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(54) **REFRIGERATOR**

(57) The present invention relates to a refrigerator comprising a body; a container which is disposed in the body and wherein the foodstuffs are placed; and at least one light source which is disposed in the container and

which emits a blue light with a light wavelength between 400 nm and 520 nm, a green light with a light wavelength between 520 nm and 610 nm and a red light with a light wavelength between 610 nm and 720 nm.

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Description

[0001] The present invention relates to a refrigerator wherein the freshness of the foodstuffs placed therein is preserved.

[0002] Plants are exposed to daylight for a certain period of time in their life cycle while in the field. Although this period of time changes regionally, it is generally between 8 and 16 hours with an average of 12 hours. After the products are harvested from the field, the freshness of the plants deteriorates day by day. Users usually store the foodstuffs such as vegetables/fruits they buy from the market in the refrigerator. When the foodstuffs such as vegetables/fruits are not stored in suitable environments, they spoil in a very short period of time. It is required to ensure that the freshness of the foodstuffs is preserved while being stored in the refrigerator.

[0003] In the Patent Document No. KR100758208B1, a refrigerator is disclosed, wherein the illumination is controlled by the control unit according to the local time.

[0004] In the Patent Document No. US7685934B2, a refrigerator is disclosed, wherein the color of the light is adjusted according to the color of the foodstuff placed into the crisper.

[0005] The aim of the present invention is the realization of a refrigerator wherein the freshness of the foodstuffs placed therein is preserved.

[0006] The refrigerator realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a body; a container which is disposed in the body and wherein the foodstuffs are placed; and at least one light source which is suitable for emitting blue, green and red light into the container. The light source can be a single light source which contains blue, red and green lights, or a separate light source can be used for each color of light.

[0007] The refrigerator of the present invention comprises a control unit which controls the light source such that only blue light is emitted into the container for a predetermined T1 time, only green light is emitted for a predetermined T2 time, only red light is emitted into the container for a predetermined T3 time, and the light source is turned off for a predetermined T4 time so as to stop emitting light into the container. After blue light, green light and red light are successively turned on by the control unit, the lights on the light source are turned off so as to stop emitting light into the container for the T4 time. After the T4 time ends, the light source is turned on for the predetermined T1 time so as to emit only blue light into the container. The T1, T2, T3 and T4 times follow each other. In general, both red light and blue light act on the synthesis mechanism of many nutritional values while red light has a higher effect of increasing vitamin C, the total carotenoid synthesis. With the blue light, a higher level of synthesis of anthocyanin and phenolic compounds occurs. The red light also decreases ethylene release. While all of the red, green and red lights are effective on the chlorophyll synthesis, it is shown that the

green light has a higher level of effect on chlorophyll accumulation due to its higher penetration in chloroplasts.

[0008] In an embodiment of the present invention, the total of the T1, T2, T3 and T4 times is 24 hours. The 24-hour cycle of the sunlight acting on the foodstuffs such as fruits, vegetables, etc. on the field which are then placed into the container is simulated inside the container by being divided into the T1, T2, T3 and T4 times.

[0009] In another embodiment of the present invention, the lengths of the times are T4, T3, T1 and T2 in descending order. The foodstuffs such as vegetables, fruits, etc. are not exposed to sunlight in the fields for almost half of the day throughout the year. Therefore, the T4 time is the longest. While the blue light is intense at sunrise, the red light increases towards the sunset. When the entirety of the day is examined, the red light is present in the environment more than the blue light. Therefore, the T3 time when the red light is emitted is longer than the T1 time when the blue light is emitted. The green light which is the least-encountered light on average in a 24-hour sunlight cycle is emitted to the container for the least amount of time.

[0010] In another embodiment of the present invention, the T3 time is 1.5 times the T1 time. During the day, the total amount of red light in the sunlight is 1.5 times the total of blue light on average. Therefore, the T3 time when the red light is applied is 1.5 times the T1 time when the blue light is applied.

[0011] In an embodiment of the present invention, the blue light is applied for four hours while the red light is applied for 6 hours.

[0012] In an embodiment of the present invention, the T4 time when no light is emitted and thus the foodstuffs are kept in a dark environment inside the container is 12 hours. Plants which photosynthesize with light need a dark environment to renew themselves.

[0013] In an embodiment of the present invention, the light source is a RGB LED. The RGB LED emits the red, green and blue lights container therein into the container to illuminate the same.

[0014] By means of the present invention, the natural cycle of day is simulated in the refrigerator, thus preserving the vitamin and antioxidant values of vegetables and fruits.

[0015] The refrigerator comprises a body; a container which is disposed in the body and wherein the foodstuffs are placed; and at least one light source which is disposed in the container and which emits a blue light with a light wavelength between 400 nm and 520 nm, a green light with a light wavelength between 520 nm and 610 nm and a red light with a light wavelength between 610 nm and 720 nm.

[0016] The refrigerator of the present invention comprises a control unit which operates the light source such that only blue light is emitted into the container for a predetermined T1 time, only green light is emitted into the container for a predetermined T2 time, only red light is transmitted into the container for a predetermined T3

time, and the light source is turned off for a predetermined T4 time so as to stop emitting light into the container. At sunrise, the amount of blue light is higher. The amount of red light in the environment increases towards the sunset. Therefore, the light wavelengths are increased and then emitted into the container. In some cases the signal transduction pathways where the red and blue lights are active are independent, and in other cases they are interacting. When there is interference in the photoreceptors, they can reduce each other's efficiency. In order to prevent such interference in the photoreceptors, the red and blue lights are emitted at successive intervals. No two lights are emitted into the container at the same time. In a preferred version of the embodiment, the container is a crisper.

[0017] In an embodiment of the present invention, the total of the T1, T2, T3 and T4 times is 24 hours. Said times are periodically repeated.

[0018] In an embodiment of the present invention, the light source is controlled by the control unit in an order where the T3 time is shorter than the T4 time, the T1 time is shorter than the T3 time and the T2 time is shorter than the T1 time.

[0019] In an embodiment of the present invention, the T3 time is 1.5 times the T1 time. Throughout the year, the ratio of the intensity of the red light to the intensity of the blue light in the sunlight is 3/2 on average. Thus, an illuminated environment close to the sunlight is obtained.

[0020] In an embodiment of the present invention, the T1 time is between 210 minutes and 270 minutes. The T3 time is between 330 minutes and 390 minutes. In a preferred version of the present invention, the T1 time is 240 minutes and the T3 time is 360 minutes. If the blue light which is applied for the T1 time is used for longer periods, stomata on the plants open more, accelerating the moisture loss. If the blue light is shorter, it may be insufficient for the photomechanisms.

[0021] In an embodiment of the present invention, the T4 time is between 690 minutes and 750 minutes. In a preferred embodiment of the present invention, the T4 is 720 minutes. The light source in the container is turned off by the control unit for the T4 time, thus creating a dark environment. The average time the plants stay in darkness is 12 hours. The dark environment is required for the self-repair mechanism of the plants to be activated. According to the tests conducted, a two-fold increase is observed in the vitamin A and C levels of the foodstuffs stored in the container where the blue light is emitted for four hours, the green light for two hours, the red light for six hours and no light for 12 hours successively in this order.

[0022] In an embodiment of the present invention, the light source is a RGB LED. The RGB LED contains red, green and blue lights thereon. With a single light source, three different colors of light can be emitted into the container. Thus, cost advantage is provided.

[0023] By means of the present invention, a refrigerator

is realized, wherein the freshness of the foodstuffs in the container is preserved in a cycle similar to the sunlight by creating a cycle where the interior of the container is illuminated by blue, green and red lights successively and at different times, and then the interior of the container is kept dark by turning off the lights for a predetermined time.

10 Claims

1. A refrigerator comprising a body; a container which is disposed in the body and wherein the foodstuffs are placed; and at least one light source which is disposed in the container and which emits a blue light with a light wavelength between 400 nm and 520 nm, a green light with a light wavelength between 520 nm and 610 nm and a red light with a light wavelength between 610 nm and 720 nm, **characterized by** a control unit which operates the light source such that only blue light is emitted into the container for a predetermined T1 time, only green light is emitted into the container for a predetermined T2 time, only red light is transmitted into the container for a predetermined T3 time, and the light source is turned off for a predetermined T4 time so as to stop emitting light into the container.
2. A refrigerator as in Claim 1, **characterized in that** the total of the T1, T2, T3 and T4 times is 24 hours.
3. A refrigerator as in any one of the above claims, **characterized by** the T3 time which is shorter than the T4 time, the T1 time which is shorter than the T3 time and the T2 time which is shorter than the T1 time.
4. A refrigerator as in any one of the above claims, **characterized by** the T3 time which is 1.5 times the T1 time.
5. A refrigerator as in Claim 4, **characterized by** the T1 time which is between 210 minutes and 270 minutes and the T3 time which is between 330 minutes and 390 minutes.
6. A refrigerator as in any one of the above claims, **characterized by** the T4 time which is between 690 minutes and 750 minutes.
7. A refrigerator as in any one of the above claims, **characterized by** the light source which is a RGB LED.



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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
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