The system is designed for reuse of household gray water by a flush toilet. Gray water from sinks, showers, baths, washing machines and the like are pumped and led into a toilet tank. If necessary, the tank can be filled by potable water. The system may use the normal existent flushing tanks, and does not necessarily require any additional storage tank. The system may use an especially designed tank.
Published:

- with international search report (Art. 21(3))
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A TOILET FLUSHING SYSTEM FOR REUSING GRAY WATER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Israeli Patent Application No. 203,455 filed on January 21, 2010, which is incorporated herein by reference.

BACKGROUND

1. TECHNICAL FIELD

[0002] The present invention relates to the field of saving water, and more particularly, to reusing gray water.

2. DISCUSSION OF RELATED ART

[0003] The amount of potable water in the world is decreasing, and a high percentage of it is being used for flushing toilets. Often, the amount of water used to flush a toilet exceeds the necessary. Moreover, using gray water can achieve the same effect as potable water in pushing waste into the sewage system.

[0004] Today, the function of this invention is being done by a modular gray water recycling system that includes a control and reservoir unit for storing gray water, which is received from a source such as a sink drain, and is pumped to the household toilet as necessary. The single unit houses a pump, flow signals, filters, and an overflow, as well as a liquid level actuating device for signaling when the liquid level has fallen to below a
designated level. The system also utilizes a second storage reservoir and a second control
unit for adding gray water from the second reservoir to the control and reservoir unit in response to a signal indicating low water level therein.


BRIEF SUMMARY

[0007] Embodiments of the present invention provide a system for reusing household gray water in at least one toilet flush tank, comprising: at least one collection unit comprising a collector arranged to receive gray water from at least one household gray water source, a pumping unit arranged to filter, grind/shred, homogenize and pump the gray water to the at least one toilet flush tank; and a flushing mechanism in the at least one toilet flush tank arranged to limit the amount of gray water that is pumped into the at
least one toilet flush tank, wherein the system allows a user to flush a toilet with the admitted gray water.

[0008] These, additional, and/or other aspects and/or advantages of the present invention are: set forth in the detailed description which follows; possibly inferable from the detailed description; and/or learnable by practice of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention will be more readily understood from the detailed description of embodiments thereof made in conjunction with the accompanying drawings of which:

Figure 1 is a high level schematic block diagram of a toilet flushing system for reusing household gray water in toilet flush tanks, according to some embodiments of the invention;

Figures 2, 3 and 4 are schematic illustrations of three configurations of the flushing tanks, according to some embodiments of the invention; and

Figure 5 is a high level schematic flowchart of a method of reusing household gray water, according to some embodiments of the invention.

DETAILED DESCRIPTION

[0010] Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is applicable to other embodiments or of being
practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

[0011] Figure 1 is a high level schematic block diagram of a toilet flushing system for reusing household gray water in toilet flush tanks 91, according to some embodiments of the invention. The system for reusing household gray water in at least one toilet flush tank, comprising: at least one collector 110 arranged to receive gray water from at least one household gray water source 95, 97; at least one pumping unit 117 arranged to process and pump the gray water to the at least one toilet flush tank 91; and a flushing mechanism 123 arranged to limit an amount of gray water that is pumped into the at least one toilet flush tank 91. The system allows a user to flush a toilet 92 with the pumped gray water. Processing the gray water may comprises filtering by filter 113; grinding by grinders 112; shredding by shredders 118; homogenizing by homogenizers 114 or disinfecting by disinfectors 115. Flushing mechanism 123 may be connected mechanically or electronically to an existing flushing mechanism (e.g., potable water floater mechanism 93 in toilet flush tank 91).

[0012] The system may comprise at least one collector 110, and at least one pumping unit. Pumping unit 117 may be able to perform filtering, grinding, shredding and homogenizing of the grey water to facilitate it's use and storage in at least one flushing tank 91. Grinding and shredding relate to solids that may be part of the gray water.

[0013] Collector 110, filters 113, pumping units 117, shredders 118, at least one monitor 111, grinders 112, homogenizers 114 and disinfectors 115 may be organized in one or more collection units, and be arranged physically and logically in various configurations.
Pumping unit 117 may comprise some or all of the units: filters 113, shredders 118, grinders 112, homogenizers 114 and disinfectors 115. These units may be connected to each other in the logical order of their activity, for example, shredder 118 - homogenizer 114 - filter 113 and disinfect 115.

[0014] Collection unit 100 is arranged to receive gray water from at least one household gray water source 95 and/or household appliances 97, and pump the gray water to toilet flush tanks 91 (single or multiple). Each toilet flush tank 91 may have a (gray water) flushing mechanism 123 arranged to admit a specified amount of gray water into toilet flush tank 91, e.g., in addition or connected to a regular potable water floater mechanism 93. Flushing mechanism 123 is arranged to limit the amount of gray water in tank 91 by closing the gray water entrance to tank 91 when a specified gray water level is reached. The system allows a user to flush a toilet 92 with the admitted gray water and flushing water. Excess of gray water may be released to a sewage 90.

[0015] According to some embodiments of the invention, the system may further comprise a valve 125 per each toilet flush tank 91 and connected thereto, that is arranged to receive the pumped gray water and potable water, and to allow a user select gray water or potable water partly of fully as the flushing water. In these embodiments, valve 125 may be a three way valve. In embodiments, valve 125 may be further arranged to receive additives 127 and mix additives 127 with the gray water. Additives 127 may comprise pigments and coloring solutions, de-odorants and solutions for neutralizing a smell of the gray water, surfactants and solutions for removing certain ingredients in the gray water, and disinfection solution such as chlorine solutions. In this case, valve 125 may be a four way valve. The valves 125 may be single action valves.
[0016] According to some embodiments of the invention, the gray water is pumped into toilet flush tank 91 through a gray water opening in tank 91 which is in an opposite or an additional location to a potable water opening through which potable water enters tank 91. These embodiments may utilize an existing opening in some types of tanks 91, that are manufactured to allow connecting the water entrance to tank 91 in either side of it. The gray water opening may be the “un-used” existing opening, in respect to the potable water opening. Tank 91 may thus be unaltered, using the existing side opening as a gray water opening.

[0017] According to some embodiments of the invention, a normally closed valve (e.g. valve 124 in Figure 2) may be positioned at the potable water opening, such as to regulate potable water entrance to toilet flush tank 91. The user may open the normally closed valve for flushing toilet 92 with potable water, for example only sporadically when needed. The valve may be a single action opening valve.

[0018] The system may further comprise a controlling element 120, arranged to select gray water or potable water as flushing water, and optionally also to determine a quantity of flushing water. Controlling element 120 may be mechanical or electronical.

[0019] Pumping unit may be positioned in the vicinity or remotely from collector 110. Pumping unit 117 may be integrated with collector 110. Collector 110 may be an existing collector in the house, e.g., the last existing collector before sewage 90. Collector 110 may further monitor the amounts of gray water collected and reused and may comprise a monitoring module that allows higher efficiency adjustments and is connectable to intelligent household systems. The system may be installed or retrofitted into an existing house plumbing system.
The system may further comprise an indicator 121 within tank 91 arranged to indicate an amount of fluid in tank 91 and/or an estimated number of remaining flushes. Indicator 121 may comprise a floater or incorporate electronics. The amount may help the user select grey or potable water for future flushes.

According to some embodiments of the invention, the system uses the normal, existent flushing tank, and does not require any additional water tank. The system may use an especially designed tank (see e.g. Figure 4).

Figures 2, 3 and 4 are schematic illustrations of three configurations of the flushing tanks, according to some embodiments of the invention.

Figure 2 illustrates a single tank configuration, in which gray water is introduced into toilet flushing tank 91 via pipe 81 and potable water is introduced into toilet flushing tank 91 via pipe 82, both regulated by valves 125, 124 respectively. For example, valve 124 may be normally closed and valve 125 may be normally open. Water source may be determined by controller 120 that may be configured to open and close the pipe openings of pipes 81, 82 into toilet flushing tank 91.

Figure 3 illustrates a dual tank configuration, in which toilet flushing tank 91 comprises separate gray water tank 110 and a potable water tank 94, each with corresponding flushing mechanism 123, 93 respectively. Gray water enter gray water tank 110 via a pipe 81, potable water enter potable water tank 94 via pipe 82, and water is flushed by user activation of controllers 120, 132 respectively. Flushing water is delivered through pipe 83 to toilet 92. Gray water tank 110 and potable water tank 94 may be shaped to fit a volume of an original toilet flush tank 91.
Figure 4 illustrates a flushing tank configuration in which original toilet flush
tank 91 is fed from gray water tank 110 and from potable water tank 94, controllably by
valves 125 and 124 respectively. Optionally, control over valves 125, 124, and/or directly
on water input into toilet flush tank 91 may be carried out by controller 120, arranged to
mechanically allow a user choose gray water or potable water as the source of flushing
water. The selected water type may then be flushed from toilet flush tank 91 by activating
flushing mechanism 133 with controller 134, through pipe 83 into toilet 92.

In embodiments, the toilet flushing system comprises at least two water tanks 91,
94, 110, of which at least one water tank is a flushing tank (94, 110 in Figure 3, 91 in
Figure 4) comprising a flushing mechanism (93, 123, and 133 respectively) arranged to
flush toilet 92 with input water received from at least one water source - gray water or
potable water. The toilet flushing system further comprises at least one controller (132
and 120 in Figure 3, and 120 and 134 in Figure 4) arranged to allow a user select toilet
flushing water as either potable water or gray water.

Piping (81, 82, and the pipes connecting tanks 94 and 110 with flushing tank 91 in
Figure 4) connecting a potable water source and the gray water tank to the at least one
flushing tank, wherein the fluid communication of the potable water source and the gray
water tank through the piping with the at least one flushing tank is regulated by at least
one regulation device associated with the at least one controller.

The piping may further comprise valves 124, 125 as regulation device, or
controller 120 (Figure 4) arranged to select a gray water opening or a potable water
opening as source for the flushing water within flushing tank 91. The toilet flushing
system may comprise at least one valve connected to the at least one flushing tank and
arranged to receive the pumped gray water and potable water and allow a user to select gray water or potable water as flushing water.

[0029] The gray water opening may be added to a standard flushing tank, e.g. opposite to the existing opening and controller 120 (Figure 4) may close one opening and open the other opening according to user selection.

[0030] In Figure 3, gray water tank 110 and potable water tank 94 may be shaped to jointly occupy a space equal to a space occupied by a standard flushing tank.

[0031] Figure 5 is a high level schematic flowchart of a method of reusing household gray water, according to some embodiments of the invention. The method comprises the following stages: pumping gray water from at least one household gray water source to at least one toilet flush tank (stage 130), optionally homogenizing and disinfecting the gray water (stage 160), e.g., by using ultraviolet light or chemical systems; and grinding and shredding the gray water (stage 170).

[0032] The method may further comprise filtering the gray water (stage 150); optionally allowing a user to select the pumped gray water as a toilet flushing water (stage 135); and upon user selection, applying the pumped gray water to flush the toilet (stage 140). The method may further comprise allowing the user to adjust a quantity of flushing water (stage 145).

[0033] This system is different than other existing inventions in the way that it does not require an external reservoir. The system is modular, each part of it by itself may increase the efficiency of water usage. Each part may enhance the operation of the other.

[0034] Advantageously, the system utilizes the space originally planned for the flushing tank to accommodate both potable water tank and gray water tank (with common or
separate flushing mechanisms), and does not require placing and maintaining additional reservoirs.

[0035] In case the system is connected to several toilets, a control module that gives priority to certain toilet tanks over others can be added to make the invention work better.

[0036] The system can be connected to an external treatment tank to enable use of gray water that is not used for toilet flushing. The water is to be treated and used for irrigation. It is more effective to flush with gray water and treat only excess.

[0037] The system may incorporate an intelligent control unit that collects statistics on usage of water around the household, and use that information for increasing usage efficiency.

[0038] Utilizing gray water accumulated from water sources around the household would significantly decrease the inefficiency that exists in most households' water systems, consequently reducing the waste of the world's potable water.

[0039] This system does not require substantial reconstruction of, or the construction of entirely new plumbing systems, and can be easily, quickly and at relatively low costs, installed or retrofit into practically any household. The system is flexible and gives solutions for existing homes with little interference and is suitable for hotels, offices and homes.

[0040] In the above description, an embodiment is an example or implementation of the invention. The various appearances of "one embodiment", "an embodiment" or "some embodiments" do not necessarily all refer to the same embodiments.

[0041] Although various features of the invention may be described in the context of a single embodiment, the features may also be provided separately or in any suitable
combination. Conversely, although the invention may be described herein in the context of separate embodiments for clarity, the invention may also be implemented in a single embodiment.

[0042] Furthermore, it is to be understood that the invention can be carried out or practiced in various ways and that the invention can be implemented in embodiments other than the ones outlined in the description above.

[0043] The invention is not limited to those diagrams or to the corresponding descriptions. For example, flow need not move through each illustrated box or state, or in exactly the same order as illustrated and described.

[0044] Meanings of technical and scientific terms used herein are to be commonly understood as by one of ordinary skill in the art to which the invention belongs, unless otherwise defined.

[0045] While the invention has been described with respect to a limited number of embodiments, these should not be construed as limitations on the scope of the invention, but rather as exemplifications of some of the preferred embodiments. Other possible variations, modifications, and applications are also within the scope of the invention. Accordingly, the scope of the invention should not be limited by what has thus far been described, but by the appended claims and their legal equivalents.
What is claimed is:

1. A toilet flushing system comprising:
   
   at least one water tank, of which at least one water tank is a flushing tank comprising a flushing mechanism arranged to flush a toilet with input water received from at least one water source,

   at least one pumping unit arranged to process and pump gray household water to a gray one of the at least one water tank,

   at least one controller arranged to allow a user select toilet flushing water as either potable water or gray water, and

   piping connecting a potable water source and the gray water tank to the at least one flushing tank, wherein a fluid communication of the potable water source and the gray water tank through the piping with the at least one flushing tank, is regulated by at least one regulation device associated with the at least one controller.

2. The toilet flushing system of claim 1, wherein the potable water source is a potable water tank.

3. The toilet flushing system of claim 1, wherein the at least two water tanks comprise a flushing tank connected to a potable water source and a gray flushing tank connected to the at least one pumping unit, both flushing tanks comprise corresponding flushing mechanisms, corresponding controllers and are in fluid communication with the
toilet, and wherein by activating the corresponding controller, the user selects the
flushing water source.

4. The toilet flushing system of claim 3, wherein the potable water tank and the gray
water tank are shaped to jointly occupy a space equal to a space occupied by a
standard flushing tank.

5. The toilet flushing system of claim 1, wherein

the at least two water tanks comprise a potable water tank, a gray water tank and
the flushing tank,

each of the potable water tank and the gray water tank is connected through the
piping to the flushing tank having the flushing mechanism,

the at least one controller is associated with the flushing tank and is arranged to
select the water source as either the potable water tank or the gray water tank.

6. The toilet flushing system of claim 5, wherein the potable water tank and the gray
water tank are connected through separate openings to the flushing tank, and the
controller is arranged to close one of the openings upon user selection.

7. The toilet flushing system of claim 6, wherein the flushing tank is a standard flushing
tank comprising an additional opening for piping from the gray water tank.

8. The toilet flushing system of claim 6, wherein the potable water opening and the gray
water opening are opposite to each other.

9. The toilet flushing system of claim 5, wherein fluid communication between the
potable water tank and the gray water tank with the flushing tank is controlled by at
least one valve.
10. The toilet flushing system of claim 1, wherein fluid communication among the water tanks is controlled by at least one valve.

11. The toilet flushing system of claim 1, wherein processing the gray water comprises at least one of: filtering; grinding; shredding; and homogenizing.

12. The toilet flushing system of claim 1, wherein the at least one controller is associated with the at least one flushing mechanism mechanically or electronically.

13. The toilet flushing system of claim 1, further comprising at least one valve connected to the at least one flushing tank and arranged to receive the pumped gray water and potable water and allow a user to select gray water or potable water as flushing water.

14. The toilet flushing system of claim 13, wherein the at least one valve is a single action valve.

15. The toilet flushing system of claim 1, wherein the at least one pumping unit is further arranged to receive additives and mix the additives with the gray water.

16. The toilet flushing system of claim 1, wherein the piping comprises a normally closed valve for regulating potable water entrance to the flushing tank.

17. The toilet flushing system of claim 1, wherein the at least one controller is further arranged to allow a user determine a quantity of flushing water.

18. The toilet flushing system of claim 1, wherein the pumping unit further comprises at least one of: a filter; a pump; a grinder, a shredder; and a homogenizing unit.
Figure 1: Gray Water Management System

- **Potable Water**
  - Household appliances, e.g., a washing machine (ADDITIVES)
  - Valve
  - Toilet flush tank (P.W. FLOATER MECHANISM)
  - Toilet
  - Control indicator
  - Gray water (TOILET)

- **Gray Water**
  - Household gray water sources, e.g., sinks, showers, baths (GRAY WATER)
  - Collection unit
  - Monitors
  - Grinders
  - Homogenizers
  - Disinfectors
  - Pumping units
  - Filters
  - Collectors
  - Collection unit (GRAY WATER)

- **Sewage**
  - Gray water
PUMPING GRAY WATER FROM HOUSEHOLD GRAY WATER SOURCES TO TOILET FLUSH TANKS

FILTERING THE GRAY WATER

HOMOGENIZING AND DISINFECTING THE GRAY WATER

GRINDING AND SHREDDING THE GRAY WATER

ALLOWING A USER TO SELECT THE PUMPED GRAY WATER AS A TOILET FLUSHING FLUID

UPON USER SELECTION, APPLYING THE PUMPED GRAY WATER TO FLUSH THE TOILET

ALLOWING THE USER TO ADJUST A QUANTITY OF FLUSHING FLUID

Figure 5
### INTERNATIONAL SEARCH REPORT

**PCT/IB2011/050211**

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. E03D5/00

**ADD.**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

E03D E03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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X Further documents are listed in the continuation of Box C.

X See patent family annex.

* Special categories of cited documents:
  
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  "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  
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**Date of the actual completion of the international search**

14 April 2011

**Date of mailing of the international search report**

01/07/2011

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Authorized officer
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