

SYSTEM FOR GENERATING OZONISED FLUID

Field of Invention

The present invention generally relates to a system for generating ozonised fluid.

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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.

10 Furthermore, the use of air-conditioning at home and centralized ventilation systems in commercial buildings has assisted in the spread of bacterial contamination.

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. Bacterial contamination is especially pronounced within garbage containing enclosures such as rubbish chutes or organic waste collection bins. Within those enclosures, methane gas formed as a result of the bacterial contamination is substantially trapped. The trapped methane gas becomes a potential fire hazard. Therefore, there has been an increasing need for
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20 disinfection and sterilisation methods that can prevent the methane gas formation.

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
25 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 and other heat-sensitive equipment.

30 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.

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 a system for generating ozonised fluid for disinfection or for the reduction of bacterial contamination in areas such as rubbish chutes.

Summary

In accordance with a first embodiment of the invention, there is disclosed a system for generating ozonised fluid. The system comprises at least one chamber for receiving fluid and an ozonator coupled to the at least one chamber for providing ozone (O_3) to the at least one chamber for generating ozonised fluid therefrom. Additionally, the system comprises at least one exhaust and that the at least one chamber is further for providing the ozonised fluid to the at least one exhaust. Furthermore, the at least one exhaust is for exhausting the ozonised fluid as one of at least an O_3 gas, an ozonised vapour and a liquid jet, wherein the ozonised vapour and the ozonised liquid jet are pressurised.

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In accordance with a second embodiment of the invention, there is disclosed a method for generating ozonised fluid comprising the steps of receiving fluid into at least one

chamber and providing ozone (O₃) into the at least one chamber for generating ozonised fluid therefrom. The ozone is generated by an ozonator coupled to the at least one chamber. The method further involves providing the ozonised fluid by the at least one chamber to at least one exhaust. The at least one exhaust is for exhausting the ozonised fluid as one of an O₃ gas, an ozonised vapour and an ozonised liquid jet, wherein the ozonised vapour and the ozonised liquid jet are pressurised.

Brief Description Of The Drawings

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

FIG. 1 shows a system flow chart of an system for generating ozonised fluid according to an embodiment of the invention;

FIG. 2 shows a partial sectional view of a first chamber and a first exhaust of the system of FIG. 1;

FIG. 3 shows a partial sectional view of a second chamber and a second exhaust of the system of FIG. 1; and

FIG. 4 shows a partial sectional view of a third chamber and a third exhaust of the system of FIG. 1.

Detailed Description

A system for generating ozonised fluid is described hereinafter for addressing the foregoing problems.

In accordance with an embodiment of the invention, a system 20 is described with reference to FIG. 1. The system 20 comprises a first chamber 22A, a second chamber 22B, a third chamber 22C and an ozonator 24. The system 20 further comprises a first exhaust 26A, a second exhaust 26B and a third exhaust 26C. The system 20 is

configurable for installation in, for instance rubbish chutes, organic waste collection bins or other locations that require sterilization and disinfection.

The first and third chambers 22A, 22C are both for receiving fluid 28, for example water. The first and third chambers 22A, 22C preferably receive fluid 28 from a fluid container 30. Alternatively, the first and third chambers 22A, 22C are coupled collectively or individually to a water point or a water manifold using an adaptor (not shown) for receiving fluid 28.

Preferably, the system 20 further comprises a pump 32 connected to the fluid container 30 for delivering the fluid 28 through a filtration assembly 34 and into each of the first and third chambers 22A, 22C. The liquid 28 is thereafter delivered into the first and third exhausts 26A, 26C. The pump 32 can be a centrifugal pump or a displacement pump and is preferably electrically operated. The filtration assembly 34 is for filtering the fluid 28 directed by the pump 32 to the first and third chambers 22A, 22C and the first and third exhausts 26A, 26C. The filtration assembly 34 preferably comprises replaceable filters (not shown).

The ozonator 24 is coupled to the first, second and third chambers 22A, 22B, 22C. The ozonator 24 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 ultraviolet irradiation or electrolysis.

With reference to FIG. 2, a first venturi 38A structurally interfaces the first chamber 22A and is connected to the ozonator 24. The first venturi 38A directs the ozone 36 generated by the ozonator 24 into the first chamber 22A for mixing with the fluid 28. Preferably, the first venturi 38A comprises a first one-way flow valve 40A for substantially impeding flow of the fluid 28 from the first chamber 22A back to the ozonator 24.

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When the ozone 36 from the ozonator 24 is mixed with the fluid 28 in the first chamber 22A, a first ozonised liquid 42A is obtained from the first chamber 22A. The first

ozonised liquid 42A is then directed towards the first exhaust 26A. The first exhaust 26A is an atomising structure containing a first nozzle 44A. A first channel 46A is formed in the first nozzle 44A, which is in fluid communication with the first chamber 22A to allow ozonised vapour 48A directed at the first nozzle 44A to passage through
5 the first channel 46A.

The first channel 46A is shaped and dimensioned for atomising the first ozonised liquid 42A passaging therethrough at preferably a first pre-determined pressure into the ozonised vapour 48A. Additionally, the first channel 46A is further for directing the
10 ozonised vapour 48A away from the first nozzle 44A. The first channel 46A atomises the first ozonised liquid 42A into the ozonised vapour 48A.

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

As vapour is also typically known as fog or mist, the ozonised vapour 48A can
20 alternatively be ozonated vapour, ozonised fog or ozonised mist.

With reference to FIG. 3, the second chamber 22B is connected to the ozonator 24 via a second one-way flow valve 40B. The ozone 36 generated by the ozonator 24 enters the second chamber 22B via the second one-way flow valve 40B. The second one-way
25 flow valve 40B substantially impedes flow of the ozone 36 from the second chamber 22B back to the ozonator 24.

When the ozone 36 from the ozonator 24 is delivered into the second chamber 22B, the ozone 36 is then directed towards the second exhaust 26B. The second exhaust 26B is
30 preferably a second nozzle 44B for releasing the ozone 36 away from the second nozzle 44B and into the surroundings as ozonised gas 48B.

The ozonised gas 48B is advantageously used for reducing odour and for the reduction of bacterial contamination in enclosures such as rubbish chutes and organic waste collection bins. This further eliminates the formation of methane gas due to the bacterial contamination, which is potentially a fire hazard.

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With reference to FIG. 4, a second venturi 38B structurally interfaces the third chamber 22C and is connected to the ozonator 24. The second venturi 38B directs the ozone 36 generated by the ozonator 24 into the third chamber 22C for mixing with the fluid 28. Preferably, the second venturi 38B comprises a third one-way flow valve 40C for
10 substantially impeding flow of the fluid 28 from the third chamber 22C back to the ozonator 24.

When the ozone 36 from the ozonator 24 is mixed with the fluid 28 in the third chamber 22C, a second ozonised liquid 42B similar to that of the first chamber 22A is obtained
15 from the third chamber 22C. The second ozonised liquid 42B is then directed towards the third exhaust 26C. The third exhaust 26C is preferably a third nozzle 44C. A second channel 46B is formed in the third nozzle 44C, which is in fluid communication with the third chamber 22C to allow the second ozonised liquid 42B directed at the third nozzle 44C to passage through the second channel 46B. The third nozzle 44C further
20 exhausts the second ozonised liquid 42B as an ozonised liquid jet 48C.

The second channel 46B is shaped and dimensioned for channelling the second ozonised liquid 42B passing therethrough at preferably a second pre-determined pressure into the ozonised liquid jet 48C. Additionally, the second channel 46B is
25 further for exhausting the ozonised liquid jet 48C away from the third nozzle 44C.

The ozonised liquid jet 48C is advantageously used for disinfecting or sterilising air, objects and surfaces without being harmful to human and food for human consumption. The ozonised liquid jet 48C generated by the system 20 is preferably applicable for
30 disinfection, deodorisation, sterilisation and other cleaning purposes.

Alternatively, the third exhaust 26C is an ultrasonic nozzle. The ultrasonic nozzle is capable of generating and increasing the force applicable by the ozonised liquid jet 48C for enhancing the disinfection or sterilisation of surfaces.

- 5 The pump 32 preferably delivers the fluid 28 into the first and third chambers 22A, 22C at the first and pre-determined pressures respectively. This is to enable the first and second ozonised liquids 42A, 42B to passage through the first and second channels 46A, 46B respectively at the first and second pre-determined pressures. Alternatively, the first and second pre-determined pressures are substantially the same.

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The pump 32 can be connected between the first chamber 22A and the first exhaust 26A, as well as between the third chamber 22C and the third exhaust 26C for drawing the fluid 28 through the filtration assembly 34 and into the first and third chambers 22A, 22C.

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A valve (not shown) preferably structurally interfaces each of the first, second and third chambers 22A, 22B, 22C and the corresponding first, second and third exhausts 44A, 44B, 44C. The valve is for substantially impeding the flow of ozonised fluids from the first, second and third chambers 22A, 22B, 22C back to the corresponding first, second and third exhausts 44A, 44B, 44C. A selector (not shown) is preferably coupled to the valve for selecting one of or a particular combination of ozonised fluid exhausting from the first, second and third exhausts 44A, 44B, 44C.

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In another embodiment of the invention, the fluid container 30 and the pump 32 are replaceable with a pressurised fluid container or tank (not shown) which is pre-filled with pressurised fluid. Each of the first and third chambers 22A, 22C preferably has an adaptor (not shown) for enabling the pressurised fluid container to be removably couplable thereto. Using a valve (not shown) for interfacing the pressurised fluid container with each of the first and third chambers 22A, 22C, the valve is operable for releasing fluid from the pressurised fluid container for delivery into the first and third chambers 22A, 22C at a pressure level that is pre-determined. The adaptor allows an

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emptied pressurised fluid container to be easily replaceable with a filled pressurised liquid container during use of the system 20.

The system 20 further comprises a controller for controlling delivery of the ozone 36 and the fluid 28 from respectively the ozonator 24 and the pump 32 into the first and third chambers 22A, 22C. The system 20, when installed in a rubbish chute or bin, preferably also includes fire or smoke detectors and sprinklers. The fire or smoke detectors is for detecting fire or smoke and to activate the sprinklers should any fire or smoke be detected.

Preferably, the system 20 further comprises a battery array (not shown) for electrically powering the pump 32 and the ozonator 24. The battery array comprises an arrangement of rechargeable batteries to enable the system 20 to be physically portable and operationally independent. The fluid container 30 has a pre-determined shape and size to improve compactness and portability of the system 20.

Alternatively, a diesel or gas engine is used for powering the pump 32 and ozonator 24. Other sources of energy, such as solar power, are usable for providing the required energy for powering the pump 32 and ozonator 24. The pump 32 and ozonator 24 may be powered by common or different energy sources.

The compactness and portability of the system 20 enables use thereof as preferably one of an ozone gas generator, an ozonised vapour generator or an ozonised liquid-jet generator. The system 20 is installable, amongst various locations, atop a rubbish chute or entrances of installations and buildings, in a rubbish bin or along walkways. Any of the output from the generators, specifically that of ozonised liquid-jet can be used for the purpose of fire suppression.

Alternatively, the system 20 comprises an array of ozonators (not shown) coupled to and for fluid communication with each of the first, second and third chambers 22A, 22B, 22C. The controller further enables sequence of discharge of ozone 36 from each of the controllers to each of the first, second and third chambers 22A, 22B, 22C to be

controlled and coordinated. This enables the operational load of generating ozone to be distributed amongst the ozonators to thereby increase the operational lifespan of the system 20.

- 5 In the foregoing manner, a system is described according to embodiments of the invention for addressing the foregoing disadvantages of conventional ozonised fluid generators. Although only two embodiments 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.

Claims

1. A system for generating ozonised fluid, the system comprising:
 - at least one chamber for receiving fluid;
 - an ozonator coupled to the at least one chamber for providing ozone
 - 5 (O₃) to the at least one chamber for generating ozonised fluid from each of the at least one chamber; and
 - at least one exhaust, the at least one chamber providing the ozonised fluid to the at least one exhaust and the at least one exhaust exhausting the ozonised fluid as one of at least an O₃ gas, an ozonised vapour and an ozonised
 - 10 liquid jet,
 - wherein the ozonised vapour and the ozonised vapour liquid jet are pressurised.
2. The system as in claim 1, the at least one exhaust being a nozzle having a
- 15 channel formed therein, the ozonised fluid passages through the channel when being directed at the nozzle, the channel being shaped and dimensioned for directing the ozonised liquid away from the nozzle as the ozonised vapour.
3. The system as in claim 1, the at least one exhaust being a nozzle having a
- 20 channel formed therein, the ozonised fluid passages through the channel when being directed at the nozzle, the channel being shaped and dimensioned for directing the ozonised liquid away from the nozzle as the ozonised liquid jet.
4. The system as in claim 1, wherein the at least one exhaust being a nozzle for
- 25 exhausting the ozonised fluid as the O₃ gas.
5. The system as in claim 1, further comprising:
 - a pump coupled to the at least one chamber for pressurising and
 - delivering fluid into the at least one chamber at at least one pre-determined
 - 30 pressure.
6. The system as in claim 1, further comprising:

a fluid container being removably coupled to the at least one chamber, the fluid container for containing pressurised fluid for delivery into the at least one chamber.

- 5 7. The system as in claim 1, the chamber being coupled to a fluid source for providing fluid to the at least one chamber at a pre-determined pressure.
8. The system as in claim 1, further comprising:
 - at least one of a centrifugal pump and a displacement pump for
- 10 delivering fluid into the at least one chamber.
9. The system as in claim 8, further comprising:
 - an energy source for electrically powering at least one of the at least
 - one of a centrifugal pump and the displacement pump and the ozonator.
- 15 10. The system as in claim 1, further comprising:
 - a container in fluid communication with the at least one channel for
 - storing and providing fluid thereto.
- 20 11. The system as in claim 1, wherein ozone (O₃) is generated by the ozonator using one of corona discharge, ultraviolet irradiation and electrolysis.
12. The system as in claim 1, further comprising:
 - a venturi structurally interfacing the ozonator and the at least one
- 25 chamber for drawing ozone generated by the ozonator into the fluid in the at least one chamber.
13. The system as in claim 12, the venturi comprising:
 - a one-way flow valve for substantially impeding flow of fluid from the at
- 30 least one chamber to the ozonator.
14. The system as in claim 1, further comprising:

a controller for controlling delivery of at least one of ozonised liquid and ozone into the at least one chamber.

15. The system as in claim 14, wherein the at least two ozonator are couple to the
5 at least one chamber, the at least two ozonator being controllable by the controller.

16. The system as in claim 1, further comprising one of a fire and smoke detector
10 and a sprinkler for detecting and putting out fire.

17. The system as in claim 1, further comprising:
a selector for selecting a particular combination of the ozonised fluid
exhausting from the at least one exhaust.

15 18. A method for generating ozonised fluid comprising the steps of:
receiving fluid into at least one chamber;
providing ozone (O_3) into the at least one chamber for generating
ozonised fluid from each of the at least one chamber, the ozone being
generated by an ozonator coupled to the at least one chamber; and
20 providing the ozonised fluid by the at least one chamber to at least one
exhaust and the at least one exhaust exhausting the ozonised fluid as one of an
 O_3 gas, an ozonised vapour and an ozonised liquid jet,
wherein the ozonised vapour and the ozonised liquid jet are
pressurised.

25 19. The method for generating ozonised fluid as in claim 18, the step of directing
the ozonised fluid by the at least one chamber towards the exhaust comprising
the step of:

30 directing the ozonised fluid by a nozzle, the nozzle having a channel
formed therein, the ozonised fluid passages through the channel when being
directed at the nozzle, the channel being shaped and dimensioned for directing
the ozonised fluid away from the nozzle as ozonised vapour.

20. The method for generating ozonised fluid as in claim 18, the step of directing the ozonised fluid by the at least one chamber towards the exhaust comprising the step of:

5 directing the ozonised liquid by a nozzle, the 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 directing the ozonised liquid away from the nozzle as ozonised liquid jet.

- 10 21. The method for generating ozonised fluid as in claim 18, the step of directing the ozonised fluid by the at least one chamber towards the exhaust comprising the step of:

directing the ozonised fluid by a nozzle for exhausting the ozonised fluid as the O₃ gas.

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22. The method for generating ozonised fluid as in claim 18, further comprising the step of:

pressurising and delivering fluid into the at least one chamber at at least one pre-determined pressure by a pump.

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23. The method for generating ozonised fluid as in claim 18, further comprising the step of:

providing a fluid container being removably coupled to the at least one chamber, the fluid container for containing pressurised fluid for delivery into the at least one chamber.

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24. The method for generating ozonised fluid as in claim 18, further comprising the step of:

providing fluid to the at least one chamber at a pre-determined pressure by coupling the chamber to a fluid source.

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25. The method for generating ozonised fluid as in claim 18, further comprising the step of:

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

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26. The method for generating ozonised fluid as in claim 25, further comprising the step of:

providing an energy source for electrically powering at least one of the at least one of a centrifugal pump and the displacement pump and the ozonator.

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27. The method for generating ozonised fluid as in claim 18, further comprising the step of:

providing a container in fluid communication with the channel for storing and providing fluid thereto.

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28. The method for generating ozonised fluid as in claim 18, the step of directing the ozonised fluid by the at least one chamber towards the at least one exhaust comprising the step of:

generating ozone (O_3) by one of corona discharge, ultraviolet irradiation and electrolysis.

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29. The method for generating ozonised fluid as in claim 18, further comprising the step of:

providing a venturi structurally interfacing the ozonator and the at least one chamber for drawing ozone generated by the ozonator into the fluid in the at least one chamber.

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30. The method for generating ozonised fluid as in claim 29, the step of providing a venturi comprising the step of:

providing a one-way flow valve for substantially impeding flow of fluid from the at least one chamber to ozonator.

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31. The method for generating ozonised fluid as in claim 18, further comprising the step of:

providing a controller for controlling delivery of at least one of ozonised liquid and ozone into the at least one chamber.

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32. The method for generating ozonised vapour as in claim 31, further comprising the step of:

coupling the at least two ozonator to the at least one chamber, the at least two ozonator being controllable by the controller.

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33. The method for generating ozonised fluid as in claim 18, further comprising the step of:

providing one of a fire and smoke detector and a sprinkler for detecting and putting out fire.

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34. The method for generating ozonised fluid as in claim 18, further comprising the step of:

selecting a particular combination of the ozonised fluid exhausting from the at least one exhaust.