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A Method of Preserving Foodstuffs and a Display Shelf for Foodstuffs

The invention relates to a method of preserving foodstuffs, in particular fruit and vegetables, on open display shelves, wherein cooled air is guided over the foodstuffs by means of an evaporator, and the heat withdrawn from the foodstuffs is conducted away via a heat exchanger.

Furthermore, the invention relates to a display shelf for foodstuffs, in particular for fruit and vegetables, comprising bases arranged on a rear wall for receiving the foodstuffs and a system for guiding cooling air over the foodstuffs with at least one fan for conveying the cooling air and at least one evaporator for lowering the temperature of the cooling air and at least one heat exchanger for conducting away the heat withdrawn from the foodstuffs.

The present invention is mainly directed at fruit and vegetables, which perish particularly easily and are particularly sensitive to changes of temperature and the humidity of the ambient air. Nevertheless, the method and the display shelf according to the invention are also usable for other foodstuffs, such as, e.g., fish, meat, dairy products or also sweets, such as chocolate or cookies.

Usually, fruit and vegetables are stored at very low temperatures ranging between 6 and 8°C immediately after having been harvested, and they are also transported at these temperatures to the stores where they are sold. In particular with fruit and vegetables it is necessary to display the goods in the store on open shelves so that the customer can see the goods and also touch them. At the usual temperatures of up to 25°C prevailing in supermarkets, the fruit and vegetables would perish after a very short time and would have to be exchanged within very short intervals. Already at temperatures of higher than 18°C, perishing of fruit and vegetables proceeds very rapidly, followed by an infestation with fruit flies. Besides too high a temperature of the ambient air, also too low a humidity is a further parameter which substantially accelerates the perishing particularly of fruit and vegetables. Especially due to air conditioning systems as they are common in today's supermarkets, the humidity is reduced to particularly low values, at which fruit and veget-



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ables quickly dehydrate and perish.

The relatively short durability of foodstuffs, in particular of fruit and vegetables, results in increased product costs, manipulation costs in the stores and enormous logistics and disposal costs. Usually, fruit and vegetables are removed from selling after 36 hours and replaced by new produce. Apart from the poor optical condition of the produce, also important nutrients and vitamins are degraded more rapidly by the perishing of the products.

To increase the durability of foodstuffs, in particular of fruit and vegetables, cooled display shelves are used, by which the storage temperature can be kept below 18°. For this purpose, cooling air which is cooled in an evaporator is blown over the foodstuffs. When cooling the air in the evaporator, usually humidity is withdrawn, on account of which subsequently the moisture is withdrawn from the fruit and vegetables, and perishing thereof is further accelerated. Since the evaporator normally has a surface temperature of below 0°C, the humidity of the air is bound thereto and, as mentioned before, more and more moisture is withdrawn from the cooled items, finally resulting in a the products becoming dry. To remedy this situation, humidifying systems are employed by which water is sprayed on the foodstuffs via nozzles. A consequence of this is that even more moisture is bound to the evaporator, the latter becomes iced, and the cooling output is greatly reduced. Moreover, the foodstuffs are supplied with moisture in an uncontrolled manner, which is inadmissible for many products. Finally, the moisture may give rise to the formation of mould and may negatively affect the optical appearance of the foodstuffs. Also cleaning expenditures are substantially increased when the deposited moisture is too high.

DE 198 28 306 A1 describes a method for preserving fruit and vegetables, wherein air cooled in a heat exchanger flows over the foodstuffs. Moreover, for avoiding the formation of germs, the cooling air is conducted through a sterilisation device using ultraviolet radiation for killing the microorganisms contained in the cooling air. No precise references are made concerning the type and humidification of the cooling air.

US 5 440 894 A shows a cooling device in which a coolant is circulated from a remove source to the respective heat ex-

changers so as to be able to ensure cooling at a substantially constant temperature.

US 2002/0062654 A1, US 5 317 881 A as well as US 5 315 837 A show display shelves of the instant type, in which appropriately cooled air is guided over the goods to be cooled.

US 6 390 378 B1 describes a container for the transportation of perishable goods, which has a source of moisture, so that a desired relative humidity of 90% or more can be attained.

DE 85 24 577 U1 describes a display shelf of the instant type comprising a system for circulating cooling air over the foodstuffs, wherein the cold unit is switched on as a function of the ambient temperature. To humidify the cooling air, an evaporator trough is arranged below the evaporator. This, too, results in an uncontrolled humidification of the cooling air and increased cleaning expenditures.

Finally, US 5 477 702 shows a cooled display device for foodstuffs, which is particularly characterized by special guides of the coolant flows. There are no details concerning the type of cooling and a possible humidification of the cooling air.

The present invention has as its object to provide an above-described method of preserving foodstuffs, in particular fruit and vegetables, by which a particularly long durability can be achieved while simultaneously keeping efforts and costs as low as possible. Moreover, the nutritional values of the foodstuffs shall be retained as long as possible.

A further object of the present invention consists in providing an above-mentioned display shelf for foodstuffs, in particular for fruit and vegetables, by which as long a durability of the foodstuffs with simultaneous assembly and costs expenditures as low as possible can be achieved. Existing display shelves shall be retrofittable as easily and quickly as possible.

Disadvantages of the prior art shall be avoided, or reduced, respectively.

The first object according to the invention is achieved in that the air in the evaporator is cooled by means of a cooling liquid, which cooling liquid has an entry temperature of more than 0°C, preferably 4°C, and in that the evaporator is dimensioned such that the cooling air has a relative humidity which

is higher than the relative humidity of the ambient air. By using a cooling liquid of more than 0°C, preferably 4°C, in the evaporator, the evaporator will operate at temperatures of higher than 0°C, so that no humidity will be bound to the evaporator and, thus, the former will not be withdrawn from the air, either. Since, thus, no humidity is removed in the evaporator, the absolute humidity of the cooling air will remain substantially the same when passing through the evaporator, whereby, when the temperature of the cooling air decreases, the relative humidity of the air will increase. By appropriate dimensioning of the evaporator which works at temperatures of more than 0°C, an increase in the relative humidity as compared to the ambient air, thus, becomes possible. With the method according to the invention, thus, both the reduction of the temperature and also the increase in the relative humidity of the air without an active sprinkling of the foodstuffs with water is achieved. Thus, the condensation of the humidity of the air can be reduced or avoided, respectively, whereby the optic condition of the foodstuffs can be improved, on the one hand, and the cleaning efforts can be reduced, on the other hand. As will be explained further below by way of an example, a durability of fruit and vegetables of up to 120 hours could be achieved in tests with the method according to the invention. Thus, it is possible to increase the usual maximum period of 36 hours to more than the threefold.

Advantageously, water is used as the cooling liquid for cooling the air. Water is a biologically completely harmless material which is available substantially everywhere and is relatively inexpensive.

Advantageously, the cooling air is cooled down to a temperature of from 10 to 18°C, preferably 13 to 15°C. In this range, a long durability of the foodstuffs is achieved.

Advantageously, the relative humidity of the cooling air is higher by between 10 to 30% than the relative humidity of the ambient air. The advantage with the present method is that moisture need not be actively introduced for increasing the humidity of the air, but that this is automatically done by appropriately dimensioning the evaporator.

According to a further feature of the invention, the temperature of the cooling air and/or of the ambient air as well as

the humidity of the cooling air and/or of the ambient air is measured with appropriate sensors. This can serve to check the quality on the one hand, or also for regulating cooling.

To check the performance of the evaporator, the humidity of the cooling air can be measured before its entry into the evaporator and after its exit from the evaporator, and an alarm, e.g., can be set off if certain limit values are fallen short of.

According to a further feature of the invention, the conveyance of the cooling liquid can be controlled as a function of the temperature of the cooling air and/or of the temperature of the ambient air and/or of the humidity of the cooling air and/or of the humidity of the ambient air. Thus, cooling can be changed as a function of the respective ambient conditions and, thus, the energy demand can be lowered to a minimum.

Likewise, the rate of the cooling air can be controlled as a function of the temperature of the cooling air and/or of the temperature of the ambient air and/or of the humidity of the cooling air and/or of the humidity of the ambient air. It is an object to keep the cooling air rate as low as possible so as to lower the energy expenditures, on the one hand, and to keep low the moisture loss of the foodstuffs which occurs to a certain extent, on the other hand. The rate of the cooling air advantageously is controlled by changing the rotational speed of the fans.

Advantageously, also the entry temperature of the cooling liquid of the evaporator is measured with appropriate sensors.

To prevent the operating temperature of the evaporator from dropping to below a certain value, in particular to below 4°C, the heat removal can be stopped, which may, e.g., be effected by closing a valve in the secondary loop of the heat exchanger. Thus, heat cannot be conducted away any longer by the heat exchanger, and the temperature of the cooling liquid cannot drop any further. In this way, icing of the evaporator and a withdrawal of humidity due to moisture depositing on the evaporator is prevented.

Further monitoring may be provided in that the flow rate of the cooling liquid through the evaporator is measured by means of a sensor.

The second object according to the invention is achieved by

an above-indicated display shelf in which a liquid-cooled evaporator is used, wherein the entry temperature of the liquid coolant of the evaporator is higher than 0°C, preferably 4°C, and the relative humidity of the cooling air is higher than the relative humidity of the ambient air. By such a display shelf, a very long durability of the foodstuffs, in particular of fruit and vegetables, can be attained in a particularly simple and cost-effective manner.

Advantageously, the liquid coolant is formed by water. As has already been mentioned above, water is relatively inexpensive, substantially everywhere available and biologically harmless.

The temperature of the cooling air is 10 to 18°C, preferably 13 to 15°C.

The relative humidity of the cooling air advantageously is by 10 to 30% higher than the relative humidity of the ambient air so as to prevent the foodstuffs from drying out and thereby increase their durability.

According to further features of the invention, sensors can be provided for measuring the temperature of the cooling air and/or of the ambient air, as well as for measuring the humidity of the cooling air and/or of the ambient air. Such sensors may be designed in different ways and may be used for monitoring for the purpose of a quality check, on the one hand, or as an input signal of a control circuit for regulating cooling.

For control purposes, a control means may be provided, which is connected to a pump for circulating the cooling liquid and to a sensor for measuring the temperature of the cooling air and/or to a sensor for measuring the temperature of the ambient air and/or to a sensor for measuring the humidity of the cooling air and/or to a sensor for measuring the humidity of the ambient air. Thus, the circulating pump of the cooling liquid may be actuated differently as a function of the respective parameters, whereby cooling can be increased or reduced.

Likewise, a control means may be provided which is connected to at least one fan for conveying the cooling air and to a sensor for measuring the temperature of the cooling air and/or to a sensor for measuring the temperature of the ambient air and/or to a sensor for measuring the humidity of the cooling air and/or to a sensor for measuring the humidity of the ambient

air.

Furthermore, a sensor may be provided for measuring the entry temperature of the cooling liquid in the evaporator. In this manner it can be ensured that the evaporator will operate at temperatures of more than 0°C, preferably at 4°C, and, thus, humidity will not be withdrawn from the air.

The sensor for measuring the entry temperature of the cooling liquid may be connected to a valve in the secondary loop of the heat exchanger, so that the heat removal can be stopped in case the entry temperature falls short of a given value, in particular below 4°C.

Moreover, at least one sensor may be provided for measuring the flow rate of the cooling liquid so as to allow for an indication of the orderly operation of the cooling shelf and, on the other hand to set off an alarm when certain limit values are fallen short of or exceeded.

In order to form a channel for guiding the cooling air, the rear wall of the display shelf may be double-faced, which cooling air, after having left the evaporator, enters the channel from below and exits through outlet openings above the bases for cooling the foodstuffs arranged on these bases. This also represents a simple embodiment variant of the display shelf which also allows for a rapid and simple retrofitting of uncooled shelves by exchanging the rear wall.

For reducing swirling in the air flow of the cooling air, the outlet openings may be formed by adjacently arranged pipes having an, e.g., honey-comb cross-section. By this, a laminary air flow is attained which will ensure cooling also of the most forwardly arranged foodstuffs on the base even in case of extraordinarily long shelf bases, and, on the other hand, will entrain as little warm ambient air as possible, by which a higher energy consumption would be necessary for cooling the air.

For directing the air flow, the outlet openings may be inclined. Often the bases of the display shelves also are inclined forwardly. In this case, the angle of inclination of the outflow openings advantageously is adapted to the inclination of the base of the display shelf.

For adapting the cooling to the respective foodstuffs, yet also to the respective loading of the bases of the display shelf, the outlet openings may also comprise an adjustable in-

clination.

For conducting the cooling air in the channel within the rear wall of the display shelf, means for guiding the cooling air may be provided in the channel. Such baffle plates or the like may serve for branching off partial air flows in the direction of the outlet openings so that also several superimposedly arranged levels of the display shelf can be sufficiently supplied with cooling air.

To save energy, the rear wall may comprise a thermal insulation of a suitable material. For guiding the cooling liquid, in particular water, from the heat exchanger to the evaporator, ducts are provided which may be made of copper or plastics material, e.g..

In order to lose as little energy via these ducts as possible, a thermal insulation of a suitable material may be provided.

For refilling cooling liquid, the cooling liquid ducts may be provided with an appropriate connection. Such a connection for cooling liquid, in particular for water, may be formed by a conventional plug connection, to which, e.g., a water hose can be attached so as to be able to fill water into the cooling circuit.

To reduce the losses of energy, side walls may be provided for a lateral limitation of the display shelf, which side walls prevent the cooling air from escaping laterally.

In order to create different regions for depositing different foodstuffs, e.g., intermediate walls may be provided. By this and by further measures, such as, e.g., the arranging of different evaporators, theoretically also display shelves can be created which provide different temperature zones for different foodstuffs.

Advantageously, the at least one fan and the at least one evaporator are arranged at the bottom of the display shelf. Since the displaying of the foodstuffs cannot occur as far as to the bottom of the shelf for purposes of convenience, this region is particularly well suited for arranging such components. For maintenance and cleaning of the components, the latter should be as readily accessible as possible.

To receive condensed water, a removable trough may be arranged at the bottom, which trough may preferably be made of

rust-resistant materials, such as plastics materials, e.g.. The condensed water may also be taken up by a channel.

In order to avoid noise exposure of the customers and also of the staff, a sound insulation means may be provided for the at least one fan.

Finally, advantageously a lighting means may be provided on the lower side of the bases of the shelf. In this instance, the electrical connection of the lighting means may be by plug-in connections which allow for rapid mounting and dismounting.

The present invention will be explained in more detail by way of the accompanying drawings.

Therein,

Fig. 1 shows a sectioned side-view of a variant of an embodiment of the display shelf;

Fig. 2 shows the top view onto the display shelf according to Fig. 1 as viewed by the customer; and

Fig. 3 shows a schematic block diagram of the air cooling system contained in the display shelf according to the invention.

Fig. 1 shows a sectioned view of an embodiment of a display shelf 1 for foodstuffs 2, in particular for fruit and vegetables. On a rear wall 3, several bases 4 are arranged in a common manner so as to receive the foodstuffs 2. For a good hold of the display shelf 1, the rear wall 3 is connected with feet 6 by means of an appropriate shelf cantilevering means 5. At the upper end of the rear wall 3, a closure 7 can be arranged in the form of a roof. Cooling of the foodstuffs 2 is effected via cooling air K which is guided over the foodstuffs 2, which has been characterized schematically by way of the broken line and the arrows. The cooling air K is conveyed by at least one fan 7 which may be located in the lower region between the shelf cantilevering means 5. The fan 7 may be provided with sound insulation means for reducing its noise. The cooling air K is blown through an evaporator 8 which lowers the temperature T_k of the cooling air K to appropriate values. To conduct away the heat withdrawn from the foodstuffs 2, a heat exchanger 9 is arranged, preferably in the upper region of the shelf 1, which heat exchanger is connected to the evaporator 8 via corresponding ducts (not illustrated). The secondary loop of the heat exchanger 9 is connected to a cooling unit via corresponding refrigerating

agent ducts (not illustrated), which cooling unit usually is not arranged in the display shelf 1 and may be designed in various ways. For guiding the cooling air K, the rear wall 3 preferably is configured in double-leaf manner so as to form a channel 10. To avoid heating of the cooling air K by the environment, an appropriate thermal insulation 11 may be provided on the rear wall 3. After having left the evaporator 8, the cooling air K enters the channel 10 in the rear wall 3 from below and leaves this channel 10 through corresponding outlet openings 12 arranged above the bases 4. For guiding the cooling air K, guide means 13, e.g. baffle plates or the like, may be arranged. For operating the evaporator 8, a cooling liquid, in particular water, is used, which is guided by corresponding ducts (not illustrated) to a pump 14 preferably arranged in the upper region of the display shelf 1, and to the heat exchanger 9 for conducting away the heat. For illuminating the foodstuffs 2, appropriate lighting fixtures 15 may be provided, preferably at the lower side of the bases 4.

To illustrate the outlet openings 12 for the cooling air K, reference is made to Fig. 2 which shows a top view onto the display shelf 1 as viewed by the consumer. To give a better overview, the bases 4 as well as the closing means 7 have not been illustrated. The rear wall 3 has outlet openings 12 for the cooling air K which may, e.g., be in the form of adjacently arranged tubes 16, e.g. of honey-comb type cross-section, so as to attain a laminar flow of the cooling air K. Laterally, the display shelf 1 preferably is delimited by side walls 18, 19.

Fig. 3 shows a schematic block diagram of the device for cooling and humidifying the foodstuffs on the display shelf 1. The block diagram shows a total of four evaporators 8 through which the air K for cooling the foodstuffs 2 is blown by means of fans 7. Cooling liquid, in particular water, which is circulated in appropriate cooling ducts 20 is used to operate the evaporator 8. To avoid losses of energy, the cooling liquid ducts 20 preferably are provided with a thermal insulation 21. The cooling liquid is conducted from the evaporator 8 to a heat exchanger 9 via a pump 14 so as to deliver the heat, and from this heat exchanger 9 it is conducted to the evaporators 8 again. To enable refilling of cooling liquid, a connection means 22 may be connected to the ducts 20, via which the cooling li-

liquid, in particular the water, can be refilled. According to the invention, the evaporators 8 are designed such that the entry temperature T_E of the cooling liquid has more than 0°C , preferably 4°C . In circulation of the cooling liquid, an equalizing container 23 having an equalizing valve 24 may further be arranged. For conducting away the heat via the heat exchanger 9, a refrigerating agent is guided to a corresponding cold unit (not illustrated) via corresponding ducts 25, 26, which cold unit may be designed in various ways. For connecting the display shelf 1 to such an appropriate cold unit, the cooling agent ducts 25, 26 preferably are equipped with corresponding connecting elements 27, 28. For measuring the entry temperature T_E of the cooling liquid at the entrance of the evaporator 8, an appropriate sensor 29 may be provided. When a certain temperature, e.g. of 4°C , is fallen short of, the further removal of heat by the heat exchanger 9 can be stopped in that a solenoid valve 30 in the cooling agent duct 25 is actuated. For measuring the flow rate of the cooling liquid, a flow sensor 31 may be arranged in the duct 20. To measure the temperature T_K of the cooling air K, the temperature T_U of the ambient air as well as the humidity F_K of the cooling air K as well as the humidity F_U of the ambient air, sensors may also be located at suitable sites which have not been entered in the drawing for the purpose of giving a better overview. Via an appropriate control means 32, which e.g. may be connected to the fans 7 and/or to the pump 14 and to the temperature sensors, regulation of the cooling of the foodstuffs 2 is possible.

According to the invention, by operating the evaporators 8 with a cooling liquid, in particular water, at a temperature in the range above 0°C , in particular at 4°C , it is achieved that the evaporator 8 does not withdraw any humidity from the cooling air K, but that, due to the cooling down of the cooling air K, the humidity of the cooling air K even increases. Thus, a substantially longer durability of the foodstuffs 2 is achieved.

By way of the following example, the effect of the invention will be explained in yet more detail:

Fruit and vegetables were stored on a non-cooled shelf and on a shelf cooled according to the present invention, and the temperature and the humidity of the air on the shelf were measured. The evaporator 8 used showed the following technical data:

Entry temperature of the cooling liquid (water): 4°C;
Exit temperature of the cooling liquid (water): 7°C;
Volume flow of cooling liquid: 0.41 m³/hour;
Volume flow of the cooling air at entry into the evaporator:
400 m³/hour;
Volume flow of the cooling air at exit from the evaporator:
389 m³/hour;
Temperature of cooling air at entry into the evaporator: 17.5°C;
Temperature of cooling air at exit from the evaporator: 10.5°C;
relative humidity of cooling air at entry into the evaporator:
64%;
relative humidity of cooling air at exit from the evaporator:
84%.

While the temperature on the cooled shelf ranged between 9.6 and 13°C, the temperature on the non-cooled shelf was between 18.1 and 21.1°C. The humidity of the air on the cooled shelf ranged between 80.2 and 99.2%, whereas on the non-cooled shelf merely levels of the relative humidity of air of between 60.3 and 83.1% could be recorded. While some of the fruit and vegetable varieties tested had already perished after one day, with the display shelf according to the invention the durability could be increased to 99 hours.

Therefore, the present invention shows a method of preserving foodstuffs, in particular fruit and vegetables, as well as a display shelf for foodstuffs, in particular for fruit and vegetables, by which the durability of the foodstuffs can be increased by a multiple as compared to today's methods in a simple and cost-effective way.

Claims:

1. A method of preserving foodstuffs (2), in particular fruit and vegetables on open display shelves (1), wherein cooled air is conducted over the foodstuffs (2) by means of an evaporator (8) and the heat withdrawn from the foodstuffs (2) is conducted away via a heat exchanger (9), characterised in that the air (K) in the evaporator (8) is cooled by means of a cooling liquid, which cooling liquid has an entry temperature of more than 0°C, preferably of 4°C, and in that the evaporator (8) is dimensioned such that the cooling air (K) has a relative humidity (F_K) which is higher than the relative humidity (F_U) of the ambient air.
2. The method according to claim 1, characterised in that water is used as the cooling liquid for cooling the air (K).
3. The method according to claim 1 or 2, characterised in that the cooling air (K) is cooled down to a temperature (T_K) of 10 to 18°C, preferably 13 to 15°C.
4. The method according to any one of claims 1 to 3, characterised in that the relative humidity (F_K) of the cooling air (K) is higher by between 10 to 30% than the relative humidity (F_U) of the ambient air.
5. The method according to any one of claims 1 to 4, characterised in that the temperature (T_K) of the cooling air (K) is measured.
6. The method according to any one of claims 1 to 5, characterised in that the temperature (T_U) of the ambient air is measured.
7. The method according to any one of claims 1 to 6, characterised in that the humidity (F_K) of the cooling air is measured.
8. The method according to claim 7, characterised in that the humidity (F_K) of the cooling air (K) is measured before its entry into the evaporator (8) and/or after its exit from the evaporator (8).

9. The method according to any one of claims 1 to 8, characterised in that the humidity (F_u) of the ambient air is measured.

10. The method according to any one of claims 5 to 9, characterised in that conveyance of the cooling liquid is controlled as a function of the temperature (T_k) of the cooling air (K) and/or of the temperature (T_u) of the ambient air and/or of the humidity (F_k) of the cooling air (K) and/or of the humidity (F_u) of the ambient air.

11. The method according to any one of claims 5 to 10, characterised in that the rate of the cooling air (K) is controlled as a function of the temperature (T_k) of the cooling air (K) and/or of the temperature (T_u) of the ambient air and/or of the humidity (F_k) of the cooling air (K) and/or of the humidity (F_u) of the ambient air.

12. The method according to any one of claims 1 to 11, characterised in that the entry temperature (T_E) of the cooling liquid of the evaporator (8) is measured.

13. The method according to claim 12, characterised in that when the entry temperature (T_E) of the cooling liquid falls short of a certain value, the removal of heat is stopped.

14. The method according to any one of claims 1 to 13, characterised in that at least one sensor (31) is provided for measuring the flow rate of the cooling liquid.

15. A display shelf (1) for foodstuffs (2), in particular for fruit and vegetables, comprising bases (4) arranged on a rear wall (3) for receiving the foodstuffs and a system for guiding cooling air (K) over the foodstuffs (2), at least one fan (7) for conveying the cooling air (K) and at least one evaporator (8) for lowering the temperature of the cooling air (K), and at least one heat exchanger (9) for conducting away the heat withdrawn from the foodstuffs (2), characterised in that a liquid-cooled evaporator (8) is used, wherein the entry temperature (T_E) of the liquid coolant of the evaporator (8) is higher than 0°C ,

preferably 4°C, and the relative humidity (F_K) of the cooling air (K) is higher than the relative humidity (F_U) of the ambient air.

16. The display shelf according to claim 15, characterised in that the liquid coolant is formed by water.

17. The display shelf according to claim 15 or 16, characterised in that the temperature of the cooling air (K) is 10 to 18°C, preferably 13 to 15°C.

18. The display shelf according to any one of claims 15 to 17, characterised in that the relative humidity (F_K) of the cooling air (K) is by 10 to 30% higher than the relative humidity (F_U) of the ambient air.

19. The display shelf according to any one of claims 15 to 18, characterised in that at least one sensor is provided for measuring the temperature (T_K) of the cooling air (K).

20. The display shelf according to any one of claims 15 to 19, characterised in that at least one sensor is provided for measuring the temperature (T_U) of the ambient air.

21. The display shelf according to any one of claims 15 to 20, characterised in that at least one sensor is provided for measuring the humidity (F_K) of the cooling air (K).

22. The display shelf according to any one of claims 15 to 21, characterised in that at least one sensor is provided for measuring the humidity (F_U) of the ambient air.

23. The display shelf according to any one of claims 15 to 22, characterised in that a control means (32) is provided which is connected to a pump (14) for circulating the cooling liquid and to a sensor for measuring the temperature (T_K) of the cooling air (K) and/or to a sensor for measuring the temperature (T_U) of the ambient air and/or to a sensor for measuring the humidity (F_K) of the cooling air (K) and/or to a sensor for measuring the humidity (F_U) of the ambient air.

24. The display shelf according to any one of claims 15 to 23, characterised in that a control means (32) is provided which is connected to at least one fan (7) for conveying the cooling air (K) and to a sensor for measuring the temperature (T_K) of the cooling air (K) and/or to a sensor for measuring the temperature (T_U) of the ambient air and/or to a sensor for measuring the humidity (F_K) of the cooling air (K) and/or to a sensor for measuring the humidity (F_U) of the ambient air.

25. The display shelf according to any one of claims 15 to 24, characterised in that at least one sensor (29) is provided for measuring the entry temperature (T_E) of the cooling liquid in the evaporator (8).

26. The display shelf according to claim 25, characterised in that the sensor (29) for measuring the entry temperature (T_E) of the cooling liquid is connected to a valve (30) in the secondary loop of the heat exchanger (9), so that the heat removal can be stopped in case the entry temperature (T_E) falls short of a given value.

27. The display shelf according to any one of claims 15 to 26, characterised in that at least one sensor (31) is provided for measuring the flow rate of the cooling liquid.

28. The display shelf according to any one of claims 15 to 27, characterised in that the rear wall (3) is double-faced to form a channel (10) for guiding the cooling air (K), which cooling air (K), after having left the evaporator (8), enters the channel (10) from below and exits through outlet openings (12) above the bases (4).

29. The display shelf according to claim 28, characterised in that the outlet openings (12) are formed by adjacently arranged tubes (16) having an, e.g., honey-comb cross-section.

30. The display shelf according to claim 28 or 29, characterised in that the outlet openings (12) are inclined.

31. The display shelf according to claim 30, characterised in

that the inclination of the outlet openings (12) is adjustable.

32. The display shelf according to any one of claims 28 to 31, characterised in that means (13) for guiding the cooling air (K) are provided in the channel (10).

33. The display shelf according to any one of claims 15 to 32, characterised in that the rear wall (3) comprises a thermal insulation (11).

34. The display shelf according to any one of claims 15 to 33, characterised in that ducts (20) are provided for guiding the cooling liquid.

35. The display shelf according to claim 34, characterised in that the ducts (20) for guiding the cooling liquid comprise a thermal insulation (21).

36. The display shelf according to claim 34 or 35, characterised in that the cooling liquid ducts (20) are provided with a connection (22).

37. The display shelf according to any one of claims 15 to 36, characterised in that side walls (18, 19) are provided for a lateral limitation.

38. The display shelf according to any one of claims 15 to 37, characterised in that intermediate walls are provided for creating different regions for depositing different foodstuffs (2).

39. The display shelf according to any one of claims 15 to 38, characterised in that the at least one fan (7) and the at least one evaporator (8) are arranged at the bottom.

40. The display shelf according to claim 39, characterised in that a removable trough is arranged at the bottom for receiving condensed water.

41. The display shelf according to any one of claims 15 to 40, characterised in that a sound insulation is provided for the at

least one fan (7).

42. The display shelf according to any one of claims 15 to 41, characterised in that a lighting means (15) is provided.