

TOILET SYSTEM**FIELD OF THE INVENTION**

The present invention relates to toilet systems
5 and in particular to toilet systems for recycling or
reusing waste products introduced to the toilet system.

BACKGROUND TO THE INVENTION

Several outdoor composting-type toilet systems are
10 available. For example, one system includes an
enclosure containing a bathroom with a toilet where
human waste disposed of in the toilet is directly
gravity fed to a underground collection pit below the
toilet. This pit must be periodically cleaned out to
15 remove the waste once it reaches a predetermined volume.
The reclaimed solid waste may then be used as nutrient
rich compost. Also, such pit toilets rely on collection
of rainwater to flush the toilet.

Australian patent application AU45132/97 describes
20 a worm digester toilet for receiving and breaking down
human waste into useable compost. To access the
compost, one must open castings doors on the side of the
waste collection bin and presumably use a shovel or
other similar means to remove the waste.

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SUMMARY OF THE INVENTION

In a first aspect the present invention provides a
toilet system; a waste bin arranged to receive waste
from a toilet and including a floor being sloped
30 inwardly to form a channel and having a plurality of
perforations which allow passage of liquid therethrough;
and solid waste extraction means positioned at a lower
portion of the channel and being arranged to operatively
cooperate with the waste bin whereby at least some of
35 the waste collected in the bin can be extracted.

Preferably, the waste bin has walls extending
upwardly from a perimeter of the floor.

- 2 -

Preferably, the waste bin further includes a removable cover through which organic material may be introduced.

5 Preferably, the waste bin includes ventilation means to allow gas to escape from the waste bin.

Preferably, the solid waste extraction means extends through an opening in the waste bin, and the auger is operable to extract waste collected in the bin through the opening.

10 Preferably, the system further includes a receptacle for receiving the liquid which passes through the perforations, and means for moving the liquid received in the receptacle to a cistern.

15 Preferably, the receptacle is divided into two chambers by a baffle.

Preferably, the receptacle includes a sump.

Preferably, the system further includes heating means for heating waste in the bin.

20 Preferably, the heating means includes a heating element disposed within the waste bin.

Alternatively, or in addition, the heating means includes a heating element arranged to heat an outer surface of the waste bin.

25 Preferably, the heating means is operable to periodically heat at least some of the waste in the bin to a temperature of at least about 72 degrees centigrade.

Preferably, the heating means is operable to maintain the waste in the waste bin at around 32 degrees centigrade.

30 Preferably, the heating means is powered by a solar panel or solar collector.

Alternatively, the heating means is powered by mains electricity.

35 Preferably, the system further includes a rain water tank for collecting rainwater, the collected rainwater being useable in the system.

Preferably, rainwater is collected from a roof of a

- 3 -

building housing the toilet system.

Preferably the solid waste extraction means includes an auger.

5 BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

10 Figure 1 is a cross sectional side representation of a preferred embodiment of a toilet system according to the present invention;

Figure 2 is a detailed view of an alternative embodiment of a storage tank for use with the present invention;

15 Figure 3 is a cross sectional side representation of an alternative embodiment of a toilet system according to the present invention;

Figure 4 is a detailed view of the storage tank of Figure 3;

20 Figure 5 is a detailed view of the waste bin of Figures 1 and 3;

Figure 6 is a cross sectional side representation of a further alternative embodiment of a toilet system according to the present invention; and

25 Figure 7 is a detailed view of the toilet system of figure 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figure 1, a toilet system is shown
30 including a toilet 10 housed in a building 11 and a waste bin 12 arranged to receive waste from the toilet 10, the waste bin being located above ground and under the floor 13 of the building 11. The waste bin includes a floor of two portions 14 and 16 which slope inwardly
35 to form a channel 18. The floor has a plurality of perforations 20 which allow passage of liquid therethrough. The liquid which passes through the

perforations 20 is collected in a receptacle 22. Side and rear walls 24 and front wall 26 extend upwardly from a perimeter 28 of the floor 14 and 16, and aid in the containment of waste in the waste bin 12.

5 Waste extraction means in the form of an auger 30 is arranged to operatively cooperate with the waste bin 12 whereby at least some of the waste collected in the bin can be extracted by the auger 30. The auger is position at a lower portion 32 of the channel 18. At or
10 adjacent one end 34 of the auger 30, the auger extends through an opening 36 of front wall 26. The auger is arranged to transport material collected in the bin 12 through this opening 36.

The receptacle 22 is in fluid communication with a
15 cistern 38 of the toilet 10. Between and in fluid communication with the receptacle 22 and cistern 38 is a tank in the form of a primary liquid storage tank 40. The storage tank 40 also includes an overflow conduit 42 for the overflow of excess liquid entering the tank 40.
20 The overflow from the tank 40 is dispersed to be infiltrated into surrounding open ground.

A solar powered pump 44 pumps water from the liquid storage tank 40 to a secondary storage tank 46. In an alternative embodiment, the pump 44 is powered by
25 mains electricity. The secondary storage tank 46 is located in a position above the cistern 38 near the ceiling 47 of the building 11 such that when the toilet 10 is flushed, liquid can be immediately gravity fed to the cistern 38 to replace the liquid used in the flush.
30 A float valve 48 is mechanically coupled to the pump 44 to ensure the secondary storage tank 46 maintains a predetermined volume of liquid. Due to the health risks associated with the presence of waste water in tank 46, the water in tank 46 should not be piped to a basin for
35 washing purposes.

The toilet flush mechanism actuated by a button 50 is located on the cistern 38 in such a location so as to

- 5 -

prevent actuation of the button when the toilet seat lid 52 is in an open position, as illustrated in Figures 1 and 3. This ensures that the toilet seat lid 52 must be closed, or in a down position, for the user to flush the toilet 10. This would aid in preventing splash back of flush liquid through the toilet opening 54 and so soiling the user. In an alternative embodiment, the flush mechanism automatically operates upon lowering of the seat lid 52 onto the toilet bowl 56.

10 The embodiment of the invention illustrated in Figure 1 will now be described in use. A user enters the building 11, housing the toilet system to use the toilet 10. Once the user has finished using the toilet 10, the user closes the toilet lid 52, allowing the user to access the button 50. On pushing the button 50, liquid is released from the cistern 38 to flush the toilet 10. Defecation from the use of the toilet 10 is then flushed into the waste bin 12. Liquid from the both the flush and from the liquid portion of the user's defecation trickles through any solid matter already present in the waste bin 12 to the floor 14 and 16 of the waste bin. The liquid then passes through perforations 20 in the floor 14 and 16 of the waste bin 12 and into the receptacle 22.

25 The liquid collected in the receptacle passes through to a secondary receptacle 58 which contains worm castings and charcoal. The charcoal aids in oxidation of urine components of the liquid defecation portion of the user.

30 The liquid then passes through to the liquid storage tank 40 where it remains until required to be pumped into secondary storage tank 46. The mechanism for determining when and whether liquid needs to be pumped from the storage tank to the secondary storage pipe 46 has been described previously. Liquid travels from the storage tank 40 to the secondary storage pipe 46 via first and second conduit 60 and 62 respectively.

- 6 -

A second solar pump 64 can also be employed to pump water from the storage tank 40 via a third conduit 66 to pump water directly to the cistern 38 as required.

Referring to Figure 2, a first inline filter 68 is
5 provided between the receptacle and liquid storage tank 40 while a second inline filter 70 is provided on first conduit 60. The first and second inline filters 68 and 70 respectively may contain any one of the following filter or sterilisation modules: course woven filter;
10 charcoal/activated carbon filter; resin deioniser; UV sterilisation; ozone sterilisation; or ceramic filter etc.

Referring to Figure 5, the waste bin 12 has an
auger 30 to remove waste product from the waste bin 12.
15 The waste bin 12 is configured to substantially allow liquid matter to filter through solid matter present in the tank, through perforations 20 and into a receptacle 22. It is also configured to contain a substantial portion of the solid component of defecated matter from
20 the user. It also may contain toilet paper, tissues, etc, flushed by the user. This solid matter will naturally break down, at least partially, in the waste bin 12. The waste bin 12 may also contains worms to aid in the breakdown of solid matter in the bin.

25 When the volume of waste matter in the waste bin 12 reaches a predetermined level, typically three-quarters full, the auger is activated to remove the solid matter adjacent the auger out of the waste bin 12 via the opening 36 of front wall 26. However, the auger
30 30 can be operated at any time the biodegraded waste material, including worm castings, is required. The waste material, including worm castings, removed from the waste bin 12 via the opening 36 can then be used as, or as a component of, fertiliser. The biodegraded waste
35 matter is collected in a suitable container to transport the matter to its place of use.

The auger 30 is of standard construction and

- 7 -

operates as per standard auger principles.

In operation, as described above, the building 11 and at least the waste bin 12 are situated above ground. For example, the building 11 may be on stilts. Also, in
5 the present embodiment, the waste bin 12 supports itself on the ground, or in the receptacle 22 which is also typically above ground, by its legs 72.

Heating means in the form of heating element 84 is used to heat the contents of the bin to a predetermined
10 temperature for aiding in the breaking down of the waste matter collected in the bin 12.

The heating element may periodically heat to a minimum temperature of about 72°C for a short period of time to denature pathogens in the waste material by
15 action of heat. The element may heat to a higher temperature yielding improved treatment of the waste matter. The maximum temperature it can reach will depend on the heat resisting capabilities of the materials chosen to fabricate the waste bin 12 and
20 associated components.

Alternatively, the heating element may be used to continuously maintain the waste in the bin at approximately 32°C. This lower temperature allows worms to be present in the waste bin. The higher temperatures
25 mentioned above would kill the worms.

The heating device employs the use of a thermostat and timer combination to maintain the heating element at the appropriate temperature at the appropriate times.

The heating element can use heat supplied directly
30 from a solar collecting panel, or use electrical energy converted from sunlight by a solar panel to heat the bin. The solar panel may trickle charge a battery for this purpose. Mains electrical power may be used.

In an alternative embodiment, the heating element
35 is a blanket-type surround which is coupled to the outer surface of one or more of the side and rear walls 24 of the bin 12.

Figure 3 illustrates an alternative embodiment of the invention where like numerals refer to like parts. The main difference between the embodiment of the invention illustrated in Figure 3 when compared with the embodiment of the invention illustrated in Figure 1 is that the liquid storage tank 40 illustrated on Figure 3 includes a central baffle or weir 74.

The liquid storage tank 40 illustrated in Figure 3 is illustrated in more detail in Figure 4. Liquid from the receptacle 22 enters the first chamber 76 of the liquid storage tank via preliminary conduit 78. Once the first chamber 76 is filled with liquid to the height of the weir 74, liquid then spills over the top edge 80 of the weir 74 and into a second chamber 82. Liquid in the second chamber 32 can then be drawn via first conduit 60 either by being pumped by first solar pump 44 to the secondary storage tank 46 via second conduit 62 or direct to the cistern 38 by second solar pump 64 via third conduit 66. Overflow of second chamber 82 is transported to the ground for infiltration into the ground via overflow conduit 42.

Referring to Figures 6 and 7, a further alternative embodiment is illustrated. Again, like numerals refer to like parts. In this embodiment, waste bin 12 includes a ventilation hole 86 to which is attached ventilation pipe 87. This allows for the ventilation of gases that are produced during the decomposition of the waste material such as methane gas. Waste bin 12 further includes an access cover 88. By removing this cover organic material may be added to the waste bin. This is useful in a domestic application where a householder can add green waste such as vegetable peelings to the waste bin. This minimises the volume of waste emanating from their home that must be dealt with in other ways. It may also have a beneficial effect upon the breakdown of waste in the bin and may be beneficial to worms in the bin by varying the diet of

the worms.

All of the components of the system are positioned within the walls of building 11. This allows the toilet system to be fabricated as a stand alone unit. As well
5 as simplifying the fabrication process, this allows the toilet system to be transported and lowered into remote or temporary locations by crane or helicopter.

Referring to Figure 7, the system includes a receptacle 22 including baffles 94 and 92. The liquid
10 trickling through the perforations in the floor of waste bin 12 runs down into receptacle 22. The receptacle increases liquid retention time within the system and improves sediment settlement. This improves the water treatment capabilities of the system.

15 Receptacle 22 includes sumps 96. These may be opened to remove settled sediment and material. This is part of the maintenance regime of the system and may be carried out once a year.

A pump 90 is provided to pump liquid from
20 receptacle 22 to storage tank 40. The pump may be solar powered and is activated by a liquid level switch (not shown) which monitors the level of liquid in secondary receptacle 98. The liquid enters storage tank 40 via inline filter 68. The inline filter in this embodiment
25 is substantially larger than in other described embodiments. This not only improves the efficacy of filtration, but allows for service intervals between filter element replacements of up to 8 years. Due to the increased efficacy of filtering by filter 68, no in-
30 line filter is required in conduit 60.

In any of the previously described embodiments, the toilet system may optionally include a rainwater tank for collecting rainwater deposited on the roof 84
of the building 11. This rainwater may then be piped to
35 a hand basin for the user to wash with. The collected rainwater may also be used to supplement the supply of liquid to the cistern 38.

Now that preferred embodiments of the invention have been described, it will be apparent to those skilled in the art that the toilet system has at least the following advantages:

- 5 1 the system provides self sufficient supply of liquid to a toilet cistern for flushing the toilet;
- 2 the configuration of the waste bin allows efficient removal of solid waste products from the
- 10 toilet; and
- 3 the use of worms directly in the waste bin improves the efficacy of the solid waste when used as a fertiliser.

15 It will be apparent to those skilled in the art that existing toilet systems can be converted to a system in accordance with the present invention.

Although the invention has been described with reference to particular examples, it will be appreciated
20 by those skilled in the art that the invention may be embodied in many other forms.

It is to be understood that any prior art publication referred to herein does not constitute an admission that that publication forms part of the common
25 general knowledge in the art.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A toilet system including:
5 a waste bin arranged to receive waste from a toilet and including a floor being sloped inwardly to form a channel and having a plurality of perforations which allow passage of liquid therethrough; and
10 solid waste extraction means positioned at a lower portion of the channel and being arranged to operatively cooperate with the waste bin whereby at least some of the waste collected in the bin can be extracted.
- 15 2. A toilet system according to claim 1 wherein the waste bin has walls extending upwardly from a perimeter of the floor.
3. A toilet system according to either claim 1 or claim 2 wherein the waste bin further includes a
20 removable cover through which organic material may be introduced.
4. A toilet system according to any preceding claim wherein the waste bin includes ventilation means to allow gas to escape from the waste bin.
- 25 5. A toilet system according to any preceding claim wherein the solid waste extraction means extends through an opening in the waste bin, and is operable to extract waste collected in the bin through the opening.
- 30 6. A toilet system according to claim 1 further including a receptacle for receiving the liquid which passes through the perforations, and means for moving the liquid received in the receptacle to a cistern.

- 12 -

7. A toilet system according to claim 6 wherein the receptacle is divided into two chambers by a baffle.
8. A toilet system according to either claim 6 or
5 claim 7 wherein the receptacle includes a sump.
9. A toilet system according to any preceding claim further including heating means for heating waste in the bin.
10. A toilet system according to claim 9 wherein the
10 heating means includes a heating element disposed within the waste bin.
11. A toilet system according to either claim 9 or claim 10 wherein the heating means includes a heating element arranged to heat an outer surface
15 of the waste bin.
12. A toilet system according to any of claims 9 to 11 wherein the heating means is operable to periodically heat at least some of the waste in the bin to a temperature of at least about 72
20 degrees centigrade.
13. A toilet system according to any of claims 9 to 12 wherein the heating means is operable to maintain the waste in the waste bin at around 32 degrees centigrade.
- 25 14. A toilet system according to any of claims 9 to 13 wherein the heating means is powered by a solar panel or solar collector.
15. A toilet system according to any of claims 9 to 13 wherein the heating means is powered by mains
30 electricity.
16. A toilet system according to any preceding claim further including a rainwater tank for collecting rainwater, the collected rainwater being useable in the system.

- 13 -

17. A toilet system according to claim 16 wherein the rainwater is collected from a roof of a building housing the toilet system.
18. A toilet system according to any preceding claim
5 wherein the solid waste extraction means is an auger.

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