



AN OZONISED VAPOUR GENERATOR

Field of Invention

The present invention generally relates to an ozonised vapour generator.

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Background

Social and technological advances have resulted in higher expectations for quality of life. However, increased urbanization that results from such social and technological advances results in declining air quality through, for example, bacterial contamination. Furthermore, the popular use of air-conditioning at home and centralized ventilation systems in commercial buildings has assisted in the spread of harmful bacteria. Additionally, bacterial contamination can also occur to any objects and surfaces, for example processed and unprocessed food through contact or spatial proximity thereof with contaminants or other already contaminated objects.

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15 Therefore, there has been an increasing interest in disinfection and sterilisation methods and approaches.

Chemical disinfectants, for example phenols, hypochlorite and formaldehyde, are commonly used for disinfection or for the reduction of pathogens. However, when food and water come into contact with these chemical disinfectants, they become unsafe for human consumption. The production and use of steam for disinfection is also a commonly used method. However, the heat generated during the production of steam is not only harmful to individuals but will also damage some materials, for example fabrics, books, papers and heat-sensitive equipment.

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United States Patent No. 6,589,489 B2 describes a system which uses ultraviolet (UV) light for irradiating ozone and water in a dielectric body for the formation of highly reactive hydroxyl radical for sterilizing air drawn into a channel. However, as sterilization only occurs within the channel, this system can only be used for sterilizing air and cannot be used for sterilizing objects or surfaces.

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United States Patent No. 6,886,373 B2 describes a garment steamer which produces steam by boiling water. The steam produced is subsequently mixed with ozone for deodorizing and potentially disinfecting garment. However, as abovementioned, the heat generated during the production of steam is harmful to human and damaging to material.

United States Patent No. 6,379,633 describes a system for applying ultrasound produced by acoustic transducers and temperature control to ozonated water for obtaining ozonated vapour therefrom. Objects are then passed through the ozonated vapour for sterilization and disinfection. However, the system requires a highly elaborate set-up and the ozonated vapour generated therefrom has to be controlled by discharge thereof into chambers for containment.

There is therefore a need for an ozonised vapour generator for at least one of disinfecting and sterilising air, objects and surfaces without being harmful to human and food for human consumption.

Summary

In accordance with a first aspect of the invention, there is disclosed an ozonised vapour generator comprising a chamber for receiving liquid thereinto, an ozonator and an atomising structure. The ozonator is coupled to the chamber for delivering ozone (O_3) into the liquid received by the chamber for obtaining ozonised liquid therefrom. In addition, the chamber is further for directing the ozonised liquid towards the atomising structure while the atomising structure is for atomising the ozonised liquid directed thereat into and for directing the ozonised vapour away from the atomising structure as ozonised vapour.

In accordance with a second aspect of the invention, there is disclosed an ozonised vapour generator comprising a chamber for receiving liquid thereinto, a plurality of ozonators and an atomising structure. The plurality of ozonators are coupled to the chamber for delivering ozone (O_3) into the liquid received by the chamber for obtaining ozonised liquid therefrom. In addition, the chamber is further for directing

the ozonised liquid towards the atomising structure while the atomising structure is for atomising the ozonised liquid directed thereat into and for directing the ozonised vapour away from the atomising structure as ozonised vapour.

- 5 In accordance with a third aspect of the invention, there is disclosed a method for generating ozonised vapour comprising the step of receiving liquid into a chamber. Next, ozone (O_3) is delivered into the liquid received by the chamber for obtaining ozonised liquid therefrom. The ozone is generated by an ozonator that is coupled to the chamber. The ozonised liquid is then directed by the chamber towards the
10 atomising structure, the atomising structure for atomising the ozonised liquid directed thereat into and for directing the ozonised vapour away from the atomising structure as ozonised vapour.

Brief Description Of The Drawings

- 15 Embodiments of the invention are disclosed hereinafter with reference to the drawings, in which:

FIG. 1 shows a system flow chart of an ozonised vapour generator according to an embodiment of the invention; and

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FIG. 2 shows a partial sectional view of the ozonised vapour generator of FIG. 1.

Detailed Description

- 25 An ozonised vapour generator is described hereinafter for addressing the foregoing problems.

An embodiment of the invention, an ozonised vapour generator 20 is described with reference to FIG. 1 and FIG. 2. The ozonised vapour generator 20 comprises a chamber 22, an ozonator 24 and an atomising structure 26.

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The chamber 22 is for receiving liquid 28, for example water, thereinto. The chamber 22 preferably receives liquid 28 from a container 30 being in fluid communication

therewith. Alternatively, the chamber 22 is coupled to one of a water point and a water manifold using an adaptor (not shown) for receiving liquid 28 therefrom.

Preferably, the ozonised vapour generator 20 further comprises a pump 32 for
 5 delivering the liquid 28 through a filtration assembly 34 and into the chamber 22. The pump 32 is one of a centrifugal pump and a displacement pump and is preferably electrically operated. The filtration assembly 34 is for filtering the liquid 28 delivered by the pump 32 to the chamber 22 and preferably comprises replaceable filters (not shown).

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The ozonator 24 is coupled to the chamber 22 and is for generating ozone (O_3) 36. The ozone 36 is generated by the ozonator 24 preferably by corona discharge. Alternatively, the ozone 36 is generated by the ozonator 24 by one of ultraviolet irradiation and electrolysis. A venturi 38 structurally interfaces the ozonator 24 and
 15 the chamber 22 for drawing the ozone 36 generated by the ozonator 24 into the liquid 28 in the chamber 22. The venturi 38 comprises a one-way flow valve 40 for substantially impeding flow of the liquid 28 from the chamber 22 to the ozonator 24.

When the ozone 36 from the ozonator 24 is delivered into and mixes with the liquid
 20 28 in the chamber 22, ozonised liquid 42 is obtained therefrom. The ozonised liquid 42 is then directed towards the atomising structure 26. The atomising structure 26 is preferably a nozzle 44 having a channel 46 formed therein. The channel 46 is formed in fluid communication with the chamber 22 to allow the ozonised liquid 42 directed at the nozzle 44 to passage through the channel 46.

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The pump 32 preferably delivers the liquid 28 into the chamber 22 at a pre-determined pressure to thereby enable the ozonised liquid 42 to passage through the channel 46 at the pre-determined pressure. The channel 46 is shaped and dimensioned for atomising ozonised liquid 42 passing therethrough at preferably
 30 the pre-determined pressure into ozonised vapour 48. Additionally, the channel 46 is further for directing the ozonised vapour 48 away from the nozzle 44 as it is being atomised as ozonised liquid 42 into the ozonised vapour 48 by the channel 36.

As vapour is also typically known as one of fog and mist, the ozonised vapour 48 can alternatively be ozonated vapour, ozonised fog or ozonised mist.

5 Generating the ozonised vapour 48 using the ozone vapour generator 20 differs from boiling liquid to obtain steam because the temperature of the ozonised vapour 48 being generated is substantially lower than that of steam.

10 Alternatively, the container 30 and the pump 32 are replaceable with a pressurised container (not shown) which is pre-filled with pressurised liquid. The chamber 22 preferably has an adaptor (not shown) for enabling the pressurised container to be removably couplable thereto. Using a valve (not shown) for interfacing the pressurised container with the chamber 22, the valve is operable for releasing liquid from the pressurised container for delivery into the chamber 22 at a pre-determined pressure. The adaptor allows an emptied pressurised container to be easily
15 replaceable with a filled pressurised container during use of the ozonised vapour generator 20.

Alternatively, the atomising structure 26 is a disc (not shown) being operable for spinning at a pre-determined rotational speed. When the ozonised liquid 42 is
20 directed at a portion of the spinning disc, the spinning disc atomises the ozonised liquid 42 into the ozonised vapour 48 and directs the ozonised vapour 48 away from the spinning disc.

The ozonised vapour generator 20 further comprises a controller for controlling
25 delivery of the ozone 36 and the liquid 28 from respectively the ozonator 24 and the pump 32 into the chamber 22.

Preferably, the ozonised vapour generator 20 further comprises a battery array (not shown) for electrically powering the pump 32 and the ozonator 24. The battery array
30 comprises an arrangement of rechargeable batteries to enable the ozonised vapour generator 20 to be physically portable and operationally independent. The container

30 has a pre-determined shape and size to improve compactness and portability of the ozonised vapour generator 20.

5 The compactness and portability of the ozonised vapour generator 20 enables use thereof as preferably one of a vapour-curtain generator along walkways or atop entrances of installations and buildings, a fogging machine for generating ozonised fog, and a cleaning apparatus for generating ozonised vapour.

10 Alternatively, the ozonised vapour generator 20 comprises an array of ozonators (not shown) coupled to and for fluid communication with the chamber 22. The controller further enables sequence of discharge of ozone from each of the controllers to the chamber 22 to be controlled and coordinated. This enables the operational load of generating ozone amongst the ozonators to thereby increase the operational lifespan of the ozonised vapour generator 20.

15 The ozonised vapour 48 generated by the ozonised vapour generator 20 is preferably applicable for disinfection, deodorisation, sterilisation and humidification purposes.

20 In the foregoing manner, a ozonised vapour generator is described according to one embodiment of the invention for addressing the foregoing disadvantages of conventional ozonised vapour and ozonised liquid generators. Although only one embodiment of the invention is disclosed, it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modification can be made without departing from the scope and spirit of the invention.

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Claims

1. An ozonised vapour generator comprising:
 - a chamber for receiving liquid thereinto;
 - an ozonator coupled to the chamber for delivering ozone (O₃) into the
 - liquid received by the chamber for obtaining ozonised liquid therefrom; and
 - an atomising structure, the chamber further for directing the ozonised
 - liquid towards the atomising structure, the atomising structure for atomising
 - the ozonised liquid directed thereat into and for directing the ozonised vapour
 - away from the atomising structure as ozonised vapour.
2. The ozonised vapour generator as in claim 1, the atomising structure being a nozzle having a channel formed therein, the ozonised liquid passages through the channel when being directed at the nozzle, the channel being shaped and dimensioned for atomising the ozonised liquid passaging therethrough into and for directing the ozonised vapour away from nozzle as ozonised vapour.
3. The ozonised vapour generator as in claim 2, further comprising:
 - a pump for pressurising and delivering liquid into the chamber at a pre-determined pressure.
4. The ozonised vapour generator as in claim 2, further comprising:
 - a container being removably coupled to the chamber, the container for containing pressurised liquid for delivery into the chamber.
5. The ozonised vapour generator as in claim 1, the atomising structure being a disc, the disc for spinning at a pre-determined rotational speed when operated, whereby when the disc is operated, ozonised liquid directed at a portion thereof is atomised into and directed away therefrom as ozonised vapour.
6. The ozonised vapour generator as in claim 1, further comprising:

at least one of a centrifugal pump and a displacement pump for delivering liquid into the chamber.

7. The ozonised vapour generator as in claim 6, further comprising:
 5 a battery array for electrically powering at least one of the at least one of a centrifugal pump and the displacement pump and the ozonator.
8. The ozonised vapour generator as in claim 1, further comprising:
 10 a container in fluid communication with the channel for storing and providing liquid thereto.
9. The ozonised vapour generator as in claim 1, wherein ozone (O₃) is generated by the ozonator using one of corona discharge, ultraviolet irradiation and electrolysis.
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10. The ozonised vapour generator as in claim 1, further comprising:
 a venturi structurally interfacing the ozonator and the chamber for drawing ozone generated by the ozonator into the liquid in the chamber.
- 20 11. The ozonised vapour generator as in claim 10, the venturi comprising:
 a one-way flow valve for substantially impeding flow of liquid from the chamber to the ozonator.
12. The ozonised vapour generator as in claim 1, further comprising:
 25 a controller for controlling delivery of at least one of liquid and ozone into the chamber.
13. An ozonised vapour generator comprising:
 a chamber for receiving liquid thereinto;
 30 a plurality of ozonators coupled to the chamber for delivering ozone (O₃) into the liquid received by the chamber for obtaining ozonised liquid therefrom; and

an atomising structure, the chamber further for directing the ozonised liquid towards the atomising structure, the atomising structure for atomising the ozonised liquid directed thereat into and for directing the ozonised vapour away from the atomising structure as ozonised vapour.

- 5 14. The ozonised vapour generator as in claim 1, further comprising:

 a pump for pressurising and delivering liquid into the chamber at a pre-determined pressure,

 wherein the atomising structure being a nozzle having a channel formed therein, the ozonised liquid passages through the channel when being
10 directed at the nozzle, the channel being shaped and dimensioned for atomising the ozonised liquid passing therethrough into and for directing the ozonised vapour away from nozzle as ozonised vapour.

- 15 15. The ozonised vapour generator as in claim 1, the atomising structure being a disc, the disc for spinning at a pre-determined rotational speed when operated,
 whereby when the disc is operated, ozonised liquid directed at a portion thereof is atomised into and directed away therefrom as ozonised vapour.

- 20 16. The ozonised vapour generator as in claim 1, further comprising:
 at least one of a centrifugal pump and a displacement pump for delivering liquid into the chamber.

- 25 17. The ozonised vapour generator as in claim 16, further comprising:
 a battery array for electrically powering at least one of the at least one of a centrifugal pump and the displacement pump and the ozonator.

- 30 18. The ozonised vapour generator as in claim 1, further comprising:
 a container in fluid communication with the channel for storing and providing liquid thereto.

20. The ozonised vapour generator as in claim 1, wherein ozone (O_3) is generated by the each of the plurality of ozonators using one of corona discharge, ultraviolet irradiation and electrolysis.
- 5 21. The ozonised vapour generator as in claim 1, further comprising:
a controller for controlling at least one of delivery of liquid and coordinating the discharge of ozone from the plurality of ozonators into the chamber.
- 10 22. A method for generating ozonised vapour comprising the steps of:
receiving liquid into a chamber;
delivering ozone (O_3) into the liquid received by the chamber for obtaining ozonised liquid therefrom, the ozone being generated by an ozonator coupled to the chamber; and
15 directing the ozonised liquid by the chamber towards the atomising structure, the atomising structure for atomising the ozonised liquid directed thereat into and for directing the ozonised vapour away from the atomising structure as ozonised vapour.
- 20 23. The method for generating ozonised vapour as in claim 1, the step of directing the ozonised liquid by the chamber towards the atomising structure comprising the step of:
directing the ozonised liquid by a nozzle towards the atomising structure, the nozzle having a channel formed therein, the ozonised liquid
25 passages through the channel when being directed at the nozzle, the channel being shaped and dimensioned for atomising the ozonised liquid passaging therethrough into and for directing the ozonised vapour away from nozzle as ozonised vapour.
- 30 24. The method for generating ozonised vapour as in claim 23, further comprising the step of:

pressurising and delivering liquid into the chamber at a pre-determined pressure by a pump.

25. The method for generating ozonised vapour as in claim 23, further comprising
5 the step of:
providing a container being removably coupled to the chamber, the container for containing pressurised liquid for delivery into the chamber.
26. The method for generating ozonised vapour as in claim 1, the step of directing
10 the ozonised liquid by the chamber towards the atomising structure comprising the step of:
directing the ozonised liquid by the chamber towards a disc, the disc for spinning at a pre-determined rotational speed when operated,
whereby when the disc is operated, ozonised liquid directed at a
15 portion thereof is atomised into and directed away therefrom as ozonised vapour.
27. The method for generating ozonised vapour as in claim 1, further comprising the step of:
20 providing at least one of a centrifugal pump and a displacement pump for delivering liquid into the chamber.
28. The method for generating ozonised vapour as in claim 27, further comprising the step of:
25 providing a battery array for electrically powering at least one of the at least one of a centrifugal pump and the displacement pump and the ozonator.
29. The method for generating ozonised vapour as in claim 1, further comprising
30 the step of:
providing a container in fluid communication with the channel for storing and providing liquid thereto.

30. The method for generating ozonised vapour as in claim 1, the step of directing the ozonised liquid by the chamber towards the atomising structure comprising the step of:
generating ozone (O_3) by one of corona discharge, ultraviolet
5 irradiation and electrolysis.
31. The method for generating ozonised vapour as in claim 1, further comprising the step of:
providing a venturi structurally interfacing the ozonator and the
10 chamber for drawing ozone generated by the ozonator into the liquid in the chamber.
32. The method for generating ozonised vapour as in claim 31, the step of providing a venturi comprising the step of:
15 providing a one-way flow valve for substantially impeding flow of liquid from the chamber to the ozonator.
33. The method for generating ozonised vapour as in claim 1, further comprising the step of:
20 providing a controller for controlling delivery of at least one of liquid and ozone into the chamber.

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