*

If there is no mains electricity to a site, it may be possible to provide power from solar and wind power. To minimise costs, lighting should be with low voltage DC (not AC) bulbs or LEDs. To minimise power demand, use a motion detector to only turn the lights on when a person enters.

A suitably sized photovoltaic panel on the roof of the building can be coupled with a battery to supply sufficient energy for lighting during the summer months, but would be inadequate in winter. Year-round power can be supplied by combining a photovoltaic panel on the south facing roof of the building with a wind turbine mounted nearby on a mast. For more advice on setting up a small battery-charging solar and/or wind power system, see our advice on solar & wind at <http://info.cat.org.uk> and the book 'Wind & Solar Electricity: a practical DIY guide', available in our online store: <http://store.cat.org.uk>



**Schematic Section of a compost toilet incorporating passive venting, renewable energy powered lighting, and rainwater collection**



This picture shows the interior of a full access compost toilet installed by 'Natsol Ltd' on some allotments. The pedestal is moved once a year, and the central handrail can be used from either side. Hand cleansing is achieved using alcohol gel so there is no need to supply running water. A waterless urinal is provided for the gentlemen.

**Interior of a full access twin-chamber urine-separating compost toilet, incorporating a waterless urinal, powered venting, and alcohol gel for hand-cleansing (Picture courtesy of Natsol Ltd).**



# Centre for Alternative Technology Canolfan y Dechnoleg Amgen



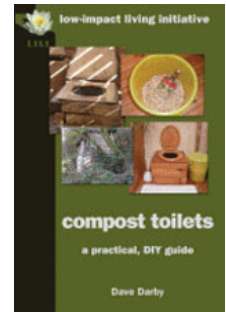
## **Choosing Ecological Sewage Treatment (184 pages, £19.95)**

Covers all aspects of small-scale wet sewage treatment and evaluates treatments including reed or willow beds, septic tanks, leachfields, trickling filters, solar ponds, living machines, and composting toilets. Also explains how to collect and use urine and grey water, and reduce clean water use.

## **Compost Toilets: A Practical DIY Guide (126 pages, £11.95)**

This DIY guide contains everything you need to know about building a compost toilet, plus proprietary models, decomposition, pathogens and hygiene, use and maintenance, environmental benefits, troubleshooting and further resources.

See the 'Water Supply & Sanitation' section of our online shop for other books and products.



## **CAT Short Courses 2018**

<http://courses.cat.org.uk/> ☎ 01654 704966

### 31 March **Compost Toilets**

2018 Advice on the component parts and the biology of a compost toilet system and the kit required to make one.

### 1 April **Reedbeds and Waste Water Management**

2018 This course explores the technicalities, design and implementation of reedbeds and alternative waste water treatment systems at a domestic level.

## **CAT University Degrees**

<http://gse.cat.org.uk/> ☎ 01654 705953

Interested in sustainability? Then why not make it your career! CAT offers fully accredited, hands-on Masters Degree courses in Renewable Energy and Sustainable Architecture & Design.

## **CAT Charity**

<http://support.cat.org.uk/> ☎ 01654 705988

We rely on generous donations to continue to provide this information service free at point of use. You can support us and the other work CAT does by donating, or joining CAT Membership.