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(54) Title: PROCESS FOR THE LYOPHILIZATION OF VEGETABLES, AND LYOPHILIZED VEGETABLES OBTAINED THROUGH SUCH PROCESS

(57) Abstract: A process is disclosed for the lyophilization of vegetables comprising the steps of: cultivating vegetables until they are ripen; harvesting the ripened vegetables; possibly washing and cleaning the harvested vegetables; possibly preparing the vegetables by peeling them and slicing them to reduce their sizes to a form adapted for packaging; lyophilizing the vegetables in the form in which they have been harvested and/or prepared; and packaging the lyophilized vegetables.



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PROCESS FOR THE LYOPHILIZATION OF VEGETABLES, AND
LYOPHILIZED VEGETABLES OBTAINED THROUGH SUCH
PROCESS

The present invention refers to a process for the lyophilization of any type of vegetable, and to the lyophilized vegetables obtained with such process.

Several processes for lyophilizing various types of products are known in the art: all of them, however, provide for one or more steps of crushing, pulverising or mixing the products, before subjecting them to such processes.

This type of operation however allows obtaining a lyophilized end product whose composition is not known with accuracy, and that, for food applications, is not always satisfactory, for example when it is necessary to use it as ointment of plates, in which the original product appearance anyway plays a role with a certain importance.

Moreover, since the common lyophilization

treatments provides to take first of all the fresh aromatics under hard vacuum to a temperature of about -40 °C and then to lyophilize them arriving to a temperature of +35 °C, the remixing to which the material is subjected in these phases damages the cells.

Object of the present invention is solving the above prior-art problems, by providing a process for harvesting and lyophilizing vegetables that allows providing a lyophilized end product with a full form or a sliced form, but not crushed or milled, that can be restored into its original form and/or conditions when a user puts it again in contact with water.

A further object of the present invention is providing a lyophilization process that does not damage the vegetables cells to which it is applied, allowing the end user to obtain the original vegetable ready for use, without possible mixtures with other undesired vegetables or substances.

A further object of the present invention is providing such a lyophilization process that can extend the storage length of the vegetables subjected to treatment, for a period that can last up to 8 - 12 months or more with sealed packages.

The above and other objects and advantages of the invention, as will appear from the following description, are obtained by a lyophilization process and a lyophilized product as claimed, respectively, in Claims 1 and 16. Preferred embodiments and non-trivial variations of the present invention are claimed in the dependent Claims.

The present invention will be better described by some preferred embodiments, provided as a non-limiting example, above all as regards the nature of the process and the type of products to which it is applied.

According to its preferred embodiment, the inventive process for the lyophilization of vegetables generally comprises the steps of:

- cultivating vegetables until they ripen;
- harvesting the ripened vegetables;
- possibly washing the harvested vegetables;
- possibly cleaning the harvested vegetables;
- possibly preparing the vegetables by peeling them and slicing them to reduce their sizes to a form adapted for packaging;
- lyophilizing the vegetables in the form in

which they have been harvested and/or prepared; and

- packaging the lyophilized vegetables.

In particular, the step of lyophilizing is composed of the almost complete removal of humidity (approximately 5% of humidity remains) from the vegetables that have been frozen by subjecting them to the application of a hard vacuum: this allows keeping the organoleptic characteristics of the products unchanged for a long time, keeping their external appearance unchanged in addition to their colour, and restoring the products in their original conditions once having put them back in contact with water.

In fact, the step of lyophilizing is based on the sublimation of water contained in the fresh aromatics of the vegetables through the exposure of the aromatics to a hard vacuum at very low temperatures; the steam in the form of ice at low temperature (about -40 °C) is then sucked by a vacuum system, obtaining a completely lyophilized and dehydrated end product, while the sublimation of ice creates voids inside the lyophilized and dehydrated material, where such voids facilitate the following rehydration of the lyophilized and

dehydrated material.

The process of the invention can be applied, as seen, to any type of vegetables cultivation, even if the preferred one is the cultivation of the biologic type: such cultivation comprises the following cultural techniques: manuring with biologic organic products, plowing or spading the earth, sod breaking, covering the surfaces aimed for planting the essences with a black cloth to avoid the growth of infestant grass, watering carried out through porous pipes arranged on the agricultural surface affected by cultivation, in which all vegetables previously cultivated in a jar are transplanted into the full field for future cultivation.

Moreover the harvesting of ripened vegetables, preferably but not in a limiting way, is an aimed harvesting according to a ripening scale: such aimed harvesting is of a manual type and is carried out by removing parts of a plant that can be used, such as leaves, flowers and roots, and afterwards arranging such parts into separate boxes.

Moreover, the above-mentioned steps of possibly washing and cleaning are composed of a process that comprises the steps of: selecting impurities;

removing dry or imperfect vegetable parts; washing and purifying from possible contamination of earth, dust or other organisms.

Still more, the step of possibly preparing the vegetables is carried out only when the vegetables have to be peeled or the vegetables are of such sizes as not to be able to be properly packaged in small packages (for example an apple or a pumpkin): this slicing step is carried out by cutting big vegetables into slices or pieces that are able to be contained into small packages.

Finally, the above-mentioned step of packaging can be carried out in bags made of plastic material according to the type of packaged vegetable.

Alternatively, the packaging can provide for the airtight sealing of bags made of plastic materials used for packaging, or other types of packaging adapted to the product to which they are applied and to the currently-available sealing technologies.

Due to its innovative character, the process of the invention can be applied to any type of agricultural and food product: it finds its most efficient actuation in the field of vegetables in general, or more in particular in the field of all

varieties of vegetable essences, aromatics and officinals, grasses and shrubs, fruits and vegetables, biologic and not biologic.

Moreover, the inventive process can be applied, in a preferred and non-limiting way, to such vegetables in all their parts: external vegetative part, roots, flowers and biologic and non biologic fruits.

A further feature of the above-mentioned process is that it can be applied to vegetables that are divided, prepared and displayed by individual typologies or to vegetables that are mixed together and displayed in various mixtures.

With the above-mentioned process, it is possible to produce whole or semifinished lyophilized products that, in the above-described case, are lyophilized vegetables of the above-cited type.

CLAIMS

1. Process for the lyophilization of vegetables, characterised in that it comprises the steps of:

- cultivating vegetables until they ripen;
- harvesting the ripened vegetables;
- possibly washing the harvested vegetables;
- possibly cleaning the harvested vegetables;
- possibly preparing the vegetables by peeling them and slicing them to reduce their sizes to a form adapted for packaging;
- lyophilizing the vegetables in the form in which they have been harvested and/or prepared; and
- packaging the lyophilized vegetables.

2. Process according to Claim 1, characterised in that said step of lyophilizing is composed of an almost complete removal of humidity from said vegetables that have been frozen by subjecting them to the application of a hard vacuum.

3. Process according to Claim 2, characterised in that said step of lyophilizing is based on a sublimation of water contained in fresh

aromatics of said vegetables through an exposure of said aromatics to a hard vacuum at very low temperatures, steam in the form of ice at low temperature (about -40 °C) being then sucked by a vacuum system, obtaining a completely lyophilized and dehydrated end product, the sublimation of ice creating voids inside the lyophilized and dehydrated material, such voids facilitating the following rehydration of the lyophilized and dehydrated material.

4. Process according to Claim 1, characterised in that said step of cultivating vegetables is composed of a cultivation of the biologic type.
5. Process according to Claim 4, characterised in that said biologic cultivation comprises the following cultural techniques: manuring with biologic organic products, plowing or spading the earth, sod breaking, covering the surfaces aimed for planting the essences with a black cloth to avoid the growth of infestant grass, watering carried out through porous pipes arranged on the agricultural surface affected by cultivation, all vegetables previously cultivated in a jar being transplanted into the

full field for future cultivation.

6. Process according to Claim 1, characterised in that said step of harvesting the ripened vegetables is composed of an aimed harvesting according to a ripening scale.
7. Process according to Claim 6, characterised in that said aimed harvesting is of a manual type and is carried out by removing parts of a plant that can be used, such as leaves, flowers and roots, and afterwards arranging such parts into separate boxes.
8. Process according to Claim 1, characterised in that said steps of possibly washing and cleaning are composed of a process of selecting impurities, removing dry or imperfect vegetable parts, washing and purifying from possible contamination of earth, dust or other organisms.
9. Process according to Claim 1, characterised in that said step of possibly preparing the vegetables is carried out only when the vegetables have to be peeled or the vegetables are of such sizes as not to be able to be properly packaged in small packages, such slicing step being carried out by cutting big

vegetables into slices or pieces that are able to be contained into small packages.

10. Process according to Claim 1, characterised in that said step of packaging is carried out in bags made of plastic material according to the type of packaged vegetable.
11. Process according to Claim 1, characterised in that said step of packaging further provides for the airtight sealing of bags made of plastic materials used for packaging.
12. Process according to any one of the previous Claims, characterised in that the vegetables to which such process is applied are composed of all varieties of vegetable essences, aromatics and officinals, grasses and shrubs, fruits and vegetables, biologic and not biologic.
13. Process according to Claim 12, characterised in that said process is applied to said vegetables in all their parts: external vegetative part, roots, flowers and biologic and non biologic fruits.
14. Process according to any one of the previous Claims, characterised in that the vegetables to which said process is applied are divided, prepared and displayed by individual

typologies.

15. Process according to any one of Claims 1 to 13, characterised in that the vegetables to which said process is applied are mixed together and displayed in various mixtures.
16. Lyophilized vegetables, characterised in that they are produced through the process according to any one of the previous Claims.