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(54) **Process for dehydrating moringa oleifera**

(57) PROCESS FOR DEHYDRATING MORINGA OLEIFERA, comprising: cutting the branches of *Moringa oleifera* in small bunches (2) and, within 1 hour, carrying them to a dehydration chamber (1); in said chamber, placing them in containers (3) with the base and side walls in the form of a grille (3a); arranging the containers forming shelves (5) with space among the containers (3) so that the small bunches (2) don't get crushed; arranging

the shelves (5) aligned so as to form among them, at least, an air channel (6); the chamber is a clean, dark, and airtight room with, at least, a heater (7), a dehumidifier (8) and fans (9) which force heated air to pass through the mentioned channel (6) at a temperature not exceeding 40°C; periodically, as a function of the humidity build-up, renewing the air within the drying room, and replacing it by new and dry air.

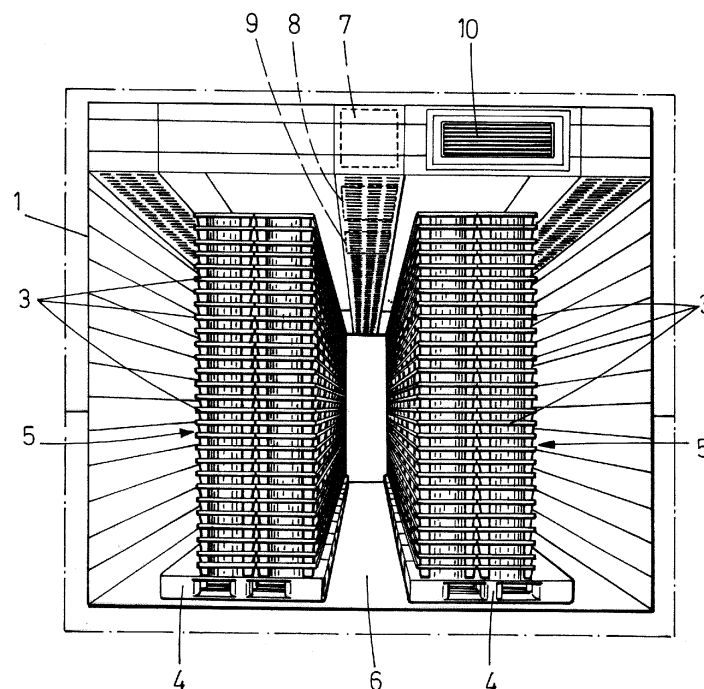


FIG.1

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Description

OBJECT OF THE INVENTION

[0001] The invention, as exposed on the wording of the present specification, relates to un process for dehydrating *Moringa oleifera*, imparting to the function it is intended to, several advantages and innovative characteristics, which will be described in detail below and which mean a remarkable improvement with regard to which is currently known for the same purpose.

[0002] More particularly, the object of the invention focuses on a process for dehydrating or drying the leaves of *Moringa oleifera* which presents the peculiarity of being fully friendly to the plant's active principles, achieving a maximal preservation of its properties, since by reducing the time between cutting and packaging, and always keeping the temperature below 40°C, it avoids spoiling the enzymes and phytohormones which said plant contains.

APPLICATION FIELD OF THE INVENTION

[0003] The application field of the present invention is framed within the agricultural and alimentary sector, focusing particularly on the field of industry of dehydrated *Moringa oleifera* packaging and marketing.

BACKGROUND OF THE INVENTION

[0004] As it is known, *Moringa oleifera* is a tree originated in the North of India which posses innumerable properties, both nutritional and medicinal and from which, excepting the root, every parts are edible, i.e., leaves, fruits and flowers.

[0005] In the Canary Islands there is the natural phenomenon of "calima" (haze) (wind laden with earth-sand coming from Africa) and given the properties of this plant to metabolize through its leaves, in the Canary Islands said leaves get saturated with more minerals and salts than in other places, reason by which, after being dehydrated, the dry mass is percentage-wise higher than the one obtained in other places.

[0006] In conventional processes for dehydrating the plant (which are rapid and at high temperatures) for using it in dry state, for example for infusions, as a spice, etc., many of the properties owned by the fresh plant can get lost, since the enzymes it contains are spoiled.

[0007] The objective of the present invention is, then, developing a new process for dehydrating this plant so as to being able to keep intact its enzymes and, therefore, all its properties, having to note that, at least on the applicant's part, it is unknown the existence of any other invention of similar application presenting technical characteristics similar to the ones presented by the procedure herein recommended.

EXPLANATION OF THE INVENTION

[0008] Thus, the process for dehydrating *Moringa oleifera* proposed by the invention is configured as a remarkable novelty within its field of application, as, according to its implementation and unequivocally, the objective pointed above as suitable is satisfactorily achieved.

[0009] Specifically, said process comprises the following steps:

First of all, the branches of *Moringa oleifera* are cut by hand and they are arranged in small bunches on ventilated containers, so as to keep them as fresh as possible, being carried to a dehydration chamber, with the peculiarity that said carrying is done within 1 hour from they were cut off from the tree until they are put in said dehydration chamber.

[0010] It is convenient to note that the cut branches are carried to the cleaning and drying area in the ventilated boxes, where they are placed after being cut, and, when they arrive to said areas, the same boxes can be used or they can be relocated in trays or in shelves, also ventilated, where they stay separated and in different heights for said cleaning and drying.

[0011] In any case, firstly the small bunches are cleaned with a quick wash in fresh drinkable water, so as to remove any impurity or dirt and to keep cool or low their temperature. Said quick wash can be manual, small bunch by small bunch, or directly within the boxes, trays or shelves where the small bunches are placed.

[0012] In the dehydration chamber, which has been previously thoroughly cleaned, between 2 and 3 kg (depending on the size of the tray) of small bunches of *Moringa oleifera* recently cut and clean are placed on each tray. The small bunches are placed separated, never overlying, so that the air can better circulate, and the trays are separated between one height and the following one so that a tray never crushes the small bunches in the lower tray.

[0013] Preferably, the branches of *Moringa oleifera* are cut and put directly in metallic trays or in boxes of perforated and light plastic, of the type suitable for food and resistant to high temperatures, from which they move no more until being dehydrated, and with which are mounted pallets which are washed and introduced directly in the dehydration chamber.

[0014] On their part, the containers, whether boxes or trays, as it was said, are ventilated, i.e., they have the base and, where applicable, the side walls in the form of a grille, being preferably of plastic material which withstands until 100°C without affecting its quality nor contaminating the *Moringa*.

[0015] In the dehydration chamber the temperature never exceeds 40°C, which slows the dehydrating process of the branches. For said reason, and in order to accelerate the process, a lot of air is passed among the trays.

[0016] The dehydration chamber is a dark room, without natural external light (although it has artificial light for emergency cases), airtight, and which also has heaters, a dehumidifier and fans.

[0017] Moreover, it is important to note that within the dehydration chamber the distribution of the shelves, pallets of boxes or trolleys of trays is arranged in such a way that a channel of dry and warm artificial air is created, which is forced to circulate among the small bunches of said boxes or trays.

[0018] If said channel of warm artificial air is not created, which forces the air to circulate among the small bunches, the air enters and temperatures and humidities are mixed without control. As they must always be below 40°C, results are maximized without mixing the air currents and increasing the air volume circulating in only one direction.

[0019] The dehydration process consist of making the Moringa exude the water it contains, and in order to avoid that it reabsorbs the water it is necessary to control the air circulation and its humidity in every moment.

[0020] To do so, the dehydration chamber is filled with the trolleys of trays or pallets of boxes so as to begin to make the Moringa exude, however, it makes that over time the air gets laden with humidity. Therefore, the room is heated below 40° and the air humidity is removed.

[0021] For removing sad air humidity, from time to time, this humid air is expelled and it is changed or renewed by air dryer and cooler, being repeated this process some times.

[0022] Preferably this process of changing the air is performed by means of a programmed control device which automatically opens and closes the windows or ventilation grilles of the dehydration chamber when the level of humidity and/or temperature reaches the expected point.

[0023] Once the Moringa dried, it is removed from the trays and the leaf is separated from the stem, manually or mechanically, having to note that said stem separation reaches a 99% thereof, which increases the concentration of the actives existing in the obtained leaves.

[0024] The leaves are cut for being used as an infusion or as a spice, or they are pulverized and vacuum-packed.

[0025] The advantages and utilities achieved with the process described are a maximal preservation of the properties of the fresh plant (without spoiling enzymes) because of the minimum time elapsing from cutting to packaging and because the temperature is always kept below 40° which spoil the enzymes contained in the plant.

[0026] The dehydrated plant obtained can be marketed as an ingredient in sachets, powdered, as juices, sauce, encapsulated, within tablets, cookies and bars, etc. This dehydration process, allows for elaborating a concentrate which is made through a soaking and subsequent distillation at low temperatures, using a vacuum for lowering the vaporizing point, and using alcohol, water or glycerine or a combination of the named substances for the extraction of the required substances from the

plant. This elaboration process, using dehydrated raw material according to the dehydration process object of the present invention, allows that all the substances present in the living plant, pass to said solution, and that after the evaporation of this liquid, the concentrate or the paste obtained presents the original nutrients previous to the dehydration of the plant, concentrated and intact.

[0027] The process for dehydrating *Moringa oleifera* described represents, then, an innovative structure with structural and constitutive characteristics unknown so far to this end.

DESCRIPTION OF THE DRAWINGS

[0028] In order to complement the description being fulfilled of the invention and with the aim of helping to a better understanding of the characteristics characterizing it, the present specification is accompanied, as an integral part thereof, by a set of plans, in which by way of illustration and not of limitation, is represented the following:

Figure number 1.- Shows a perspective view of an example embodiment of the dehydration chamber which is used to perform the process for dehydrating *Moringa oleifera*, according to the invention, being appreciated on it the elements it comprises and the arrangement of the containers with the small bunches in shelves consisting, in the example represented on it, of pallets of plastic boxes.

Figure number 2.- Shows a perspective view of a portion of the grille of the trays which, optionally, are used in the dehydration process object of the invention as a container for placing the small bunches.

Figure number 3.- Shows a top perspective view of an example of perforated box suitable for being used optionally in the procedure of the invention as a container for transporting the small bunches of *Moringa oleifera*.

Figure number 4.- Shows a perspective view of an example of trolley with multiple trays suitable for being used in the process object of the invention for transporting the cut branches of the plant.

Figure number 5.- Shows a perspective view of the dehydration chamber shown in figure 1, represented with the load of leaves complete and showing the route followed by air therein and through the boxes thanks to the arrangement of the shelves of containers.

Figure number 6.- Shows a perspective view of the dehydration chamber, in this case represented with a single row of shelves of containers, specifically pallets of boxes, having represented on it, by means of

arrows, the unsuitable mode in which the circulation of air therein occurs, because of the lack of the central air channel.

PREFERRED EMBODIMENT OF THE INVENTION

[0029] Looking at figure 1, an example of the dehydration chamber (1) is observed, in which the process for dehydrating *Moringa oleifera* according to the invention is performed, being appreciated on it how the small bunches (2) of branches of the plant are placed in ventilated containers (3) in the form of boxes or trays which are incorporated on supports (4), forming pallets or trolleys, of shelves (5) of several heights. In said specific example the containers (3) are boxes stacked in pallets.

[0030] In said figure it is appreciated how the mentioned shelves (5) of containers (3) are organized aligned, so that they determine, at least, a channel (6) among them for the air to pass through.

[0031] In said channel (6) are placed means for forcing the circulation of air and through the shelves (5) among the containers (3), which consist of, at least, a heater (7), for warming the air within the drying room, a dehumidifier (8) and one or more fans (9) so as to force the maximal recirculation of warm air as well as for renewing it every time the windows (10) or ventilation conducts are opened.

[0032] It is necessary to mention that in the represented example, said elements (heater (7), dehumidifier (8) and fans (9)) have been represented schematically, since, preferably, these are elements which are hidden in the installation of the chamber.

[0033] On their part, the ventilated containers (3) consist, of trays with grille-shaped base (3a), stackable in trolleys, such as the figures 2 and 4 show, said trays being able to be of fibreglass, stainless steel or plastic, or of boxes with grille-shaped base and partition walls and stackable in pallets, such as figures 1 and 3 show.

[0034] Figure 3 shows an example of the containers (3) in the form of ventilated boxes wherein, optionally, the small bunches (2) are carried from the plant to the dehydration chamber (1), being appreciated how said boxes, which preferably are made of plastic, present also the base and the side walls in the form of a grille.

[0035] Considering all the foregoing, the process comprises the following steps:

- the branches of *Moringa oleifera* are cut, arranged in small bunches (2) and, before 1 hour from the moment they were cut off from the tree, they are transported to the dehydration chamber (1);
- in the dehydration chamber (1), the small bunches (2) are placed in ventilated containers (3), i.e., with the base and, where applicable, the side walls, in the form of a grille (3a);
- the ventilated containers (3) are arranged forming

shelves (5) of several heights, with enough room among them so that the small bunches (2) never get crushed;

- said shelves (5) are placed in the dehydration chamber (1) arranged so that they are aligned so as to form among them, at least, a channel (6) for the artificial warm air to pass through.
- the dehydration chamber (1) is a clean, dark, and airtight room where is provided, at least, a heater (7), a dehumidifier (8) and one or more fans (9) which force heated air to pass through the mentioned channel (6) the temperature never exceeding 40°C;
- periodically, as a function of the humidity build-up in the air, the air in the dehydration chamber (1) is renewed, for being replaced by new and dry air, being said renovation repeated as many times as necessary until the complete dehydration of the plants is achieved.

[0036] As it has been noted, the ventilated containers (3) are ventilated trays or boxes which are incorporated on supports (4) forming the shelves (5) of several heights, and preferably, the cut branches are placed in ventilated boxes for being carried directly therein to the dehydration chamber.

[0037] Optionally, the cut branches are placed firstly in ventilated boxes, wherein they are carried to the dehydration chamber and then, in said chamber, trays which are incorporated on supports (4) forming the shelves (5) are relocated.

[0038] In a variant embodiment, the renewal of the humid air by new and dry air is performed automatically by means of a programmed control device which automatically opens and closes one or more windows (10) or other ventilation conducts, which will be performed as a function of the pre-programmed parameters in said device and of the readings of humidity and temperature sensors provided to this end in the dehydration chamber.

[0039] In conclusion, the essential steps of the procedure were: cutting the branches of *Moringa oleifera*, and, within 1 hour, placing them in a dehydration chamber (1) where heated air is passed among them, the temperature never exceeding 40°C, and renewing periodically the air with the humidity which the plants have exuded by new and dry air.

[0040] In figure 5 an example of dehydration chamber with the load complete and properly arranged is shown, having represented on it, by means of arrows, the mode in which the air circulates therein for a correct drying of the plants, meanwhile in figure 6, the dehydration chamber with a single row of shelves is represented, and by means of arrows, it is observed how the route of the air in such case is not suitable.

[0041] Thus, looking at the arrows of figure 5, it is appreciated how firstly enters a column of warm and dry

air, said column is forced to pass through the shelves, and after absorbing the humidity of the small bunches by passing among the container, the humidity-laden air is absorbed and expelled outside by the humidity control system which regulates its periodical extraction and the input of dry air.

[0042] On its part, in figure 6 the air does not circulate suitably, since the shelves are not properly placed and the channel for the air to pass through among them does not exist, since the air circuit is not created and the different temperatures and humidities are mixed.

[0043] Having sufficiently described the nature of the present invention, as well as a way of putting it into practice, it is not considered necessary to make a more extensive explanation in order that any expert in this area will understand its scope and the advantages that can be derived from it, making known that, within reason it could be put into practice in other embodiments differing in detail from that indicated by way of example, and which will obtain the same degree of protection, provided that they do not alter, change, or modify its fundamental principle.

Claims

1. PROCESS FOR DEHYDRATING MORINGA OLEIFERA, specifically the leaves of said plant, **characterized in that** it comprises, essentially:

- cutting the branches of *Moringa oleifera*, and, within 1 hour,
- placing them in a dehydration chamber (1) wherein heated air is passed among them, the temperature never exceeding 40°C,
- renewing periodically the air with humidity exuded by the plants by new and dry air.

2. PROCESS FOR DEHYDRATING MORINGA OLEIFERA, according to claim 1, **characterized in that** it comprises the following steps:

- the branches of *Moringa oleifera* are cut, arranged in small bunches (2) and, within 1 hour from they were cut off from the tree, they are carried to a dehydration chamber (1);
- in the dehydration chamber (1), the small bunches (2) are placed in ventilated containers (3), i.e., with the base and, where applicable, the side walls, in the form of a grille;
- said ventilated containers (3) are arranged forming shelves (5) of several heights, with space among them so that the small bunches (2) never get crushed;
- said shelves (5) are placed arranged within the dehydration chamber (1) so that they are aligned so as to form among them, at least, an air channel (6);

- in the dehydration chamber (1), which is a clean, dark, and airtight room, heated air is passed through the mentioned channel (6) among the shelves (5) the temperature never exceeding 40°C, using therefore, at least, a heater (7), a dehumidifier (8) and one or more fans (9);

- periodically, as a function of the humidity build-up in the air, the air within the dehydration chamber (1) is renewed, said air with the humidity exuded by the plants being replaced by new and dry air;

- said air renewal is repeated many times as necessary until the complete dehydration of the plants is achieved.

3. PROCESS FOR DEHYDRATING MORINGA OLEIFERA, according to claim 2, **characterized in that** the ventilated containers (3), which are boxes or trays, are incorporated on supports (4) forming the shelves (5) of several heights.

4. PROCESS FOR DEHYDRATING MORINGA OLEIFERA, according to claim 3, **characterized in that** the cut branches are placed in boxes and are carried to the dehydration chamber directly within the same, which are incorporated on the supports (4) forming the shelves (5).

5. PROCESS FOR DEHYDRATING MORINGA OLEIFERA, according to claim 3, **characterized in that** the cut branches are carried to the dehydration chamber in ventilated boxes, and then are relocated in trays which are incorporated on supports (4) forming the shelves (5).

6. PROCESS FOR DEHYDRATING MORINGA OLEIFERA, according to any of claims 1-5, **characterized in that** the renewal of humid air by new and dry air is performed by means of a programmed control device which automatically opens and closes windows (10) or ventilation conducts, as a function of the pre-programmed parameters and of the readings of humidity and temperature sensors provided in the dehydration chamber.

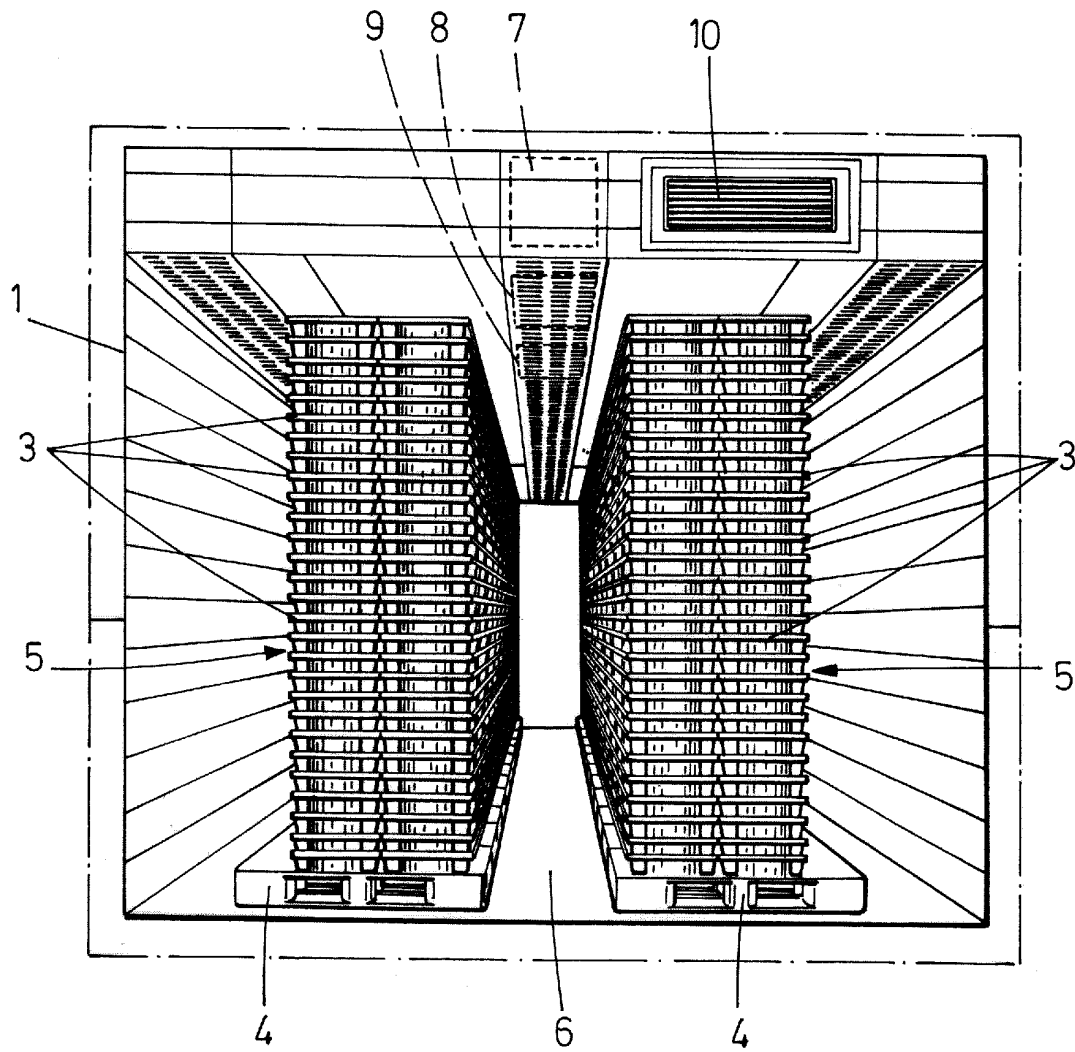


FIG.1

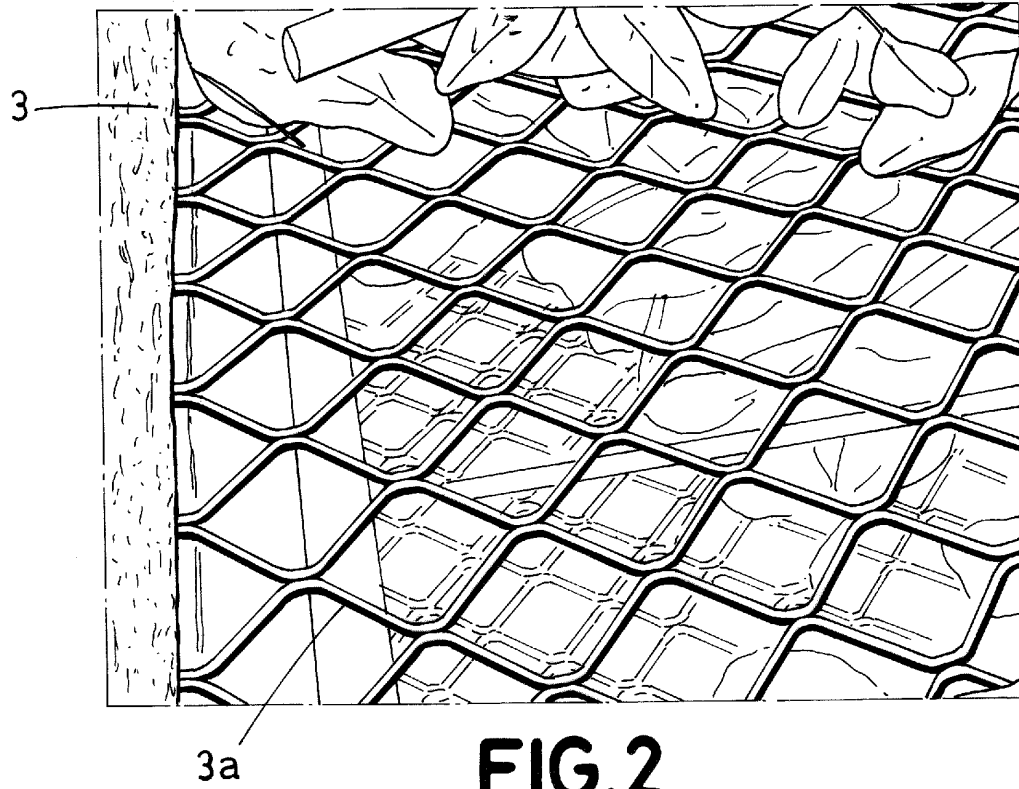


FIG. 2

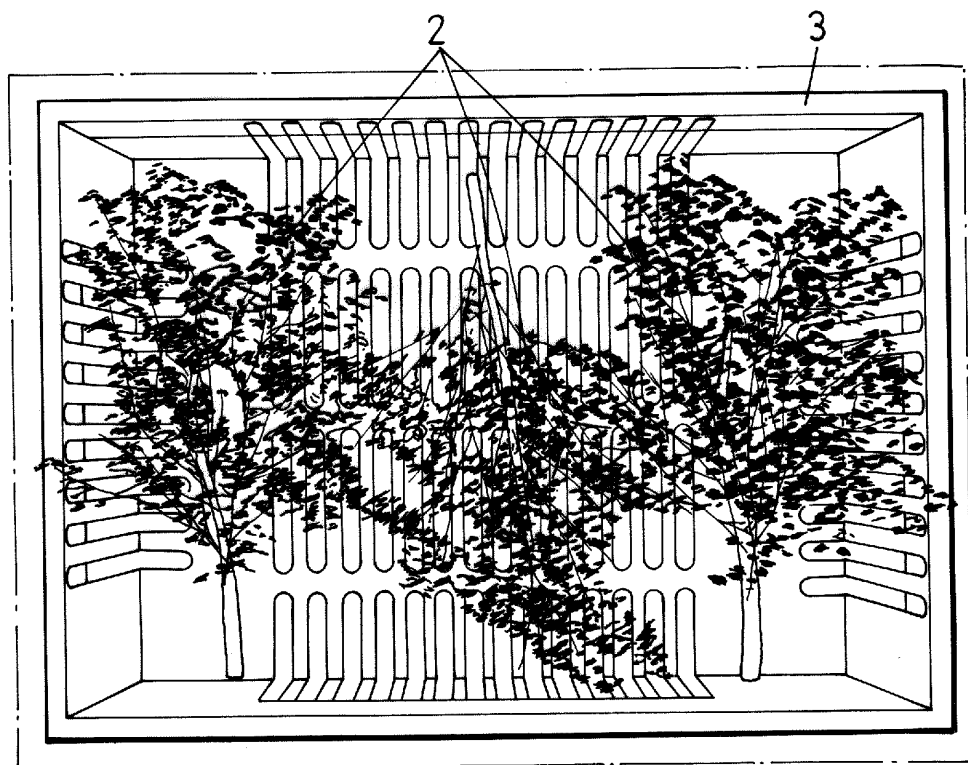


FIG. 3

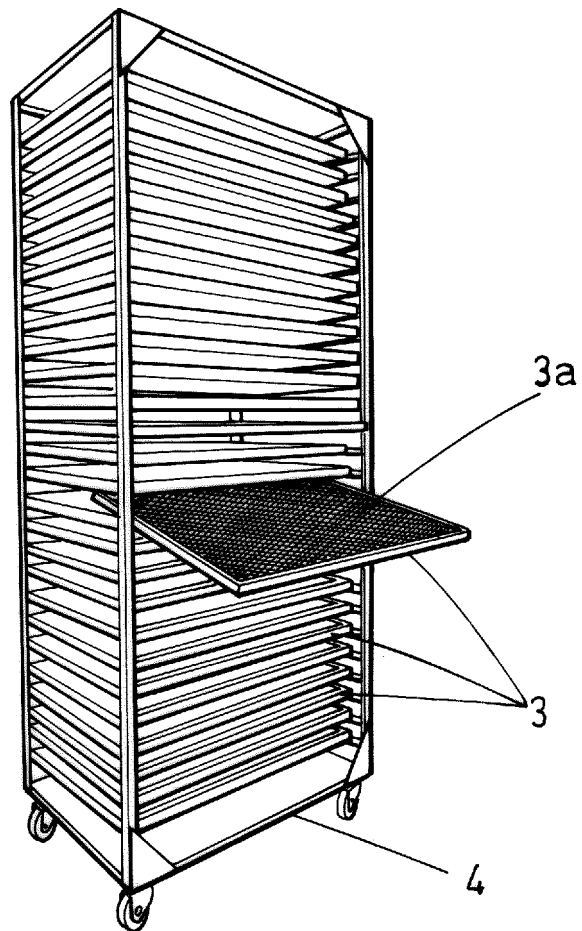


FIG.4

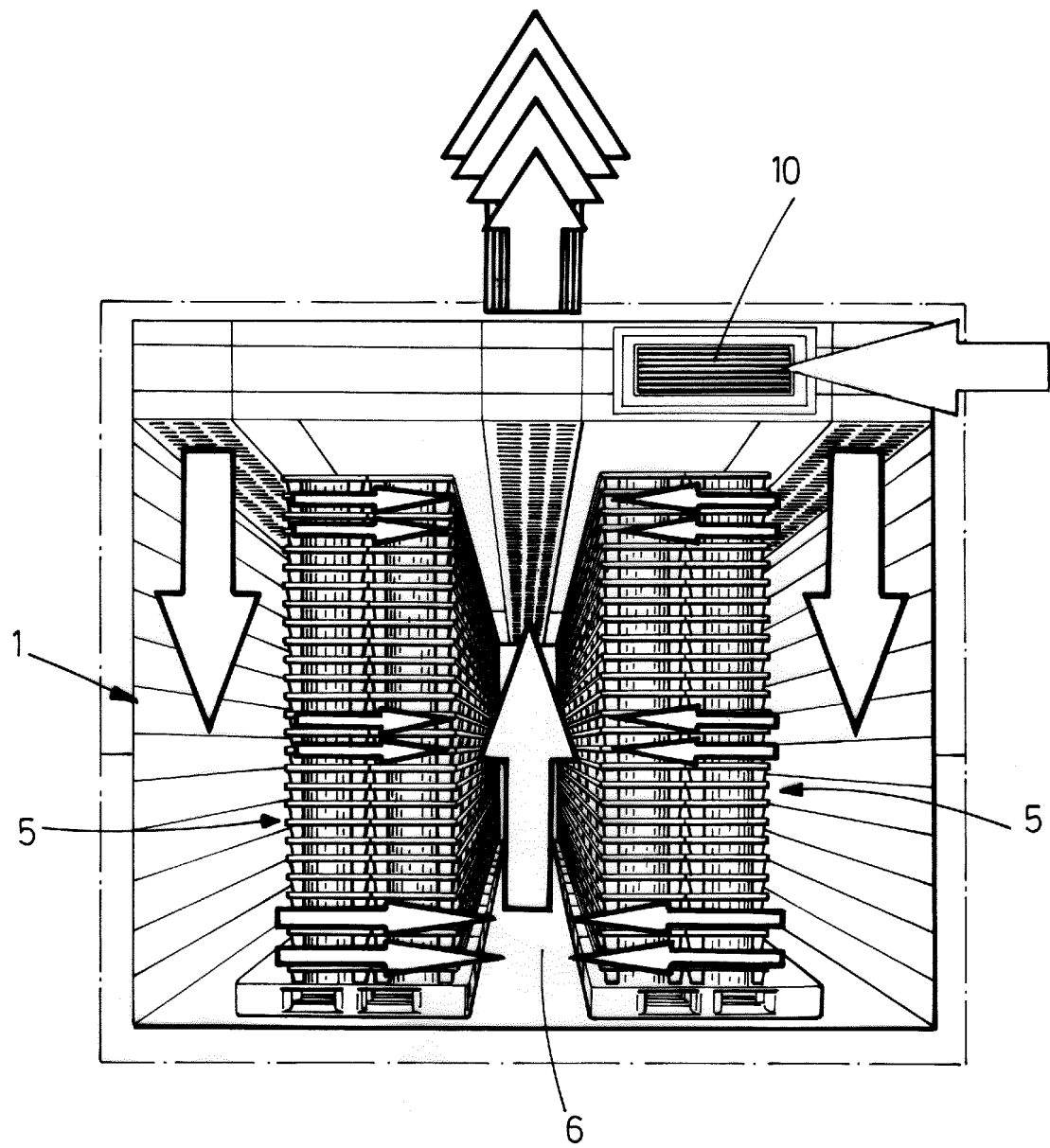


FIG. 5

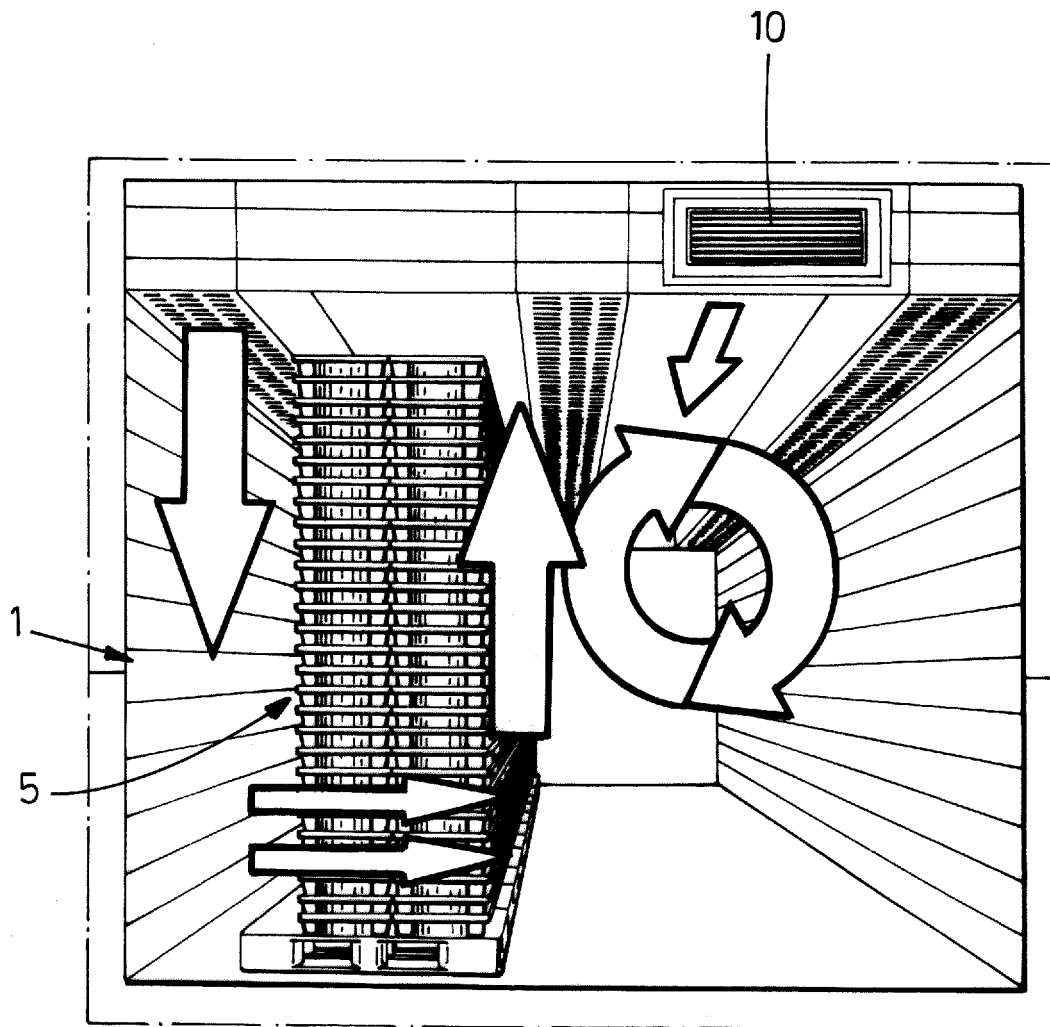


FIG.6



EUROPEAN SEARCH REPORT

 Application Number
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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	US 1 601 966 A (HARRIS HOWARD E) 5 October 1926 (1926-10-05) * figure 1 * * pages 2-3 *	1,6	
A	US 5 431 175 A (BECKETT JOHN M [US] ET AL) 11 July 1995 (1995-07-11) * column 9, lines 29-43 *	6	TECHNICAL FIELDS SEARCHED (IPC) F26B
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 October 2013	Examiner De Meester, Reni
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			

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A	CH 691 512 A5 (KURT RASCHLE [CH]) 31 July 2001 (2001-07-31) * the whole document *	1-6	
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A	US 2 921 382 A (BLUM LOUIS L) 19 January 1960 (1960-01-19) * the whole document *	1-5	
A	US 1 550 422 A (BRAEMER WILLIAM G R) 18 August 1925 (1925-08-18) * the whole document *	1-5	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 October 2013	Examiner De Meester, Reni
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			

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			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		30 October 2013	De Meester, Reni
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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	Anonymous: "Moringa Leaves Powder Preparation", Miracletrees.org 10 March 2013 (2013-03-10), XP002715420, Retrieved from the Internet: URL:http://miracletrees.org/moringa_leaves_powder.html [retrieved on 2013-10-24] * Moringa leaves should be dried in an area protected from light to prevent the loss of vitamins and protected from dust and pests to prevent contamination. If necessary, Moringa leaves can be covered by thin cloth or mosquito netting to help keep them clean while drying. The drying process should be completed as quickly as possible to prevent the growth of molds; if leaves mold or mildew they should be thrown out or used for compost. If the humidity of the air is high, the Moringa leaves should be spread out in a thin layer and mixed frequently; dehydrators, ovens, driers or fans may be required in cases of extreme humidity. * * Sun-drying in direct sunshine and under shade are the common practices used in most parts of Africa to preserve vegetables for dry season consumption (Lyimo et al., 1991). However ways of food preparation and preservation may affect significantly the concentration and availability of minerals, vitamins and other essential compounds in food. Some reports have documented the losses of nutrients from vegetables during drying (Yadav and Sehgal, 1997) and cooking (Kachik et al., 1992 and Kidmose et al., 2005). A low temperature oven drying -/--	1	TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		30 October 2013	De Meester, Reni
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	process was applied to dehydrate moringa leaves. The nutrient values were measured and compared to those of freeze dried leaves. The results showed that drying at 50°C for 16 hours maintained most nutrients and phytochemicals in moringa leaves except for vitamin C. The mild-heating and drying process could be achieved using common household facility such as stove to provide a simple and effective way for long term preservation and continuous supply of essential micronutrients. * ----- okraw: "How to Dry Moringa and Make Green Powder - A New Raw Super Food", 2 November 2010 (2010-11-02), page 1, XP054975225, Retrieved from the Internet: URL: http://www.youtube.com/watch?v=uaas01M0U0h0 [retrieved on 2013-10-24] * harvest tree (2:09) remove the branches from the tree (6:07) perforated trays that go into the oven (6:19) excalibur hot air dehydrator (6:50) shelves (6:50) dry at 118 deg. F (7:11) keep the enzymes alive (7:14) * -----	1-5	TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		30 October 2013	De Meester, Reni
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			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 13 38 2179

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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