PROCESSED Curculigo latifolia FRUITS AND PROCESSING METHOD

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This invention relates to processed Curculigo latifolia fruits and a processing method for these fruits. More particularly, it relates to processed Curculigo latifolia fruits, which have a high taste-modification activity and do not suffer from any browning, and a method for processing these fruits in such a way that the processed fruits can be efficiently prepared.

It is known that Curculigo latifolia fruits, which grow in Western Malaysia and the southern part of Thailand and belong to the genus Curculigo of the family Hypoxidaceae or Amarayllidaceae, are good to eat and exhibit an appetizing effect.

The present inventors discovered that a sour material or water taken after eating Curculigo latifolia fruits would taste sweet. Thus, they conducted extensive studies to identify the active ingredient of the Curculigo latifolia fruits. As a result, they discovered that the active ingredient is a protein which was named curculin.

The present inventors further succeeded in the extraction and purification of the curculin and formulated it into a preparation in order to use this compound as a taste-modifier (Japanese Patent Application No. 277717/1988.

The present inventors also established a method for preparing a taste-modifier containing curculin by processing Curculigo latifolia fruits which comprises peeling Curculigo fruits by passing them between a

revolving drum having a number of holes and a revolving belt, grinding and dispersing the fruits thus peeled in water to remove the seeds and then removing water-soluble material in the sarcocarp containing protease and various germs (Japanese Patent Application No 17421/1990.)

However this processing method suffers from certain problems. The taste-modification activity of a portion of the curculin is neutralised or reduced and thus the yield lowered. Also, the fruits tend to suffer browning, which deteriorates the commercial value of the product. In addition, the sarcocarp of Curculigo latifolia fruits is highly viscous, which makes removal of the seeds difficult. As a result a considerable portion of the sarcocarp is wasted and the removal of the water-soluble matters requires much labour.

It is an object of the present invention to provide processed Curculigo latifolia fruits, which have a high taste-modification activity and do not suffer from any browning, and a method for processing the fruits in which the processed Curculigo latifolia fruits can be efficiently prepared.

Accordingly, the present invention provides a method for processing Curculigo latifolia fruits which comprises drying Curculigo latifolia fruits, then grinding them and removing the seeds from the ground fruits.

Thus, in order to achieve the stated object, the present inventors conducted extensive studies. As a result of these studies, it was discovered that the inactivation or the reduction of the taste-modification activity of curculin can be suppressed and simultaneously

the sarcocarp of Curculigo latifolia fruits can be easily separated from other unnecessary parts (i.e. seeds, peel, etc.), by drying Curculigo latifolia fruits as such, without dispersing in water, followed by grinding. This makes it possible to prevent browning and to improve substantially the efficiency of the procedure thereby efficiently providing a product of high activity.

A preferred method comprises treating the fruits with an organic solvent in any step of the above-mentioned method for processing Curculigo latifolia fruits.

A more preferred method for processing Curculigo latifolia fruits comprises freezing the fruits, destroying or removing their peels and then freeze-drying the fruits in the above-mentioned method.

The invention also extends to processed Curculigo latifolia fruits produced by a method according to the invention.

The processed Curculigo latifolia fruit of the preferred embodiment of the present invention has a high commercial value since it has a high taste-modification activity without suffering from any browning.

By adopting a method for processing Curculigo latifolia fruits in accordance with the present invention, the deactivation or lowering of the taste-modification activity of curculin, which is the taste-modifying substance contained in the fruits, can be suppressed and, furthermore, the sarcocarp of the Curculigo latifolia fruits can be easily separated from other unnecessary parts (i.e. seeds, peel, etc.), which makes it possible to prevent browning and to improve substantially the efficiency of the procedure thereby

efficiently providing a product of a high activity.

In the method for processing Curculigo latifolia fruits of the present invention, the drying time can be dramatically shortened and a product having a high activity can be efficiently obtained by freezing the fruits, destroying or removing the peel and then drying the fruits.

Within the scope of the present invention, the method for drying the Curculigo latifolia fruits is not particularly restricted. Thus, fruits dried in the sun, fruits dried in the shade, hot air-dried fruits, cold-dried fruits, freeze-dried fruits and vacuum-dried fruits may be used in the present invention. It is also possible to combine these methods with each other in any appropriate fashion. It is particularly preferable to use low temperature vacuum-dried or vacuum freeze-dried fruits.

The drying temperature is preferably 80°C or below, more preferably 40°C or below, taking the inactivation or lowering of the taste-modification activity of curculin into consideration.

The degree of vacuum may be 3 Torr or below, preferably 1 Torr or below.

The drying time may vary depending upon the drying method. In the case of low-temperature vacuum drying or vacuum freeze-drying, the drying time may preferably range from 3 to 72 hours.

The drying step is preferably continued until the residual moisture content reaches approximately 0.01 to 20%. Curculigo latifolia fruits which have been dried to the extent specified, have brittle peels and sarcocarp. Therefore the dried fruits can be easily ground and the ground material can be divided into

sarcocarp and peel by, for example, mixing and sieving.

When the Curculigo latifolia fruits are to be dried, it is preferable to destroy or remove their peels before drying. Fruit whose peel has been thus destroyed or removed can be easily dried within a shorter period of time as compared with fruit whose peel has not been treated.

The method for destroying or removing the peel of the fruit is not particularly restricted. Thus, the Curculigo latifolia fruits may be peeled by hand. Alternatively, they may be passed between a revolving drum having a number of holes and a revolving belt as described in Japanese Patent Application No. 17421/1990.

When the fruits are to be dried by freeze-drying, the peel may be destroyed or removed by the following methods.

The fruits should be frozen before destroying their peel. This is because when peeling of the fruits in an unfrozen state, there is a possibility that the taste-modification activity of a portion of curculin is neutralised or reduced and thus the yield is lowered and also, the fruits may suffer from browning and thus the commercial value of the product is deteriorated.

It is preferable to freeze the fruits at a material temperature of -20°C or below, because the eutectic point of the juice of the fruits is approximately -20°C.

Although the peels of the fruits thus frozen may be destroyed by any method without restriction, it is preferable to use a press. More particularly, the frozen fruits are pressed and broken up using the

press. In this procedure, it is preferable to adjust the clearance of press plates to a size larger than the diameter of the seeds of the fruits. This is because Curculigo latifolia seeds contain large proportions of fats which form impurities in the purification step. When the seeds are broken up, these fats are liberated and mix with the sarcocarp and can not then be separated without extreme difficulty.

The clearance between press plates may be adjusted to from 2.0 to 7.0 mm, preferably from 2.5 to 5.0 mm, since the seed size of Curculigo latifolia is larger than 0.5 mm, often larger than 1.0 mm and generally ranges from 1.6 to 1.8 mm, while the size of Curculigo latifolia fruits is approximately 10 mm in general. The pressing pressure may be arbitrarily selected as long as the frozen Curculigo latifolia fruits can be broken. In general, it is preferably 0.5 kg/cm^2 or above.

In this way, only the peels of the Curculigo latifolia fruits can be destroyed, without breaking up the seeds.

When their peels have been removed, the dried fruits can be easily ground. Furthermore, they can be easily divided into sarcocarp and seeds. Thus the curculin contained in Curculigo latifolia may be effectively separated.

In accordance with the present invention, the dried Curculigo latifolia fruits may be ground by mixing and stirring, for example in a mortar, a ball mill, a kneader or various mixers.

The grinding is performed to such an extent that the seeds can be separated from the other parts. It will suffice when the fruit, i.e. the peels

and sarcocarp, in particular, the sarcocarp has been grounded more finely than the seeds. Alternatively, the grinding of the dried fruits and the removal of their seeds may be performed simultaneously with the use of, for example, a strainer.

The size of a seed in a Curculigo latifolia fruit is as mentioned above. Seeds contained in a single fruit are almost the same size as each other. These seeds may be easily separated from the fruit by using one, two or three sieves having a mesh size smaller than the seed size. Alternatively, peel, seeds and sarcocarp may be separated from each other by making use of air pressure.

The processed fruit of the present invention thus obtained is preferably in the form of a granular or powdery solid consisting of particles smaller than the seeds. This product may be powdered further by grinding, if required.

Curculigo latifolia fruits have a characteristic grassy smell. In order to remove this smell, the fruits may be treated with an organic solvent in any step of the processing method of the present invention. The treatment with the organic solvent may be effected, for example, by stirring the fruits, the dried fruits or the powder together with the organic solvent. The organic solvent may be removed by a known method, for example, filtering, centrifuging, drying under reduced pressure or hot-air drying. Examples of suitable organic solvents include: ether, methanol, ethanol, acetone, propanol, ethyl acetate, n-hexane, chloroform, dichloromethane, propylene glycol and glycerol. These solvents may be used in combination. It is particularly preferable to use ethanol, acetone or a

combination of ethanol with acetone.

The treatment with the organic solvent is preferably performed at a low temperature (40°C or below) so as to prevent neutralisation or reduction of the taste-modification activity of curculin. The treatment time may vary depending on the organic solvent employed. It would usually range from such a short period as an immediate removal of the solvent after immersion of the Curculigo latifolia fruit material therein, to approximately 10 hours. However it is preferable to complete the treatment within a relatively short period of time, for example, it may be sufficient to complete the treatment within 1 hour.

Although this treatment with the organic solvent may be applied to either the Curculigo latifolia fruits, dried Curculigo latifolia fruits or the powdery final product, it is particularly preferable to subject the powdery processed fruits, from which the peels and seeds have been removed, to this treatment.

The invention may be carried into practice in various ways and some embodiments will now be described in the following Examples.

EXAMPLE 1

One kg of fresh Curculigo latifolia fruits were frozen and then subjected to vacuum freeze-drying (degree of vacuum: 0.1 Torr, drying temperature: 30°C or below, drying time : 20 hours) with the use of a vacuum freeze dryer FD-1 (manufactured by TOKYO RIKAKIKAI Co. LTD.) until the sarcocarp became brittle. Thus, dried Curculigo latifolia fruits were obtained. The residual moisture content of these dried Curculigo latifolia fruits measured with an infrared moisture meter FO-220 (manufactured by Kett) was approximately

11%. Next, the dried fruits were ground to a powder by straining through a standard sieve (JIS standard 1000 μmesh) and simultaneously, the peel and seeds were removed. The sarcocarp thus obtained was further formulated into a fine powder to give 70 g of a powder containing curculin.

EXAMPLE 2

One kg of fresh Curculigo latifolia fruits were washed with water and then peeled by treating with a deboner, Miny fish Separator SY 100 (performance: 200 kg/hr, pore size of revolving drum : 4 mm, manufactured by YANAGIYA MACHINERY WORKS Ltd.). After cooling, the fruits were subjected to vacuum freeze-drying (degree of vacuum: 0.01 Torr, drying temperature: 30°C or below, drying time : 15 hours) with the use of a vacuum freeze dryer FD-1 (manufactured by TOKYO RIKAKIKAI Co. Ltd.) until the sarcocarp became brittle. Thus, peeled and dried Curculigo latifolia fruits were obtained. The residual moisture content of these dried Curculigo latifolia fruits measured with an infrared moisture meter FO-220 (manufactured by Kett) was approximately 7%.

Then, the dried fruits were ground with a grinder T1-700A (manufactured by HEIKO MANUFACTURING, LTD.) in such a manner as not to break the seeds. When the ground product was stirred, the seeds freed themselves from the brittle sarcocarp, and then the sarcocarp was broken into smaller particles.

Next, the mixture of seeds and the particles of the sarcocarp were put through a standard sieve (JIS standard 355 μmesh) to separate the powdered sarcocarp from the seeds. The sarcocarp thus obtained was further formulated into a fine powder to give 50 g of a powder containing curculin.

500 ml of 0.5 M aqueous solution of NaCl at 5°C was added to 50 g of the curculin-containing powder thus obtained, followed by stirring for 3 minutes. The suspension thus obtained was filtered and then concentrated and desalted with an ultrafiltration device, Amicon YM-5 (manufactured by Amicon Division of W.R. GRACE & Co. - Conn.), fractional molecular weight: 5,000) to thereby give 80 ml of a desalted concentrate. This desalted concentrate was vacuum freeze-dried to give 0.15 g of a curculin preparation of a high purity.

EXAMPLE 3

30 ml of ethanol was added to 10 g of the curculin-containing powder obtained in Example 1 and this was stirred for 3 minutes. The mixture was filtered and dried under reduced pressure to remove the ethanol completely. The curculin preparation thus obtained showed no smell when kept in the mouth since the characteristic grassy smell of the Curculigo latifolia fruits had been removed.

EXAMPLE 4

50 ml of acetone was added to 50 g of the curculin-containing powder obtained in Example 1 and this was stirred for 10 minutes. The mixture was filtered and hot-air dried at 50°C to remove the acetone completely. The curculin preparation thus obtained showed no smell when kept in the mouth since the characteristic grassy smell of the Curculigo latilolia fruits had been removed.

EXAMPLE 5

This example illustrates only a method of drying fruits and destroying the peels, which may be used as part of a method according to the invention, but which in itself does not constitute the invention. 2.5 kg of fresh Curculigo latifolia fruits were washed with water and then well drained. Next 1250 g portions of said

fruits were placed on two freeze-drying trays (375 mm x 670 mm) and spread out so that the fruits formed a single layer. Then these trays were introduced into a freezer, where the fruits were frozen at - 40°C.

The frozen fruits on one of the trays were taken out of the freezer together with the tray and then immediately treated with a press in the frozen state.

The press used had a pressing area of 365 x 660 mm and was modified in such a manner that the fruits placed on the freeze-drying tray could be pressed as such. The pressing pressure was 2.5 kg/cm^2 and the clearance between the freeze-drying tray and a press plate was adjusted to 3 mm.

Thus, the peels of 1250 g of the fruits on the tray were destroyed. The fruits on the tray were then introduced into the freezer at - 40°C again and completely frozen by storing for three hours.

Then the Curculigo latifolia fruits whose peels had been thus destroyed, and those whose peels had not been destroyed, were vacuum freeze-dried by using a vacuum freeze-drier RLE-308 (manufactured by KYOWA VACUUM ENGINEERING, LTD). (Initial degree of vacuum: 0.2 Torr, drying shelf temperature: 40°C, shelf heating system: radiant heating). The times required for completely drying the fruits were thus determined. The term "shelf temperature" as used herein means the temperature of a shelf on which the trays were placed.

When the temperature of the dried material became constant around the shelf temperature, it was deemed that the drying had reached the end point. This is because the material temperature could never be elevated to the shelf temperature in the drying period, during which the

continuous sublimation or evaporation of the moisture contained in the fruits to be dried would take up the required heat of evaporation from the fruits. As the moisture contained in the fruits to be dried decreased as drying proceeded, the heat of evaporation taken up from the fruits decreased. As a result, the material temperature slowly rose and finally remained constant around the shelf temperature. This is the end point of drying.

When determined in this way, the Curculigo latifolia fruits with destroyed peels and those with their peels intact required respectively 14 hours and 20 hours for the completion of the drying.

CLAIMS

1. A method for processing Curculigo latifolia fruits which comprises drying the Curculigo latifolia fruits, then grinding the fruits and removing the seeds from the ground fruits.

2. A method as claimed in Claim 1, in which the fruits are treated with an organic solvent in any step.

3. A method as claimed in Claim 1 or Claim 2, in which the fruits are frozen, their peel is destroyed or removed, and then the fruits thus treated are freeze-dried.

4. A method as claimed in any preceding claim, in which the drying is effected by low temperature vacuum drying or vacuum freeze drying.

5. A method as claimed in Claim 4, in which the drying temperature is 80°C or below and the degree of vacuum is 3 Torr or below.

6. A method as claimed in Claim 5, in which the drying temperature is 40°C or below and the degree of vacuum is 1 Torr or below.

7. A method as claimed in any preceding claim, in which the drying is effected until the residual moisture content reaches 0.01 to 20%.

8. A method as claimed in any preceding claim, in which

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the grinding is effected until the size of the sarcocarp becomes smaller than that of the seeds.

9. A method for processing Curculigo latifolia fruits substantially as herein specifically described or as described in any one of Examples 1 to 4 herein.

10. Processed Curculigo latifolia fruits obtained by a method as claimed in any preceding claim.