

"PROCESS FOR PRODUCING ENCAPSULATED FOODSTUFF"

The present invention relates to a process for producing a Chlorella-containing foodstuff.

Chlorella is a genus of single cell algae which
5 grow in fresh water. The cells contain protein in a large amount and can be used to promote the growth of animals or microorganisms, to flavour foods and to remove foreign odour from foods. A hot water extract of Chlorella algae has a wide range of applications, because it has such growth
10 promoting and flavouring effects and is liquid.

Various products utilizing Chlorella algae have been developed. Typical of them are products made by blending a dry powder of Chlorella algae with a garlic powder and molding the blend into a tablet; noodles and
15 processed marine products containing a hot water extract of Chlorella algae used as a flavouring component and a quality improving agent during production thereof; and health food products made by incorporating a dry powder or hot water extract of Chlorella algae into vegetable edible fatty oils
20 and encapsulating the resulting material into a gelatin capsule.

In many cases, however, known Chlorella products can be difficult to produce and suffer the disadvantage that the effective ingredients of Chlorella algae are not
25 necessarily retained in a stable manner. When making a health food product using Chlorella algae in combination with other medicinal starting materials, it is important to

stably and effectively retain the medicinal ingredients of individual starting materials.

The invention seeks to provide a process for producing a foodstuff or health product using Chlorella algae in which the effective ingredients of Chlorella algae and other medicinal starting materials are stably retained. Accordingly, the invention provides a process for producing a Chlorella-containing foodstuff which comprises:

- (A) preparing dry powders by separately adding a concentrated exudate of hot water extract of Chlorella algae and a concentrated exudate of a hot water fungal extract to separate aliquots of a clathration material, blending and drying;
- (B) homogeneously mixing the dry powders from step (A) with an exudate or dry powder of, as tonic medicinal vegetable, at least one of garlic, ginseng, aloe, umeboshi (Japanese plum), prickly pear of the family Cactaceae and adlay, and an edible fatty oil to provide an oil-suspension; and
- (C) encapsulating the oil-suspension to provide a soft capsulated foodstuff.

The process of the present invention is capable of producing a product containing effective ingredients of Chlorella algae, fungi and tonic medicinal vegetables stably retained and preserved therein. Further, the

product has a perculiar property in that the soft capsule cannot be swelled, even if it contains an exudate of a tonic medicinal vegetable having a relatively large content of moisture, because it contains a large amount of an
5 edible fatty oil having a cholesterol reducing effect and each of the ingredients is homogeneously dispersed.

The Chlorella-containing fatty oil foodstuff produced in accordance with the invention can be eaten by itself as a health food, or can be used as a flavouring
10 element for foods or as a cooking material for oily foods. It can be utilised when camping or as an emergency ration since it is readily portable.

In the present invention, an edible fatty oil is suitably used in a relatively large amount with respect to
15 the other starting materials, namely the concentrated exudate of a hot water extract of Chlorella algae, the concentrated exudate of a hot water extract of fungi and the exudate or dry powder of tonic medicinal vegetable, so that the soft capsule is not subjected to a change, such
20 as swelling or dissolution by moisture present in the other starting materials, which might cause the capsule to break. In this way also the product can be made suitable for use in cooking and particularly in frying.

The hot water extract of the Chlorella algae may
25 suitably be produced by subjecting an aqueous suspension of fresh Chlorella algae from an aerobic mass cultivation under light to a heat treatment at a temperature of 80 to 100°C,

say for 15 to 20 minutes, followed by fractionation of the algae. Typical of the *Chlorella* algae are single cell algae growing in fresh water such as *Chlorella pyrenoidosa*, *Chlorella vulgaris*, *Chlorella ellipsoidea* and *Senedesmus*.

- 5 The hot water extract of *Chlorella* algae contains effective polysaccharides such as N-1, 3 glucan and acidic rhamnan. Alternatively, the hot water extract of *Chlorella* algae may be produced by adding water to *Chlorella* algae powder in an amount about four times more than such powder, and
- 10 subjecting the mixture to a heat treatment at a temperature of 50 to 120°C, say for about one hour or more and then to a slow extraction treatment.

The hot water fungal extract may be a hot water extract of fungus body, dry fungi or fungus body powder.

- 15 For example, use may be made of a hot water-extract produced by adding water to fungus body powder in an amount four times more than such powder and subjecting the mixture to a prolonged heat treatment at a temperature of 45 to 120°C, preferably for 5 to 7 hours. The word "fungi or fungus"
- 20 refers, for example, to a polypore, kawaratake, shiitake and other edible mushrooms.

- The tonic medicinal vegetable is selected from garlic, ginseng, aloe, ume (Japanese spicot), prickly shrub of the family *Aradiaceae*, and adlay. The tonic medicinal
- 25 vegetable may be used in the form of the vegetable itself, an exudate or dry powder. The

word "exudate" refers to leached liquids resulting from leaching of a tonic medicinal vegetable by a usual method and slurry-like exudates resulting from grinding in a colloid mill, and the word "dry powder" refers to a powder
5 resulting from a pretreatment of a vegetable, followed by hot air drying, freeze drying or spray drying, or a powder resulting from drying an exudate.

The hot water extracts of the Chlorella algae and fungi can be independently concentrated into a slurry-like
10 concentrated exudate in a concentrator, and each exudate can then be blended in a blender, preferably under a humidified and depressurised condition, together with a separate aliquot of clathration material, preferably a cyclodextrin, followed by drying to form separate dry
15 powders.

It is preferred that each clathrate blend is used in a pulverised form obtained by drying in a dryer to the extent of a defined moisture content, followed by
20 pulverisation.

The tonic medicinal vegetable preferably is used in the form of a slurry-like exudate resulting from grinding each vegetable or its exudate powder in the optional presence of vitamin E oil in a colloid mill.
25 Edible oils which may be used include peanut oil,

sesame oil, wheat germ oil, rapeseed oil, soybean oil, coconut oil, safflower oil, beeswax, and other edible fatty oils. These oils may be used singly or as mixtures of two or more of them. When mixtures of the edible oils are used
5 it is preferred that they are used in the form of an oil emulsified material produced by heating a mixture of edible oils, optionally adding a heated and dissolved soybean lecithin thereto, and stirring and mixing the mixture by a homomixer and cooling it to room temperature.

10 To mix the effective ingredient containing materials of Chlorella algae, fungi and tonic medicinal vegetables homogeneously with the edible fatty oil, the dry powders of the clathrate blends, the exudate or dry powder of the tonic medicinal vegetable and the edible
15 fatty oil may be homogeneously stirred and mixed in a mixer. The sequence in which the individual starting materials are mixed is not particularly limited, but when the material containing the tonic medicinal vegetable is an exudate, it is preferred that the exudate is homogeneously mixed with
20 the edible fatty oil and the resulting suspension is then mixed with the dry powders of the clathrate blends. When the material containing the tonic medicinal vegetable is a dry powder, it is preferred that the dry powder is mixed with the dry powders of the clathrate blends and
25 then the resulting mixture is homogeneously mixed with the edible fatty oil.

Concurrent homogeneous mixing of the various starting materials may also be employed.

Thus-obtained starting mixture is then passed
5 through a proper mesh strainer and degassed in a deaerator, following which the resulting mixture is encapsulated into a soft capsule such as a soft gelatin capsule.

When the exudate of the tonic medicinal vegetable is a leached liquid, it can be also used as a spray-dried
10 material, but this is expensive, because water is present in a large amount in the leached liquid. Therefore, it is preferred that with or without dry powders of Chlorella algae and/or tonic medicinal vegetable added, the leached liquid is adsorbed to an edible powder such as lactose or
15 starch and the resulting material is powdered. The edible powder such as lactose or starch is used in order to absorb water in the leached liquid and has no adverse effect on the soft capsule, but serves merely as a bulking filler and an excipient.

20 It should be noted that the proportion of each effective ingredient derived from Chlorella algae, fungi and tonic medicinal vegetable relative to the edible fatty oil is not particularly limited.

The present invention will now be described in more
25 detail by way of Examples.

Example 1

Water 300 l was mixed with a powder of a light
5 cultured Chlorella 30 kg, and the mixture was subjected to
an extraction of effective ingredients in a hot water
extractor. The resulting extract was concentrated about 20
times in a concentrator to provide a slurry-like
concentrated exudate.

10 Separately, 400 l of water was mixed with 25 kg of
dried kawaratake, and the resulting mixture was subjected to
an extraction of effective ingredients in a hot water
extractor. The resulting extract was concentrated about 20
times in a concentrator to provide a slurry-like
15 concentrated exudate.

A clathration material, cyclodextrin 4.5 kg, was
added to each of these concentrated exudates, and each
resulting mixture was subjected to a clathration blending in
a blender. Then, each blend was dried in a drier and
20 pulverised in a pulveriser to provide individual starting
exudate materials.

A mixture of 8.5 kg of a dry powder of ginseng and
8.5 kg of an exudate powder of odorless garlic was ground
together with 15 kg of a natural vitamin E oil in a colloid
25

mill to provide 32 kg of a slurry-like exudate starting material.

The individual starting materials produced in the above manner were added to 210 kg of peanut oil containing 5 15 kg of soybean lecithin added thereto, and the resulting mixture was stirred and mixed to provide a material to be encapsulated. The resulting oil-suspension was encapsulated with soft gelatin to provide an encapsulated product.

Example 2

10 Water 300 l was mixed with a powder of light cultured Chlorella 30 kg, and the mixture was subjected to an extraction of effective ingredients in a hot water extractor. Then, the resulting extract was concentrated about 20 times in a concentrator to provide a slurry-like 15 concentrated exudate.

Separately, 400 l of water was mixed with 25 kg of dried shiitake, and the resulting mixture was subjected to an extraction of effective ingredients in a hot water extractor. The resulting extract was concentrated about 20 20 times in a concentrator to provide a slurry-like concentrated exudate.

A clathration material, cyclodextrin 4.5 kg, was added to each of these concentrated exudates, and each resulting mixture was subjected to a clathration blending in 25 a blender.

Then, each blend was dried in a drier and pulverised in a pulveriser to provide individual starting

exudate materials.

5 A mixture of 9.5 kg of an exudate of garlic and 9.5 kg of an exudate powder of adlay was ground together with 20 kg of a natural vitamin E oil in a colloid mill to provide 39 kg of a slurry-like starting exudate material.

10 The individual starting materials produced in the above manner were mixed with an oil-emulsified material resulting from addition of soybean lecithin to a heated mixture of sesame oil and peanut oil to provide a homogeneous mixture which was then degassed in a deaerator. The resulting oil-suspension was encapsulated with soft gelatin to provide an encapsulated product.

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This application is divided out from Application No. 9020358.9 which describes the preparation of a Chlorella-containing foodstuff in which a single dry powder is prepared by adding exudates of hot water Chlorell algae and 20 fungal extracts to a clathration material. Applications 9309857.2 and 9309858.0 are also divided out from Application No. 9020358.9.



CLAIMS

1. A process for producing a Chlorella-containing foodstuff which comprises:

(A) preparing dry powders by separately adding a concentrated exudate of hot water extract of Chlorella algae and a concentrated exudate of a hot water fungal extract to separate aliquots of a clathration material, blending and drying;

(B) homogeneously mixing the dry powders from step (A) with an exudate or dry powder of, as tonic medicinal vegetable, at least one of garlic, ginseng, aloe, ume (Japanese spicet), prickly shrub of the family Aradiaceae and adlay, and an edible fatty oil to provide an oil-suspension; and

(C) encapsulating the oil-suspension to provide a soft capsulated foodstuff.

2. A process according to claim 1, wherein the clathration material is a cyclodextrin.

3. A process according to claim 1 or 2 wherein the fungal extract is derived from at least one of kawatatake, polypore and shiitake.

4. A process according to any one of claims 1 to 3 wherein the blending is carried out under a humidified and depressurized condition.

5. A process according to any one of the preceding claims wherein the edible fatty oil is at least one of peanut oil, sesame oil, wheat germ oil, rapeseed oil,



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soybean oil, coconut oil, safflower oil and beeswax.

6. A process according to any one of the preceding claims wherein the edible fatty oil contains a lecithin.

7. A process according to any one of the preceding
5 claims wherein the edible fatty oil used in step (B) contains vitamin E oil.

8. A process according to claim 1 substantially as described in Example 1 or 2.

9. An encapsulated foodstuff when produced in accordance
10 with a process as claimed in any one of the preceding claims.
