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MALODOUR ABSORPTION CARTRIDGE FOR LITTER BOX

FIELD OF THE INVENTION

- 5 The present invention relates generally to pet care, in particular to a filter cartridge for and a method thereof.

BACKGROUND TO THE INVENTION

- 10 It is known that animals can do their business in a litter box when these animals are indoors or when they are in a cage or similar.

Litter box here means a litter box in which animals such as cats, but also other animals such as dogs, rabbits, guinea pigs, and similar.

- 15 The known litter boxes consist of an open tray that the animal can step in or out of, or a closed box that the animal can enter via an opening in a sidewall, whereby this can be provided with a flap or otherwise, whereby the box is filled with sand, grit or similar.

- 20 However, the known litter boxes present the disadvantage that when the animal has done its business, an unpleasant and sometimes pungent odor is observable outside the litter box, which is caused by the feces and/or urine.

- 25 EP0912084 describes a litter box for a pet which uses a complicated mechanical set-up including a grinder, to clean at regular intervals or automatically when a cat leaves the litter box, the litter from the litter box using a cleansing liquid pumped across the litter bed. This complex mechanical arrangement is prone to malfunction, typically caused by clogging of the litter bed and/or problems with the grinder. It is an object of the present invention to have a much simpler solution in addressing the malodor caused by animal waste.

- 30 The purpose of the present invention is to provide a solution to at least one of aforementioned and other disadvantages. It has been found that different from air washers, such as for example described in US 2,601,519, that require spraying installations, the contaminated air in a litter box can simply be treated by suction of the air through a liquid reservoir with a liquid reagent and
35 evaporative absorption of the contaminants in the liquid reagent.

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SUMMARY OF THE INVENTION

5 The subject of the present invention is a litter box in which a cat or another animal can do its business, whereby the litter box essentially consist of a closable box that is provided with an opening with a small door flap for the access of the animal and a closable opening for introducing or removing a removable tray filled with sand, grit or similar, whereby the closable box is provided with an extraction installation in the form of a built-in fan and a connection for an outlet for transporting the extracted air to a ventilation system of a home or similar.

10 Closed box here means a box that defines a closed space without necessarily being hermetically sealed and on which there are sufficient cracks and chinks to enable an airflow through the closed space.

15 The present invention provides for a filter cartridge for removal of malodor caused by animal waste, comprising a liquid reservoir, a pump coupled to the liquid reservoir configured to circulate a liquid reagent in the reservoir, such as by at least two tubes, the liquid reservoir comprises said liquid reagent, an air inlet coupled to an air inlet valve present within the circuit comprising the pump and configured to circulate the liquid reagent in the reservoir. In one embodiment the air inlet valve is disposed in one of the tubes coupled to the pump, and further characterized in
20 that the tube, comprising the air inlet valve comprises an one-way valve at the junction with the liquid reservoir. The one-way valve in one of said tubes controls an unidirectional circulation of the liquid reagent through the tubes.

25 In an embodiment, the filter cartridge for removal of malodor caused by animal waste is removable.

In some embodiments, the liquid reservoir of the filter cartridge for removal of malodor caused by animal waste is open.

30 In another embodiment, the liquid reservoir of the filter cartridge for removal of malodor caused by animal waste comprises an additional filter or the liquid reservoir is configured to function as a nutrient source for a plant, such as for example by incorporation into a planter.

In a further embodiment, the liquid reagent of the liquid reservoir is water.

35 In yet another embodiment, the filter cartridge for removal of malodor caused by animal waste is configured to regulate an air circulation. In particular an air circulation drawing air from the base (lower section) of the litter box, through the air inlet towards the air inlet valve, the latter configured to mix the contaminated air with the liquid reagent. As further detailed hereinafter, in

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a particular embodiment the air inlet valve is a venturi, wherein the flow of the liquid reagent across said venturi pulls (suction) the contaminated air into the liquid reagent.

5 The filter cartridge for removal of malodor caused by animal waste comprises a presence detector.

In another embodiment, the presence detector can be selected from a motion detection sensor, an IR indication sensor.

10 In a following embodiment, the sensor can be programmable.

15 In a further embodiment, a litter box comprises the filter cartridge for removal of malodor caused by animal waste, comprising a liquid reservoir, a pump coupled to the liquid reservoir by at least two tubes, the liquid reservoir comprises a liquid reagent, an air inlet, coupled to an air inlet valve disposed in one of the tubes coupled to the pump, characterized in that the tube, comprising the air inlet valve comprises a one-way valve at the junction with the liquid reservoir. Within said further embodiment the filter cartridge is preferably removable.

20 In one embodiment the present invention provides a litter box comprising a filter cartridge, preferably a removable cartridge for removal of malodor caused by animal waste, comprising an open liquid reservoir, a pump coupled to the liquid reservoir by at least two tubes, the liquid reservoir comprises a liquid reagent, an air inlet, coupled to an air inlet valve disposed in one of the tubes coupled to the pump, characterized in that the tube, comprising the air inlet valve comprises an one-way valve at the junction with the liquid reservoir.

25 In another embodiment, the present invention provides a litter box comprising a filter cartridge for removal of malodor caused by animal waste, comprising an liquid reservoir comprises an additional filter or a liquid reservoir configured to function as a nutrient source for a plant, a pump coupled to the liquid reservoir by at least two tubes, the liquid reservoir comprises a liquid reagent, an air inlet, coupled to an air inlet valve disposed in one of the tubes coupled to the pump, characterized in that the tube, comprising the air inlet valve comprises an one-way valve at the junction with the liquid reservoir.

30 In yet another embodiment the present invention provides, a litter box comprises a filter cartridge for removal of malodor caused by animal waste as presented herein,, preferably configured to regulate an air circulation, comprising a liquid reservoir, a pump coupled to the liquid reservoir by at least two tubes, the liquid reservoir comprises a liquid reagent, an air inlet, coupled to an air inlet valve disposed in one of the tubes coupled to the pump, characterized in that the tube, comprising the air inlet valve comprises an one-way valve at the junction with the liquid reservoir.

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In a next embodiment, the present invention provides a litter box comprises the filter cartridge, preferably removable, for removal of malodor caused by animal waste, comprising a liquid reservoir, a pump coupled to the liquid reservoir by at least two tubes, the liquid reservoir
5 comprises a liquid reagent, an air inlet, coupled to an air inlet valve disposed in one of the tubes coupled to the pump, further comprises a presence detector, characterized in that the tube, comprising the air inlet valve comprises an one-way valve at the junction with the liquid reservoir. In this embodiment the presence detector can be selected from a motion detection sensor, an IR indication sensor, and the like; preferably from a motion detection sensor and/or an IR
10 indication sensor.

In a further embodiment, of a litter box according to the invention comprising a presence detector the presence detector can be programmable.

15 In a further embodiment, the present invention provides a planter comprising the filter cartridge for removal of malodor caused by animal waste as described herein, i.e., comprising a liquid reservoir, a pump coupled to the liquid reservoir by at least two tubes, the liquid reservoir comprises a liquid reagent, an air inlet, coupled to an air inlet valve disposed in one of the tubes coupled to the pump, characterized in that the tube, comprising the air inlet valve comprises an
20 one-way valve at the junction with the liquid reservoir.

Each of the embodiments described hereinbefore in relation to the filter cartridge in a litter box, are equally and each independently applicable on a planter comprising the filter cartridge.

Hence in some embodiments of the planter;

- 25
- The filter cartridge will be removable.
 - The filter cartridge is open.
 - The filter cartridge comprises an additional filter.
 - The liquid reservoir of the filter cartridge is configured to act as nutrient source for a plant.
- 30
- The filter cartridge is configured to regulate an air circulation.
 - The filter cartridge further comprises a presence detector, preferably selected from a motion detection sensor, and/or an IR indication sensor. In some embodiments the presence detector can be programmable.

35 In yet another embodiment the present invention provides a planter comprising a litter box as provided in each of the different embodiments herein provided.

In an another embodiment, the present invention provides a method for cleaning air using the filter cartridge according to the invention, preferably for cleaning air in a litter box, said method

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comprising the steps of turning on the pump, in particular using a sensor or on a user schedule; starting the circulation of the water using the pump; suction of the contaminated air, such as from the litter box using the air inlet valve; mixing the contaminated air such as from the litter box with the liquid reagent from the liquid reservoir using the air inlet valve; letting out the purified
5 air into the environment from the liquid reservoir using a process of evaporation; turning off the pump in particular using a sensor or on a user schedule

As mentioned herein before, in an embodiment of the present invention the filter cartridge and optionally the litter box can be integrated into a planter. Hence in some embodiments, the
10 present invention provides a method for removal of malodor caused by animal waste, comprising the steps of suction of the air from a litter box into a filter cartridge for removal of malodor caused by animal waste, preferably removable, comprising a liquid reservoir, a pump coupled to the liquid reservoir by at least two tubes, the liquid reservoir comprises a liquid reagent, an air inlet,
15 coupled to an air inlet valve disposed in one of the tubes coupled to the pump, characterized in that the tube, comprising the air inlet valve comprises an one-way valve at the junction with the liquid reservoir; and an integration of the filter cartridge with a planter. In said further embodiment the liquid reservoir will act as a nutrient source for a plant,

Different methods on configuration of the liquid reservoir as nutrient source can be applied. In
20 one such embodiment the integration as nutrient source comprises a water bridge system, typically comprising further the steps of an integration of the filter cartridge with a planter using a dividing surface, placing soil in the planter. In a particular embodiment on the integration of the liquid reservoir as nutrient source comprising a water bridge system, a soil-liquid ratio is adjustable and has a ratio of 2:1 to 4:1.

25 In an alternative embodiment the integration as nutrient source comprises hydroponics, comprising further the steps of an integration of the filter cartridge with a planter using a perforated separation plate, placing soil on the perforated separation plate. In a particular embodiment on the integration of the liquid reservoir as nutrient source comprising hydroponics,
30 a soil-liquid ratio is adjustable and has a ratio of 2:1 to 4:1.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of a filter cartridge for removal of malodor caused by animal waste, according
35 to an embodiment of the present invention.

Fig. 2 is an isometric longitudinal sectional view of a litter box comprising a filter cartridge for removal of malodor caused by animal waste, according to an embodiment of the present invention.

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- Fig. 3 is a schematic side perspective view of a litter box comprising a filter cartridge for removal of malodor caused by animal waste, according to an embodiment of the present invention.
- Fig. 4 is a front perspective view of a filter cartridge for removal of malodor caused by animal waste, according to an embodiment of the present invention.
- 5 Fig. 5 is a side view of a filter cartridge for removal of malodor caused by animal waste, according to an embodiment of the present invention.
- Fig. 6A is a measurement over time (days) of the pH in the water reservoir of the filter cartridge when used as a nutrient for a planter
- 10 Fig. 6B is a measurement of the ammonia concentration (mg/L) in the water reservoir of the filter cartridge when used as a nutrient for a planter.

DETAILED DESCRIPTION OF THE INVENTION

- 15 The present invention will be described with respect to particular embodiments and with reference to certain drawings, but the invention is not limited thereto. The drawings, as further described, are only schematic and non-limiting. In the drawings, some of the elements may not be drawn to scale for illustrative purposes. The dimensions and the relative dimensions do not correspond to the actual reductions to practice of the invention.

- 20 Furthermore, the terms first, second, further and the like in the description and in the claims are used for distinguishing between similar elements and not necessarily for describing a sequence, either temporally, spatially, in ranking or in any other manner. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or
- 25 illustrated herein.

- It is to be noticed that the term "comprising", used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated features, integers, steps or
- 30 components as referred to, but does not preclude the presence or addition of one or more other features, integers, steps or components, or groups thereof. Thus, the scope of the expression "a product comprising A and B" should not be limited to devices consisting only of components A and B. It means that with respect to the present invention, the relevant components of the product are A and B, and that further components such as C may be present.

- 35 Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are

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not necessarily all referring to the same embodiment. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to one of ordinary skill in the art from this disclosure, in one or more embodiments.

5 Similarly, it should be appreciated that in the description of exemplary embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed invention
10 requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the claims following the detailed description are hereby expressly incorporated into this detailed description, with each claim standing on its own as a separate embodiment of this invention.

15 Furthermore, while some embodiments described herein include some, but not other features included in other embodiments, combinations of features of different embodiments are meant to be within the scope of the invention, and form different embodiments, as would be understood by those in the art. For example, in the following claims, any of the claimed embodiments can
20 be used in any combination.

In the description provided herein, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practiced without these specific details. In other instances, well-known methods, structures and techniques have not been shown in
25 detail in order not to obscure an understanding of this description.

As used herein and unless otherwise specified, the term "an air inlet valve" is to be understood as a valve or device that permits entrance of air, in particular the malodor air that needs to be treated, into the filter cartridge such as, in particular, a venturi, where the air inlet is connected
30 to the low pressure/suction side of the venturi. The low pressure is created by flow of the liquid reagent across the venturi. This configuration also explains the need of a one-way valve in the tube downstream of the venturi and in particular at the junction with the liquid reservoir.

As used herein and unless otherwise specified, the term "an one-way valve" is to be understood as a device for automatically limiting flow in a piping system to a single direction. Also known as
35 nonreturn valve, check valve.

As used herein and unless otherwise specified, the term "removable" is to be understood as something that can easily be moved from its place or position.

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As used herein and unless otherwise specified, the term "liquid reagent" is to be understood as a substance for use in a chemical reaction, especially for use as a solvent or reagent in chemical synthesis and analysis, in the state, as distinguished from solid and gas, in which a substance
5 has a definite volume but no definite shape.

As used herein and unless otherwise specified, the term "planter" is to be understood as a ornamental container to receive plants.

10 As used herein and unless otherwise specified, the term "programmable" is to be understood as something that is capable of following instructions or being programmed for automatic operation or computer processing.

As used herein and unless otherwise specified, the term "a water bridge system" is to be
15 understood as a concept, wherein use is made of the capillary forces in an absorbent material that can absorb the liquid, preferably water, from the liquid reservoir and release it to the substrate in which the plant is located.

As used herein and unless otherwise specified, the term "hydroponics" is to be understood as a
20 growth of plants without the use of potting soil, wherein the roots of the plants are immersed in water that contains all the nutrients and oxygen normally present in the potting soil.

It is an advantage of embodiments of the current invention that the unpleasant and pungent odor can be removed from the litter box by means of the extraction installation, such that it can no
25 longer cause an odor nuisance both inside and outside the litter box.

This will increase the comfort of both the animal and people in the vicinity of the litter box.

It is a further advantage of embodiments of the current invention that the removable tray is
30 integrated as it were the losable box, and a separate removable tray does not have to be provided.

It is yet a further advantage of embodiments of the current invention that a separate ventilation system does not have to be provided but can be integrated within the litter box. The filter
35 cartridge as herein provided has been exemplified as part of a litter box, but this particular application shouldn't be understood as restrictive to the application of the filter cartridge in other environments and devices wherein malodor air treatment may be required.

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It is also an advantage of embodiments of the current invention that the removing of malodor caused by animal waste can be set to switch on automatically when an animal uses the litter box.

- 5 It is also an advantage of embodiments of the current invention that the malodor feces and/or urine continue to emit after the animal has defecated are also removed.

We now refer to figure 1, showing a side view of a filter cartridge (100) for removal of malodor caused for example by animal waste, according to an embodiment of the present invention.

- 10 This figure clearly shows that the filter cartridge (100) for removal of malodor for example caused by animal waste comprises a liquid reservoir (101) and a pump (102) coupled to the liquid reservoir (101) by at least two tubes (103, 104). In this example, the filter cartridge (100) is removable and open. The filter cartridge (100) can also be integrated in the device requiring malodor air treatment, such as for example a litter box. The liquid reservoir (101) comprises a liquid reagent. The liquid reagent can be a water. The liquid reservoir (101) can also act as a nutrient source for a plant. The filter cartridge (100) comprises an air inlet (105) coupled to an air inlet valve (106) disposed in one of the tubes (103), coupled to the pump (102). The air inlet valve (106) can be a venturi injector, which builds up a low pressure at one side of the venturi when the liquid reagent is pumped through. The air inlet (105) is connected to the low pressure/suction side of the Venturi (106). The tube (103), comprising the air inlet valve (106), comprises a one-way valve (107) at the junction with the liquid reservoir (101). The filter cartridge (100) is configured to regulate an air circulation and comprises in the embodiment shown in figure 1 a presence detector (109). The presence detector (109) is connected with a printed circuit board (PCB) (108), present within the filter cartridge and configured to control amongst others the pump to circulate the liquid reagent (*infra*). The presence detector (109) can be a sensor (110) selected from a motion detection sensor, an IR indication sensor. The sensor (110) can also be programmable. The PCB (108) can be powered by the electrical network or any type of batteries. The PCB (108) also can provide power to the pump (102). The PCB (108) also can be a transformer. It is possible to provide a light source (111), such as a lamp, LED's or similar for example, on the inside of the walls of the litter box (200) and, if desired, this lighting source (111) can also be coupled to the presence detector (109) and if applicable can be also programmable in order to control the switching on and off thereof. The light source (111) can be powered by the PCB (108).

- 35 We now refer to figure 2, showing an isometric longitudinal sectional view of a litter box (200) comprising a filter cartridge (100) for removal of malodor caused by animal waste, according to an embodiment of the present invention. This figure clearly shows that the litter box (200) comprises the filter cartridge (100). In this example, the filter cartridge (100) also is removable and open and also comprises a liquid reservoir (101). The filter cartridge (100) further comprises

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an additional filter (112), which can be a carbon filter, disposed above the liquid reservoir (101), downstream of the air flow direction indicated by the arrow in the figure 2. The filter cartridge (100) further comprises the PCB (108). The walls of the litter box (200) can be made lightproof or opaque, for example by constructing the walls of the litter box (200) of wood or a diffuse transparent plastic or similar. This has the advantage that the animal has sufficient privacy when using the litter box (200).

It is clear that the litter box (200) according to the present invention can be used by different species of animals, and that the dimensions of the litter box (200) can be adapted to the animal that will use the litter box (200). It is accordingly an embodiment of the present invention to provide the use of a litter box comprising a filter cartridge according to the invention by animals.

A method for cleaning the malodor air in for example a litter box (200) is also illustrated on fig. 2 and is carried out as follows. The pump (102) is turned on using the sensor (110) or on a user schedule. The circulation of the water is started using the pump (102). The air is sucked from the litter box (200), preferably from the base (lower section) of the litter box through the air inlet (105) using the air inlet valve (106). The air from the litter box (200) is mixed with the liquid reagent from the liquid reservoir (101) using the air inlet valve (106). The purified air is let out into the environment from the liquid reservoir (101) using a process of evaporation. The pump (102) is turned off using the sensor (110) or on a user schedule. The direction of air movement inside the litter box is indicated on fig. 2 by arrows.

One of the benefits of the present invention is that the liquid reservoir, and as such the filter cartridge (100), illustrated on fig. 1, can be used as a fertilizer for plants, wherein the liquid reservoir (101) is a nutrient source, such as for example by incorporation into a planter.

Figure 3 illustrates a schematic side perspective view of a litter box comprising a filter cartridge for removal of malodor caused by animal waste, according to an embodiment of the present invention. This figure clearly shows that the litter box (200) comprises a planter (201) which is integrated with the filter cartridge (100), illustrated on fig. 1. The litter box (200) can be either integrated with or adjacent to the planter (201). The liquid reservoir (101) of the filter cartridge acts in this example as a nutrient source for a plant.

In this embodiment, wherein the filter cartridge and optionally the litter box are part of a planter, the removal of malodor caused by animal waste is carried out as follows. The air is sucked from a litter box (200) into a filter cartridge (100) according to the invention, such as illustrated on fig. 1, yielding adsorption of the malodors, being rich in Nitrogen (N), Potassium (K) and Phosphorous (P), by the liquid reagent in the liquid reservoir. Being enriched in said plant nutrients, it is an advantage of the present invention to integrate the filter cartridge (100) with a

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planter (201), wherein the liquid reservoir acts as a nutrient source to the soil and plant which is placed in the planter (201). The integration of the filter cartridge (100) can be configured to use a water bridge system or a hydroponics. By integration into a planter, with consumption of the malodors, saturation of the liquid reagent is prevented, and one only needs to monitor the water level in liquid reservoir.

If the integration of the filter cartridge (100), illustrated on fig. 1, is configured to use a water bridge system, then the filter cartridge (100) is integrated with a planter (201) using a dividing surface (202). The position of the dividing surface (202) is also adjustable depending on the plant species. With the adjustable dividing surface (202), it must be taken into account that the dividing surface (202) fixed enough to the wall of the litter box (200) so that potting soil does not fall into the liquid reservoir (101) and that the planter (201) using the dividing surface (202) are strong enough to support the (moistened) potting soil and a plant. With a water bridge system, the soil and the liquid reservoir (101) are completely separated and on top of each other. The water bridge is a piece of cloth that on one side touches the liquid below and on the other side touches the soil in the top reservoir. The liquid is lifted with a capillary effect.

There are three options for the water bridge system: the first, wherein a mat system in which a mat transports the liquid, the second, wherein a wick serves as a wick, and the third wherein the wick is replaced by granulate. In order to visually present the system with the water bridge, two examples were worked out in which there is a horizontal and a vertical extension of the litter box (200) into the planter. A horizontal extension of the litter box (200) is illustrated on fig. 3. In this example, a soil-liquid solution is adjustable. In some embodiments, in accordance with the present invention, the soil-liquid solution can have a ratio of 2:1 or a ratio of 4:1. The ratio depends on the plant species and can be regulated by the position of the dividing surface (202). In this example the soil-liquid solution has a ratio of 2:1.

Figure 4 illustrates is a front perspective view of a filter cartridge for removal of malodor caused by animal waste, according to an embodiment of the present invention. This figure clearly shows a vertical extension of the litter box (200). In this example a vertical extension of the litter box (200) is used, wherein the planter (201) and the liquid reservoir (101) are placed on top of the litter box (200) to preserve the original footprint. The relatively large surface area of the proposed planter (201) can present a challenge in terms of uniform distribution of the liquid, preferably actin as the nutrient water, in the potting soil. That is why the mat system with a mat (203) is used, on which the soil is placed. The soil can be a potting soil. Doubts about the ability of such a mat (203) to fully provide deeper layers of potting soil with moisture can be resolved with the help of so-called "pylons" (204). These pylons (204) are cylinders of porous material that vertically connect the liquid reservoir (101) with even the shallowest parts of the potting soil. For example, the pylons (204) could be made of a porous material such as fiberglass wool

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surrounded by a cylindrical plastic structure with slots to allow liquid transfer. It can be a combination mat-wick system. Furthermore, the figure 4 illustrates also a water level indicator (flag pole) (205) in case the liquid reservoir (101) is opaque. Other options can be placed on this on the side of the liquid reservoir (101).

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Figure 5 illustrates is a side view of a filter cartridge for removal of malodor caused by animal waste, according to an embodiment of the present invention. This figure clearly shows that in this embodiment the integration of the filter cartridge (100), illustrated on fig. 1, is configured to use hydroponics. In this example the filter cartridge (100) is integrated with a planter (201) using a perforated separation plate (206). The perforated separation plate (206) is disposed on top of the liquid reservoir (101) filled with the liquid reagent, preferably the nutrient-rich water. Each perforation of the perforated separation plate (206) comprises a dish (207). A plant is anchored in hydroponic media in the dish (207). The roots of the plant are disposed in the nutrient-rich water. The liquid reservoir (101) can also comprise an air pump and an air stone to enrich the water with oxygen.

It has been found that when the liquid reservoir is configured to be used as a nutrient source for a planter, the need of regularly replacing the filter cartridge is seriously reduced. From an analysis of the malodor caused by animal waste, it has been determined that the main volatile components consist of thiols, ammonia and pyruvic acid, with ammonia being the main component. In order to test the durability of the liquid reservoir when used as a plant nutrient an experiment has been performed in which two parameters were monitored over time.

Absorption of the volatile components in water is expected to influence the pH, with the main component being ammonia, increasing concentrations of ammonia will result in a more basic, hence higher pH. Besides the pH, also the ammonia concentration has been measured over time. As evident from Figure 6, the pH only slightly increased over the tested period of 27 days, and the ammonia concentration only starts to rise from day 20 onwards, but remains far below the values of about 200 to 300 mg/L found in liquid fertilizers.

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LIST OF FEATURES

Number	Feature
100	A filter cartridge
101	a liquid reservoir
102	A pump
103	A tube with the air inlet valve
104	A tube
105	an air inlet
106	an air inlet valve
107	an one-way valve
108	printed circuit board (PCB)
109	a presence detector
110	a sensor
111	LED
200	A litter box
201	A planter
202	a dividing surface
203	a mat
204	a pylon
205	a water level indicator
206	a perforated separation plate
207	a dish

CLAIMS

1. A filter cartridge (100) for purifying contaminated air comprising malodor caused by animal waste,
5 comprising
 - a presence detector (109)
 - a liquid reservoir (101)
 - A pump (102) coupled to the liquid reservoir (101) by at least two tubes (103, 104),
 - the liquid reservoir (101) comprises a liquid reagent
 - 10 - an air inlet (105), coupled to an air inlet valve (106) disposed in one of the tubes (103) coupled to the pump (102)Characterized in that
 - the tube (103), comprising the air inlet valve (106) comprises an one-way valve (107) at the junction with the liquid reservoir (101); and in that
 - 15 - the air inlet (105) is configured to mix the contaminated air with the liquid reagent from the liquid reservoir.
2. The filter cartridge (100) according to claim 1, wherein said filter cartridge (100) is removable
20
3. The filter cartridge (100) according to claim 1, wherein the liquid reservoir (101) is open
4. The filter cartridge (100) according to claim 1, wherein the liquid reservoir (101) comprises an additional filter or wherein the liquid reservoir (101) is configured as a nutrient source for a plant.
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5. The filter cartridge (100) according to claim 1, wherein said liquid reagent is water.
6. The filter cartridge (100) according to claim 1, wherein the pump (102) is configured to circulate the liquid reagent from the liquid reservoir (101) through said at least two tubes (103, 104)
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7. The filter cartridge (100) according to claim 1, wherein the presence detector (109) can be a sensor (110) selected from a motion detection sensor, an IR indication sensor
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8. The filter cartridge (100) according to claim 7, wherein the sensor (110) can be programmable

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9. A litter box (200) comprising the filter cartridge (100) according to any of previous claims
10. The litter box (200) according to claim 9, wherein the filter cartridge (100) is removable
- 5 11. A planter (201) comprising the filter cartridge (100), according to claims 1 to 8
12. The use of the litter box (200) according to any of previous claims
- 10 13. The use of filter cartridge (100) according to any of previous claims as a fertilizer for plants, wherein the liquid reservoir (101) is a nutrient source
14. A method for cleaning contaminated air in a litter box (200) using a filter cartridge according to any one of the previous claims comprising the steps of
- 15 - Turning on the pump (102) of the filter cartridge using the presence detector (109) or on a user schedule
- Starting the circulation of the liquid reagent using the pump (102)
- Suction of the contaminated air from the litter box (200) into the filter cartridge using the air inlet (105)
- 20 - mixing the contaminated air from the litter box (200) with the liquid reagent from the liquid reservoir (101) using the air inlet valve (106)
- letting out the purified air into the environment from the liquid reservoir (101) using a process of evaporation
- Turning off the pump (102) using the presence detector (109) or on a user schedule
- 25 15. The method according to claim 14, comprising the steps of:
- Integration of the filter cartridge (100) with a planter (201)
- Placing at least one plant in the planter (201)
- 30 16. A method for removal of malodor caused by animal waste according claim 15, wherein the integration of the filter cartridge (100) with a planter (201) is configured to use a water bridge system, comprising further the steps of:
- An integration of the filter cartridge (100) with a planter (201) using a dividing surface (202)
- 35 - Placing soil in the planter (201)
17. A method for removal of malodor caused by animal waste according claim 15, wherein the integration of the filter cartridge (100) with a planter is configured to use a hydroponics, comprising further the steps of:

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- An integration of the filter cartridge (100) with a planter (201) using a perforated separation plate (206)
- Placing at least one plant on the perforated separation plate (206)

5 18. A method for disposal of animal waste, according to claim 17, wherein a soil-liquid solution is adjustable and has a ratio of 2:1 to 4:1

19. A method for removal of malodor caused by animal waste, according to claim 15, wherein the litter box (200) is either integrated with or adjacent to the planter (201)

10