

METHOD FOR REFRIGERATING VEGETABLES AND FRUIT AND A SYSTEM USED TO CARRY OUT THE METHOD

1. Field of the Invention

The present invention relates to a method for refrigerating vegetables and fruit, and more particularly to a method that keeps the vegetables and fruit in good and fresh condition for a long time. A system used in the method is also disclosed.

2. Description of Related Art

Agriculture products, such as vegetables and fruit, continue to ripen and wither after harvesting and lose moisture within a short period of time. As a consequence, the appearance of agriculture products degrades rapidly so that sales and prices of the agriculture products decrease dramatically.

To keep the agricultural products fresh, the agriculture products are stored in a closed refrigerated space (such as refrigerated chill rooms or refrigerated containers) at low temperatures. However, microorganisms propagate on the agricultural products even at low temperatures and cause the agricultural products to spoil. Therefore, the agricultural products easily spoil especially when the relative humidity in the refrigerated space is 85 to 92%. The high humidity makes the microorganisms propagate fast, and the refrigerated space is usually unventilated to keep a ripening agent of ethylene inside the system. Consequently, the agricultural products ripen and wither at an accelerated rate, and loss of some of the agricultural products is inevitable.

The present invention has arisen to mitigate or obviate the disadvantages of the conventional method of refrigerating vegetables and

fruit.

The main objective of the present invention is to provide a method to refrigerate vegetables and fruit, which keeps the vegetables and fruit fresh and maintains a good appearance for a long time, about 15 days.

The method comprises placing vegetables and fruit in a refrigerated container, repeatedly flooding and draining the refrigerated container with chilled water to wash the vegetables and fruit and lower the level of microorganisms, chilling the refrigerated container and spraying atomized chilled water into the refrigerated container.

Another main objective of the present invention is to provide a system to carry out the method. The system fundamentally comprises an essentially watertight refrigerated container, a chilled water vessel and associated ancillary equipment and piping.

Further benefits and advantages of the present invention will become apparent after a careful reading of the detailed description with appropriate reference to the accompanying drawings.

IN THE DRAWINGS

Fig. 1 is a block diagram of a method for refrigerating vegetables and fruit in accordance with the present invention; and

Fig. 2 is a piping diagram of a system to carry out the method in Fig. 1.

With reference to Fig. 1, a method for refrigerating vegetables and fruit in accordance with the present invention comprises acts of:

placing the vegetables and fruit in a refrigerated container;

chilling water;
optionally filtering the chilled water;
optionally sterilizing the chilled water;
pumping the chilled water into the refrigerated container to wash the vegetables and fruit;
draining the chilled water out of the refrigerated container;
chilling the refrigerated container; and
spraying the chilled water into the refrigerated container to maintain relative humidity in the refrigerated container at almost 100%, wherein the chilled water is atomized.

The acts of pumping and draining the cold water are selectively repeated several times until microorganisms are decreased to a low level.

Preferably, the vegetables and fruit are washed to remove dust and dirt before being placed into the refrigerated container.

With reference to Fig. 2, the system to carry out the method in accordance with the present invention comprises a refrigerated container (10), a chilled water vessel (20), a water cooler (24), an optional water filter (22), an optional sterilizing device (23), an optional oxygen detector (17), multiple pipes (13, 14, 15, 16, 21) and multiple isolation valves (110, 120, 130).

The refrigerated container (10) is a thermally insulated chamber that provides a low temperature environment for vegetables and fruit and has a top, a bottom, outer surface, an entrance (100), multiple atomizing nozzles (11), multiple cooling elements (12), multiple outlets and multiple inlets. The entrance (100) is formed through the outer surface near the bottom for

loading vegetables and fruit into the refrigerated container (10). The multiple atomizing nozzles (11) and the cooling elements (12) are mounted inside the refrigerated container (10) at the top. The multiple inlets include a water inlet port, atomizer nozzle ports and chilled water element ports. The water inlet port is formed in the bottom of the refrigerated container (10). The atomizer nozzle ports and chilled water element ports are formed in the top of the refrigerated container (10). The multiple outlets include at least one drain, an overflow port and a vacuum breaker port. The at least one drain is formed in the bottom of the refrigerated container (10). The overflow port is formed through the outer surface of the refrigerated container (10) near the top to drain excess water from the refrigerated container (10). The vacuum breaker port is formed through the outer surface of the refrigerated container (10) opposite to the overflow port.

The chilled water vessel (20) holds chilled water and has a top, a bottom, a sidewall and a discharge pump (200) to pump water out of the chilled water vessel (20) to the refrigerated container (10).

The water cooler (24) is mounted near and connected to the chilled water vessel (20) to keep the water in the chilled water vessel (20) cold.

The water filter (22) and the sterilizing device (23) are mounted in line between the chilled water vessel (20) and the refrigerated container (10) to pre-treat the cold water before the cold water enters the refrigerated container (10).

The oxygen detector (17) is connected to the refrigerated container (10) to monitor the oxygen concentration inside the refrigerated container

(10).

The multiple pipes comprise a cooling water return pipe (121), two drain pipes (14), a water inlet (13), an overflow pipe (15), a vacuum breaker (16) and a vent (21). The cooling water return pipe (121) is connected to the cooling water elements (12) and the chilled water vessel (20) to return cooling water to the chilled water vessel (20). The two drain pipes (14) are attached to the bottom of the refrigerated container (10) and the cooling water return pipe (121). The water inlet (13) is attached to the bottom of the refrigerated container (10). The overflow pipe (15) is attached to the refrigerated container (10) near the top to drain excess cold water from the refrigerated container (10). The vacuum breaker (16) is attached to the outer surface of the refrigerated container (10) near the top opposite to the overflow pipe (15) and to the top of the chilled water vessel (20).

The isolation valves (110, 120, 130) are mounted in line with pipes between the chilled water vessel (20) and the refrigerated container (10) to regulate cold water respectively to the atomizing nozzles (11), cooling elements (12) and the water inlet (13).

The system carries out the method by placing the vegetables and fruit into the refrigerated container (10), and the entrance (100) to the refrigerated container (10) is sealed. The refrigerated container (10) is repeatedly flooded and drained with chilled water from the chilled water vessel (20) to wash the vegetables and fruit several times until microorganisms on the vegetables and fruit are reduced to a low level. Excess chilled water in the refrigerated container (10) is returned to the

chilled water vessel (20) through the overflow pipe (15). The effect of the washing can be checked by examining the chilled water drained from the drain pipes (14) for microorganisms.

After washing, the isolation valve (120) to the cooling elements (12) is opened to allow the chilled water to flow to the cooling elements (12) in the refrigerated container (10). The refrigerated container (10) is kept in a suitable low temperature by thermal exchange with the chilled water at the cooling elements (12). Moreover, after the chilled water absorbs heat in the refrigerated container (10), the water returns to the chilled water vessel (20) through the cooling water return pipe (121) to be chilled again.

To keep the vegetables and fruit from dehydrating, chilled water is atomized and sprayed inside the refrigerated container (10) to keep the relative humidity at almost 100%. Although the humidity is high, the vegetables and the fruit will not deteriorate easily because the microorganisms are relatively low in number after washing. Over a relatively short time (i.e. 15 days), the microorganisms do not propagate to high enough to significantly deteriorate the vegetables and fruit. If the acts of washing and spraying the atomized cold water are carried out regularly, the vegetables and the fruit are kept fresh for a long time.

Additionally, ozone is added in cycles to the chilled water between the water cooler (24) and the chilled water vessel (20) to sterilize the chilled water. The chilled water is filtered and sterilized again in the water filter (22) and the sterilizing device (23) to make sure the chilled water is pure before entering the refrigerated container (10).

When the chilled water is pumped into the refrigerated container (10), air inside the refrigerated container (10) is pushed out through the vacuum breaker (16). Because the air contains a ripening gas such as ethylene gas or carbon dioxide, renewing the air keeps the vegetables and fruits from ripening early.

Although the invention has been explained in relation to its preferred embodiment, many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

CLAIMS:

1. A method for refrigerating vegetables and fruit comprising acts of
placing the vegetables and fruit in a refrigerated container;
chilling water;
pumping the chilled water into the refrigerated container to wash the
vegetables and fruit;
draining the chilled water out of the refrigerated container;
chilling the refrigerated container; and
spraying chilled water into the refrigerated container to relative
humidity at almost 100%, wherein the chilled water is atomized;
wherein, the acts of pumping and draining the cold water are
selectively repeated several times until microorganisms are decreased to a
low level.
2. The method as claimed in claim 1, wherein before pumping
chilled water into the refrigerated container, the method further comprises:
filtering the chilled water; and
sterilizing the chilled water.
3. The method as claimed in claim 2, wherein the vegetables and
fruit are washed before placing into the refrigerated container.
4. A system for carrying out the method in claim 1, the system
comprising
a refrigerated container (10) being a thermally insulated chamber
with a top, a bottom and outer surface, the refrigerated container (10) holding
vegetables and fruit inside and having

an entrance (100) formed through the outer surface near the bottom;

multiple atomizing nozzles (11) mounted inside the refrigerated container (10) at the top; and

multiple cooling elements (12) mounted inside the refrigerated container (10) at the top;

a water inlet port formed in the bottom of the refrigerated container (10);

atomizer nozzle ports and chilled water element ports formed in the top of the refrigerated container (10);

at least one drain formed in the bottom of the refrigerated container (10);

an overflow port formed through the outer surface of the refrigerated container (10) near the top; and

a vacuum breaker port formed through the outer surface of the refrigerated container (10) opposite to the overflow port;

a chilled water vessel (20) having a top, a bottom, a sidewall and a discharge pump (200) to pump water out of the chilled water vessel (20) to the refrigerated container (10);

a water cooler (24) connected to the chilled water vessel (20) to keep water in the chilled water vessel (20) cold; and

multiple pipes connecting the chilled water vessel (20) to the atomizing nozzles (11), cooling elements (12) and the water inlet port.

5. The system as claimed in claim 4, wherein the refrigerated

container (10) further has:

a cooling water return pipe (121) connected to the cooling water elements (12) and the chilled water vessel (20) to return the cooling water to the chilled water vessel (20);

an overflow pipe (15) connected from the refrigerated container (10) to near the top to the chilled water vessel (20);

a vacuum breaker (16) attached to the outer surface of the refrigerated container (10) near the top opposite to the overflow pipe (15);
and

an oxygen detector (17) connected to the refrigerated container (10).

6. The system as claimed in claim 5, wherein the chilled water vessel (20) further comprises:

a discharge pump (200) to push the chilled water to the refrigerated container (10); and

a water filter (22) and a sterilizing device (23) attached between the chilled water vessel (20) and the refrigerated container (10).