APPARATUS FOR GENERATING OZONISED LIQUID JET

Field of Invention

The present invention generally relates to an apparatus for generating ozonised liquid jet.

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

Chemical disinfectants, for example phenols, hypochlocite 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 and other heat-sensitive equipment.

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 an apparatus for generating ozonised liquid 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 apparatus for generating ozonised liquid jet comprising a chamber for receiving liquid thereinto, at least one ozonator and an exhaust. The at least one 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 exhaust while the exhaust is for exhausting the ozonised liquid as an ozonised liquid jet, wherein the ozonised liquid jet is pressurised.

In accordance with a second aspect of the invention, there is disclosed a method for generating ozonised liquid jet 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 at least one ozonator that is coupled to the chamber. The ozonised liquid is then directed by the chamber towards

an exhaust, the exhaust for exhausting the ozonised liquid as an ozonised liquid jet, wherein the ozonised liquid jet is 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 apparatus for generating ozonised liquid jet according to an embodiment of the invention; and

FIG. 2 shows a partial sectional view of the apparatus of FIG. 1.

Detailed Description

An apparatus for generating ozonised liquid jet is described hereinafter for addressing the foregoing problems.

An embodiment of the invention, an apparatus 20 for generating ozonised liquid jet is described with reference to FIG. 1 and FIG. 2. The apparatus 20 comprises a chamber 22, an ozonator 24 and an exhaust 26.

The chamber 22 is for receiving liquid 28, for example water, thereinto. The chamber 22 preferably receives liquid 28 from a liquid 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 apparatus 20 further comprises a pump 32 connected to the liquid container 30 for delivering the liquid 28 through a filtration assembly 34 and into the chamber 22. Alternatively, the pump 32 is connected between the chamber 22 and exhaust 26 for delivering the liquid 28 through the filtration assembly 34 and into the chamber 22, before the liquid 28 is directed into the exhaust 26. 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 exhaust 26 and preferably comprises replaceable filters (not shown).

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 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 28 in the chamber 22, ozonised liquid 42 is obtained therefrom. The ozonised liquid 42 is then directed towards the exhaust 26. The exhaust 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. The nozzle 44 further exhausts the ozonised liquid as an ozonised liquid jet 48.

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 channelling ozonised liquid 42 passaging therethrough at preferably the pre-determined pressure into the ozonised liquid jet 48. Additionally, the channel 46 is further for exhausting the ozonised liquid jet 48 away from the nozzle 44 as it is being channelled as ozonised liquid 42 into the ozonised liquid jet 48 by the channel 36.

The ozonised liquid jet 48 is advantageously used for disinfecting or sterilising air, objects and surfaces without being harmful to human and food for human consumption.

Alternatively, the liquid container 30 and the pump 32 are replaceable with a pressurised liquid container or tank (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 liquid container with the chamber 22, the valve is operable for releasing liquid from the pressurised liquid container for delivery into the chamber 22 at a pre-determined pressure. The adaptor allows an emptied pressurised liquid container to be easily replaceable with a filled pressurised liquid container during use of the apparatus 20.

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

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

Preferably, the apparatus 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 apparatus 20 to be physically portable and operationally independent. The liquid container 30 has a pre-determined shape and size to improve compactness and portability of the apparatus 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 apparatus 20 enables use thereof as preferably one of a liquid-jet generator along walkways or atop entrances of installations and buildings.

Alternatively, the apparatus 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 apparatus 20.

The ozonised liquid jet 48 generated by the apparatus 20 is preferably applicable for disinfection, deodorisation, sterilisation and other cleaning purposes.

In the foregoing manner, an apparatus is described according to one embodiment of the invention for addressing the foregoing disadvantages of conventional 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.

Claims

1. An apparatus for generating ozonised liquid jet, the apparatus comprising:

a chamber for receiving liquid thereinto;

at least one ozonator coupled to the chamber for delivering ozone (O_3) into the liquid received by the chamber for obtaining ozonised liquid therefrom; and

an exhaust, the chamber further for directing the ozonised liquid towards the exhaust and the exhaust for exhausting the ozonised liquid as an ozonised liquid jet,

wherein the ozonised liquid jet is pressurised.

2. The apparatus as in claim 1, the exhaust 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 directing the ozonised liquid away from the nozzle as ozonised liquid jet.

3. The apparatus as in claim 2, further comprising:

a pump coupled to the chamber for pressurising and delivering liquid into the chamber at a pre-determined pressure.

4. The apparatus as in claim 2, further comprising:

a liquid container being removably coupled to the chamber, the liquid container for containing pressurised liquid for delivery into the chamber.

5. The apparatus as in claim 1, the chamber being coupled to a liquid source for providing liquid to the chamber at a pre-determined pressure.

6. The apparatus 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 apparatus as in claim 6, 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 at least one ozonator.

8. The apparatus as in claim 1, further comprising:

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

9. The apparatus as in claim 1, wherein ozone (O_3) is generated by the at least one ozonator using one of corona discharge, ultraviolet irradiation and electrolysis.

10. The apparatus as in claim 1, further comprising:

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

11. The apparatus as in claim 10, the venturi comprising:

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

12. The apparatus as in claim 1, further comprising:

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

13. A method for generating ozonised liquid jet 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 at least one ozonator coupled to the chamber; and

directing the ozonised liquid by the chamber towards an exhaust, the exhaust for exhausting the ozonised liquid as an ozonised liquid jet,

wherein the ozonised liquid jet is pressurised.

14. The method for generating ozonised jet as in claim 13, the step of directing the ozonised liquid by the chamber towards the exhaust comprising the step of:

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.

15. The method for generating ozonised jet as in claim 14, further comprising the step of:

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

16. The method for generating ozonised vapour as in claim 14, further comprising the step of:

providing a liquid container being removably coupled to the chamber, the liquid container for containing pressurised liquid for delivery into the chamber.

17. The method for generating ozonised jet as in claim 13, further comprising the step of:

providing liquid to the chamber at a pre-determined pressure by coupling the chamber to a liquid source.

18. The method for generating ozonised jet as in claim 1, further comprising the step of:

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

19. The method for generating ozonised vapour as in claim 18, 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 at least one ozonator.

20. The method for generating ozonised jet as in claim 13, further comprising the step of:

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

21. The method for generating ozonised vapour as in claim 13, the step of directing the ozonised liquid by the chamber towards the exhaust comprising the step of:

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

22. The method for generating ozonised vapour as in claim 13, further comprising the step of:

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

23. The method for generating ozonised vapour as in claim 13, the step of providing a venturi comprising the step of:

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

24. The method for generating ozonised vapour as in claim 13, further comprising the step of:

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