Disclosed is an ice making apparatus and method whereby the cleanliness of ice is improved through the use of ozone (O$_3$). The invention utilizes a aspirating injector that is positioned within the water chamber of an ice maker. The presence of the ozone within the water inhibits the growth of bacteria and other contaminants. The ozonated water is then used in the production of ice. The invention further discloses a method for retrofitting existing ice makers to benefit from the anti-bacterial uses of ozone.
ICE MAKING AND DISPENSING METHOD AND APPARATUS WITH INCREASED SANITATION

RELATED APPLICATION DATA

This application claims priority to co-pending provisional application Ser. No. 60/783,206 filed Mar. 16, 2006 entitled “Bubbler Ozonation Apparatus,” the contents of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an ice making apparatus with increased sanitation. More particularly, the present invention relates to an ice making apparatus and method that inhibits the growth of harmful microorganisms via ozone. Further, this invention similarly relates to a method for increasing sanitation of existing ice makers by retrofitting existing ice makers to inhibit the growth of harmful microorganisms via ozone.

2. Description of the Background Art

The ice machine is one of the most common appliances in use today. These machines are commonly found in kitchens, restaurants, cafeterias, hospitals, nursing facilities, and convenience stores across the country. A widely employed construction sits the ice machine above an array of fountain drink dispensers. As is typical, this ice machine is coupled to an independent supply of water. This water is then routed over an evaporator. Due to the cooling effect of the evaporator, over time ice builds up upon the evaporator. This ice is then removed from the evaporator in cubes during a harvest cycle. The harvest cycle is generally accomplished by introducing a layer of warm air between the ice and evaporator, whereby the ice is melted a sufficient degree to allow it to slip off the evaporator. The collected ice is then stored within a bin and thereafter selectively removed as so to fill a cup or other such container. Typically, the ice is removed by pressing the container against a lever which actuates a bin opening.

There are two classes of ice machine available in the industry: Cubers and Flakers. The difference between these two classes is in the type of ice they produce.

Cuber-class ice makers (known as Cubers) produce a product known as hard ice. Hard ice is a solid, crystal-clear ice made by recirculating water over one or more evaporator plate(s) that are cooled via the operation of a gas compressor and condenser.

There are two phases that comprise the ice-making process in cuber-type ice machines. The first phase—the ice-making cycle—includes the recirculation of water over refrigerated evaporator plate(s) via a water pump, resulting in ice forming on the plate(s). This cycle continues until the ice reaches a desired size/thickness that is determined by one of any number of control systems. Once the ice reaches an appropriate size/thickness, the ice machine then moves into the second phase of the ice-making process—the harvest cycle. During the harvest cycle, the evaporator plate(s) are heated (usually via hot gas from the compressor) which leads to the formed ice detaching from the plate(s) and falling into an appropriate receptacle.

Flaker-class ice makers (known as Flakers) produce a product known as soft ice. Flaker ice contains trapped air and is therefore less dense than cuber ice. This soft ice can be prepared in several forms (described below):

- flake form (similar to snow cone ice)
- pellet form (produced by adding an extrusion and breaker assembly atop the auger)
- chunklet form (continuous column of ice is produced and snaps off into round chunks)

Flaker ice is produced by water being drip-fed into a single cylindrical evaporator cooled by the operation of a gas compressor and condenser. As ice-making water drips into the cooled evaporator, it freezes and is scraped upward by a motor-driven auger. When the flake ice reaches the top of the evaporator it either a) exits in a flake form—or—b) moves through an extrusion plate and breaker assembly where the flakes are compressed into a pellet or chunklet form. The ice making and harvest cycles take place simultaneously in flaker-class ice machines.

Recently, attention has been drawn to the unsanitary condition of many commercial ice machines. Ice makers and their components are all too frequently host to E. coli, flagella, legionella and other toxins. In fact, Applicant is aware of ice machines infected with legionella and other bacteria within hospitals and nursing homes, that are supposed to maintain the highest sanitary conditions. Ice machines contain drains, pumps, hoses, evaporators and bins, all of which must be periodically cleaned and disinfected. All too often, however, ice machines are forgotten about and are never cleaned or otherwise maintained. As a result, the internal components become contaminated with bacteria, mold, or other undesirable contaminants. These contaminants are then ingested by unwary individuals consuming the ice.

Manual cleaning of the above equipment with detergents and sterilizing chemicals can be effective; however, cleaning schedules are not, as a practical matter, always adhered to. In addition, the job may not be done satisfactorily in terms of a thorough cleaning and rinsing of the food content areas, and drain elements or tubes. Even when a meticulous cleaning and sanitation process is correctly performed, if the equipment is located in an area where contaminated air or water can be reintroduced into the machine, the cleaning/sanitation process is negated. By placing the ice maker atop the beverage/ice dispenser, the ability to manually clean the beverage/ice dispenser is severely curtailed, leading to possible elevated microorganism levels.

As a result of the foregoing, numerous attempts have been made over the years to improve the sanitation within ice making machines. For example, U.S. Pat. No. 6,506,428 to Berge et al. discloses an ozone cleaning and sanitation method and apparatus for ice and ice conveyance systems. The apparatus includes an ozone generator. Ozone-rich air exiting the ozone generator is drawn through a conduit to a venturi where through aspiration it is incorporated into water circulating through a conduit. Water is circulated through the conduit via a circulation pump that is located downstream from the venturi.

Likewise, U.S. Pat. No. 6,334,328 to Brill discloses a sanitary ice making and dispensing apparatus. The device
includes an ozone generator and an associated air pump for feeding ozone enriched air to the air inlet of a venturi. The venturi is used to entrain ozone into water that is pumped through the venturi by an upstream pump.

[0018] Similarly, U.S. Pat. No. 6,287,515 to Koosman et al. discloses a cleaning and sanitizing assembly for clean in place food and beverage automatic dispensing machines. The assembly includes an ozone generator which introduces ozone into a water supply line.


[0020] Finally, U.S. Pat. No. 7,127,900 to Yoshimura et al. discloses a method for producing ice containing ozone by injecting ozonated water into a cylindrical-shaped container. Once the ozonated water is injected in the container, the container is pressurized to increase the ozone solubility and generate finer ozone bubbles within the water.

[0021] Although each of the above referenced inventions achieves its individual objective, they all suffer from a common problem. Namely, none of the above referenced devices can be easily retrofitted upon an existing ice machine. Nor do the above referenced devices operate with Flaker-type ice machines. Finally, the above referenced inventions do not disclose using a rheostat as a means of regulating the amount of ozone being entrained within the ice thereby giving operators the ability to control how ozonated the generated ice will be, which is important as ice machines that are subject to more contaminants will require a higher volume of ozone to effectively combat the bacteria and other contaminants within the ice machine. The present invention is aimed at overcoming the aforementioned deficiencies in the background art.

SUMMARY OF THE INVENTION

[0022] It is therefore one of the objectives of this invention to provide an apparatus and method for inhibiting the growth of microorganisms in ice making machines.

[0023] It is also an object of this invention to provide ozonated water for Flaker ice machines.

[0024] Still another object of this invention is to provide a cost-effective method for retrofitting existing ice makers without the need to replace the vital components of the existing ice makers with ozonation systems.

[0025] Yet another object of this invention is to provide a sanitary ice making system comprising an air pump for delivering a flow of air to an ozone generator. This flow of air is preferably restricted to a flow rate of approximately 1 liter per minute. Ozone generated from the ozone generator is then delivered to a water chamber through an aspirating injector such that the ozone bubbles up into the water within the water chamber. This process results in the ozone becoming entrained within water used for creating ice. This ozonated water is then delivered via a flexible ozone transfer line, preferably constructed of vinyl, to an evaporator for creating ice.

[0026] Still another object of this invention is to provide a method for retrofitting an existing ice maker when the existing ice maker contains a water chamber with an air-inlet by installing an air pump, interconnected to an ozone generator by way of an air flow restrictor. This air flow restrictor preferably limits the volume of air flow into the ozone generator to approximately 1 liter per minute. As the next feature in this method, the operator attaches an aspirating injector to the output of the ozone generator and inserts this aspirating injector into the water chamber of the existing ice maker, thus retrofitting an existing ice maker to be able to produce ozonated ice.

[0027] The foregoing has outlined rather broadly the more pertinent and important features of the present invention in order that the detailed description of the invention that follows may be better understood so that the present contribution to the art can be more fully appreciated. Additional features of the invention will be described hereinafter which form the subject of the claims of the invention. It should be appreciated by those skilled in the art that the conception and the specific embodiment disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention as set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

[0029] FIG. 1 is a perspective view of the ice making system of the present invention.

[0030] FIG. 2 is a partial sectional view of the water chamber and cylindrical evaporator employed in the system depicted in FIG. 1.

[0031] FIG. 3 is a detailed view of one embodiment of the aspirating injector employed in the present invention.

[0032] FIG. 4 is detailed view of an alternative embodiment of the aspirating injector employed in the present invention.

[0033] FIG. 5 is a side elevational view of the ice making system of the present invention with a Cuber ice maker.

[0034] Similar reference characters refer to similar parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0035] The present invention relates to an ice making apparatus and method whereby the cleanliness of ice is improved through the use of ozone (O₃). The invention utilizes an aspirating injector that is positioned within the supply of water used for creating ice. The injector delivers ozone to the water by bubbling the gaseous ozone into the water supply, just before the water is delivered to the evaporator and frozen into ice. The effect of this process is to entrain ozone within the water, thus resulting in ice that has ozone entrained within the ice. The presence of the ozone within the water kills or otherwise inhibits the growth of bacteria and other contaminants. The ozonated water is then used in the production of ice. Furthermore, as the ice slowly melts within various components of ice makers,
ozone is released and serves to kill latent bacteria and other contaminants that are otherwise difficult to regularly sanitize.

[0036] With reference to FIG. 1, the system 10 of the present invention is depicted. System 10 includes a conventional ozone generator 14 which delivers a steady stream of ozone gas to a flexible ozone transfer line 22. System 10 further includes a conventional air pump 12 which delivers a steady flow of air to the ozone generator 14. The air pump 12 has an air intake (not shown) and an air outlet 122 and provides a steady flow of air to the ozone generator 14. The ozone generator 14 receives the air flow from the air pump 12 and delivers an appropriate amount of ozone. The ozone generator 14 is preferably a 12 volt DC Poseidon brand ozone generator manufactured by Ozotech, Inc. of Yereka, Calif. This generator creates ozone via electrical arcing. The Poseidon brand ozone generator is preferable for many reasons, including the ability of its supplied adapter to plug into a standard household electrical outlet or connects to line voltages of the ice maker for conversion to 12 volts DC. This alleviates many of the safety concerns that various ice making companies have with exposed line voltages. Further, the Poseidon brand ozone generator includes a rheostat 146 for regulating the amount of ozone generated by the ozone generator 14.

[0037] Ozone generator 14 is preferably located within the cabinet associated with the ice machine to thereby limit the exposure of voltage lines and conduits. By adjusting the rheostat 146, a wide variety of ice machine capacities can be accommodated with a single ozone generator 14, thereby avoiding the under or over production of ozone. The production of too small amount of ozone may result in the less effective killing the bacteria and contaminates. Conversely, producing too much ozone results in ozone escaping from the ice machine, a phenomenon referred to as excessive out-gassing.

[0038] The ozone generator 14 and air pump 12 are interconnected with a non-adjustable restrictor 16. The non-adjustable restrictor 16 restricts the air flow from the air pump 12 to an appropriate amount, so as to provide an appropriate volume of air flow into the ozone generator 14. The air outlet 122 connects to the restrictor 16 to channel the air from the air pump 12 into the restrictor 16. The restrictor 16, in turn, connects to the ozone generator intake 142 to provide air as input into the ozone generator 14. The preferred volume of air flow for both Flaker and Cuber ice makers is approximately 1 L/minute. It has been discovered that this flow rate allows a proper amount of ozone to enter the remainder of the system without overwhelming it. If too much air is supplied by pump 12, the evaporator 24 can freeze up, thus 1 L/minute, appropriately restricts the air flow so as to enable ice to be formed from ozonated water without impacting the performance of the evaporator 24.

[0039] The ozone generator 14 further includes an ozone outlet 144 through which ozone is released by the ozone generator 14. The ozone outlet 144 is connected to a flexible ozone transfer line 22 which itself is coupled with the aspirating injector 20 (see FIGS. 2-4). The aspirating injector 20 is a sealed tubing and is preferably in a Z-shaped configuration, as depicted in FIG. 3. However, the use of other configurations for the aspirating injector 20 is within the scope of the present invention. For instance, FIG. 4 depicts an aspirating injector 20 pursuant to the present invention in a U-shaped configuration. In order to ensure sufficient aspiration, there is a plurality of openings 204 on the superior surface of the injector 20, which allows ozone to escape from the injector 20. In the preferred embodiment, injector 20 is formed from PVC and has an outside diameter of ¼". However, the use of other sized injectors that are formed from different materials is within the scope of the present invention.

[0040] The flexible ozone transfer line 22 is preferably vinyl air tubing, as this tubing does not negatively interact with the ozone. The aspirating injector 20 and the ozone transfer line 22 are fed through the ozone inlet 181 such that the injector is positioned within the water chamber 18 with the plurality of openings 204 (see FIGS. 3 and 4) under the water surface. In this manner, when ozone flows through the aspirating injector 20, ozone gas bubbles up into the water within the water chamber 18 that is used for creating ice. The result of this process is that ozone becomes entrained within the water, and thus is entrained within the ice generated.

[0041] The water chamber 18 further includes a water inlet 182 for receiving a supply of water, as well as a float 183 interconnected with a valve 184 to control the level of water within the water chamber 18. As depicted in FIG. 2, the water chamber 18 also includes an overflow chamber 185 with an overflow drain 186 that is used to control excess water and prevent water from spilling over.

[0042] The primary function of the water chamber 18 as used for this invention is to entrain ozone within water. As is depicted in FIG. 2, the aspirating injector 20 is positioned under the water in the water chamber 18. In this position, with ozone flowing from the ozone generator 14, the ozone bubbles out of the injector 20 and is infused into the ice-making water. Because injector 20 sits below the water line, there is no need to utilize a check valve to prevent the back flow of water into the ozone generator 14. Furthermore, the present invention achieves ozone entrainment via a simple design that can be easily retrofitted to existing ice making equipment. Most ice making equipment includes some form of water chamber, similar to water chamber 18. These water chambers include an opening for air to flow into the water chamber. To retrofit these older ice makers pursuant to the present invention, one needs only insert an aspirating injector 20, appropriately connected to an ozone source, into an air opening within the water chamber of an older ice maker. Retrofitting an existing ice maker with the present invention does not impact any product compliance certifications, such as the Underwriters Laboratories, Inc. certifications provided on ice makers.

[0043] Referring back to FIG. 1, the water chamber 18 also contains an output drain 187 through which ozonated water flows into the evaporator 24 in its journey from ozonated water to ozonated ice. The output drain 187 is interconnected with the liquid intake 242 of the evaporator 24 by way of a flexible ozonated water tubing 26 to deliver ozonated water to the evaporator 24 for ice production. The flexible ozonated water tubing 26 is preferably vinyl tubing as this does not interact with the ozone and is also flexible. The Flaker-type ice maker depicted in FIG. 1 includes a refrigerated cylindrical evaporator 24 with a motor-driven auger 246 and an exit chute 248. As is widely known in ice making, evaporator 24 serves to cool the water flowing over
its surface such that it turns into ice. Flaked ozonated ice is formed within the evaporator 24 and pushed up the cylinder of the evaporator 24 by the auger 246 until the ozonated ice exits the evaporator.

[0044] Further, as the auger 24 pushes the ice up the cylinder, more ice will slightly melt, releasing valuable ozone within the evaporator 24. This ozone gets trapped within the evaporator 24 to provide continual protection. Similarly, as the ice produced pursuant to the present invention sits in a receptacle or other bin prior to delivery, it slowly melts similarly releasing ozone to kill bacteria and other contaminants.

[0045] FIG. 5 depicts an alternate embodiment of the present invention. In FIG. 5, the aspirating injector 20 is utilized with a Cuber ice maker. The plurality of openings 204 on the superior surface of the injector 20 are still positioned below the water surface in the water chamber 18 of the Cuber ice maker. In this regard, ozone is still delivered from an ozone generator 14 in order to entrain ozone within the water supply used to make ice cubes on the evaporator 24. As can be seen in FIG. 5, the water chamber 18 in a Cuber ice maker is larger than that which is used in a Flaker ice maker. This allows a different (and larger) shaped aspirating injector 20, such as the u-shaped aspirating injector 20 depicted in FIG. 4.

[0046] Any bacteria or other contaminants within the water is effectively killed via the introduction of ozone. As a result the internal components of the ice machine are kept clean and the ice is free of bacteria or other contaminants. The use of ozone within water to kill bacteria is generally recognized as safe. Moreover, the effectiveness of ozone as a bactericide increases with colder water temperatures.

[0047] The simplicity of the present invention gives ice manufacturers the flexibility of designing control circuits for any model of ice machine, and by any ice manufacturing company, utilizing a water chamber design. The manufacturers have the ability to address the requirements of how much ice is produced and when. Logically speaking, a 400 lb ice machine with a 400 lb storage bin/dispenser given the same ozonation dosage as a 1300 lb ice machine on a 1000 lb storage bin would likely have problems with the outgassing of ozone, which would be a major concern for many end users. An added benefit of timed on cycles during periods of no ice production will keep the system ozonated on a continuous basis and will extend the life of the generator while suppressing the likelihood of excess outgassing. Whereas with proper dosage of ozonation, an acceptable level of outgas will sanitize the ice making compartment and will continue its downward flow to sanitize the storage bin continuing down through the drain. A modification to the drains has revealed that a barrier can easily be made to prevent E. coli from invading the ice making system. Further, as ozone is heavier than air, it falls down into drains and provides an extra layer of bacterial protection. For instance, most ice machine contain a running trap in their drains, where sewer gasses reside on one side. Using the present invention, outgassed ozone falls into the drain and is caught at the running trap, creating an extra barrier between the ice maker drain and the sewer gasses. The system of the present invention with minor modifications greatly enhances the cleanliness of ice produced in every installation to date.

[0048] The present disclosure includes that contained in the appended claims, as well as that of the foregoing description. Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention.

[0049] Now that the invention has been described, What is claimed is:

1) A sanitary ice making system comprising:
   an air pump having an inlet and an air outlet for delivering a flow of air;
   an ozone generator for generating a supply of ozone gas comprising:
   an ozone generator intake for receiving an air flow,
   an ozone outlet for outputting a supply of ozone gas, and
   a rheostat for regulating the amount of ozone generated by the ozone generator;
   a non-adjustable restrictor permitting a flow rate of approximately 1 liter per minute interconnected with the air outlet of the air pump and the ozone generator intake for restricting the amount of air flowing from the air pump into the ozone generator;
   a water chamber for creating ozonated water by entraining ozone within a contained supply of water within the water chamber comprising:
   an ozone inlet for receiving a supply of ozone gas, the ozone inlet being located within the water chamber and above a top surface of the contained supply of water, whereby ozone gas is delivered into water chamber through the ozone inlet;
   a water inlet for receiving a supply of water, the water inlet being located within the water chamber and above a top surface of the contained supply of water, whereby water flows down into the water chamber through the water inlet;
   a float positioned within the water chamber for determining the volume of fluid in the water chamber;
   a valve, interconnected with the float for disengaging the water inlet to stop the flow of water into the water chamber;
   an overflow chamber positioned within the water chamber for receiving excess water within the water chamber;
   an overflow drain positioned at the bottom of the overflow chamber for expelling water from within the overflow chamber; and
   an output drain positioned at the bottom of the water chamber for expelling ozonated water from within the water chamber;

an aspirating injector for delivering ozone gas into the water chamber, comprising a sealed tubing in a
z-shaped configuration having a plurality of openings on the superior surface of the sealed tubing;
a flexible ozone transfer line interconnecting the ozone generator with the aspirating injector, whereby ozone is
delivered from the ozone generator to the water chamber via the aspirating injector such that ozone becomes
entrained within water within the water chamber;
a refrigerated cylindrical evaporator for creating ice having a liquid intake, a motor-driven auger and an exit
chute; and
an ozonated water tubing interconnecting the output drain of the water chamber and the liquid intake of the
refrigerated cylindrical evaporator whereby the ozonated water tubing transports ozonated water to the
refrigerated cylindrical evaporator such that ozonated water is used in the formation of ice.
2) A system for creating flaked ice comprising:
an ozone source;
a water chamber;
an injector having a plurality of openings whereby the injector is coupled to the ozone source and inserted
within the water chamber; and
an evaporator connected to the water chamber.
3) The system of claim 1 whereby the injector is in a
z-shaped configuration.
4) The system of claim 1 whereby the injector is in a
u-shaped configuration.
5) The system of claim 1 whereby the ozone source
further comprises an air pump and an ozone generator.
6) The system of claim 5 further comprising a restrictor
interconnecting the air pump with the ozone generator.
7) The system of claim 6 whereby the restrictor is
non-adjustable.
8) The system of claim 5 whereby the restrictor restricts
the air flow from the air pump to the ozone generator to 1
liter per minute.
9) The system of claim 1 whereby the ozone source
further contains a rheostat.
10) A method for creating a sanitary ice making system by
retrofitting an existing ice maker wherein the existing ice
maker contains a water chamber with an air-inlet comprising:
installing an air pump having an inlet and an air outlet;
installing an ozone generator for generating a supply of
ozone gas having an ozone generator intake for receiving
an air flow, an ozone outlet for outputting a supply
of ozone gas, and a rheostat for regulating the amount
of ozone generated by the ozone generator;
interconnecting the air outlet of the air pump with the
ozone generator intake of the ozone generator with a
non-adjustable restrictor for restricting the amount of
air flowing from the air pump into the ozone generator;
attaching an aspirating injector to the ozone outlet of the
ozone generator whereby the aspirating injector is a
sealed tubing in a z-shaped configuration with a plurality
of openings on the superior surface of the aspirating
injector;
inserting the aspirating injector into the air-inlet of the ice
maker's water chamber such that the aspirating injector
is submerged within water within the water chamber
whereby the ozone gas expelled through the aspirating
injector becomes entrained within water within the
water chamber; and
adjusting the rheostat on the ozone generator to output an
appropriate amount of ozone to entrain within water
within the water chamber.
11) A method for retrofitting an ice maker comprising:
installing an ozone source;
attaching an injector to the ozone source, where the
injector has a plurality of openings; and
inserting the injector into a water supply of the ice maker.
12) The method of claim 11 whereby the injector is in a
z-shaped configuration.
13) The method of claim 11 whereby the injector is in a
u-shaped configuration.
14) The method of claim 11 further comprising:
installing an air pump; and
interconnecting the air pump with the ozone source.
15) The method of claim 14 whereby the air pump is
interconnected with the ozone source using a restrictor.
16) The method of claim 15 whereby the restrictor is
non-adjustable.
17) The method of claim 15 whereby the restrictor
restricts the air flow from the air pump to the ozone
generator to 1 liter per minute.
18) The method of claim 11 whereby the ozone source
further contains a rheostat.
19) The method of claim 18 further comprising adjusting
the rheostat.

* * * * *