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Food composition containing a monoglyceride mesomorphic phase

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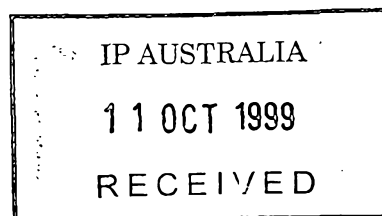
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(54) Title: FOOD COMPOSITION CONTAINING A MONOGLYCERIDE MESOMORPHIC PHASE

(54) Titre: COMPOSITION ALIMENTAIRE CONTENANT UNE PHASE MESOMORPHE DE MONOGLYCERIDE

(57) Abstract

The invention concerns a food composition comprising at least a food ingredient in aqueous or instant powder form, containing a monoglyceride, said monoglyceride being selected from the group consisting of a monoglycerol monoester comprising between 0 and 90 % of C18:1 monoolein, the rest being C18:2 monoolein and/or a saturated monoglycerol monoester, of a monoglycerol monoester comprising between 0 and 90 % of C18:2 monoolein, the rest being 18:1 monoolein and/or another saturated monoglycerol monoester and of a saturated or unsaturated diglycerol or polyglycerol monoester mixed with a diglycerol or polyglycerol diester or polyester or another food emulsifier and said composition having in aqueous phase a cubic, lamellar or hexagonal structure encapsulating or associating the food ingredient.

(57) Abrégé

L'invention concerne une composition alimentaire comprenant au moins un ingrédient alimentaire et se présentant sous la forme aqueuse ou sous la forme de poudre instantanée, qui contient un monoglycéride, ledit monoglycéride étant choisi dans le groupe constitué par un monoglycérol monoester comprenant entre 0 et 90 % de monooléine C18:1, le reste étant de la monolinoléine en C18:2 et/ou un monoglycérol monoester saturé, par un monoglycérol monoester comprenant entre 0 et 90 % de monolinoléine C18:2, le reste étant de la monooléine C18:1 et/ou un autre monoglycérol monoester saturé et par un di- ou polyglycérol monoester saturé ou insaturé en mélange avec un di- ou polyglycérol di- ou polyester ou un autre émulsifiant alimentaire et ladite composition présentant en phase aqueuse une structure cubique, lamellaire ou hexagonale encapsulant ou associant ledit ingrédient alimentaire.

Abstract

Food composition containing a monoglyceride.

The invention relates to a food composition comprising at least one food ingredient and provided in the aqueous form or in the form of an instant powder, containing a monoglyceride, said monoglyceride selected from the group consisting of monoglycerol monoester comprising from 0 to about 90 % of C18:1 monoolein, the remainder being C18:2 monolinolein and/or saturated monoglycerol monoester, monoglycerol monoester comprising from 0 to about 90 % of C18:2 monolinolein, the remainder being C18:1 monoolein and/or another saturated monoglycerol monoester and a saturated or unsaturated di- or polyglycerol monoester in mixture with a di- or polyglycerol di- or polyester or another food emulsifier and the said composition exhibiting, in aqueous phase, a cubic, lamellar or hexagonal structure encapsulating or combining said food ingredient.

Figure.

Food composition containing a monoglyceride.

The present invention relates to a food composition comprising at least one food ingredient and containing a monoglyceride, as well as to the process for obtaining said composition.

Emulsifiers, such as monoglycerides, have an amphiphilic molecular structure. This means that they have a portion of the molecule which is hydrophilic and the other portion of the molecule which is lipophilic. Because of this amphiphilic character, monoglycerides spontaneously form aggregates if they are placed in a solution or an aqueous dispersion. Various types of aggregates may be formed: this depends on the molecular structure of said monoglyceride in the water. It is thus possible to have either micelles, or a crystalline liquid phase, such as a cubic, lamellar or hexagonal phase, or finally a crystalline phase. All these structures are capable of incorporating or solubilizing host molecules. Because of the amphiphilic character of monoglycerides which leads to the formation of aggregates, it is possible to solubilize hydrophilic as well as lipophilic host molecules. The degree of solubilization depends on the molecular structure of the monoglyceride and on the host molecule.

The patent applications WO 92/09209, EP 664083 and EP 547647 mention the use of crystalline liquid phases in the food area. These three inventions are relatively similar because they describe the possibility of using such phases as structuring agent of food component with low fat content. In this perspective, the authors have more focussed on the phases named coagel and lamellar. It is known that a lot of surfactants form such molecular arrangements when they are dispersed in water and this in a wide range of temperature and of composition. Therefore, in

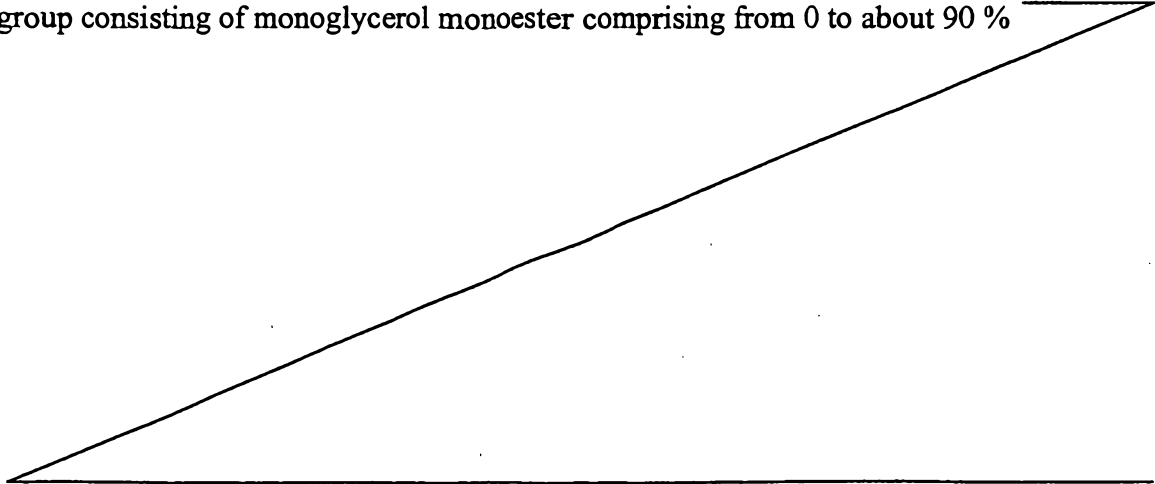
these patents, there is only a few limitations concerning the choice of the emulsifiers.

Studies have already been carried out on the use of cubic networks for encapsulating biologically active compounds, that is to say compounds which react or affect living organisms and cells, such as lidocaine, gramicidin, insulin, BSA, or vitamins E and other applications in pharmacy, in medicine or in cosmetics. Patent applications WO 93/06921 and WO 84/02076 mention uses in the field of medicine: the aim is to encapsulate an active ingredient so as to control its release. The disadvantage of these applications is that the monoglyceride used is very rich in monoolein, namely that it contains more than 90% thereof, and as a result, this increases the cost and requires a more sophisticated method of use. Since high value-added products exist in the medical field, this can be tolerated and is acceptable. On the other hand, in the food sector, this is hardly acceptable.

Any discussion of the prior art throughout the specification should in no way be considered as an admission that such prior art is widely known or forms part of common general knowledge in the field.

The present invention is concerned with the possibility of having certain mesomorphic structures which make it possible to carry out encapsulations of food products with monoglycerides, so as to control the release of said food product. According to the present invention, on the one hand, a result is obtained with a process of implementation which is not very expensive and which is simple and, on the other hand, it is possible to use commercially available, and therefore also inexpensive, monoglycerides.

Accordingly, in a first aspect the present invention provides a food composition comprising at least one food ingredient and provided in the aqueous form or in the form of an instant powder, containing a monoglyceride, said monoglyceride selected from the group consisting of monoglycerol monoester comprising from 0 to about 90 %



of C18:1 monoolein, the remainder being C18:2 monolinolein and/or saturated monoglycerol monoester, monoglycerol monoester comprising from 0 to about 90% of C18:2 monolinolein, the remainder being C18:1 monoolein and/or another saturated monoglycerol monoester and a saturated or unsaturated di-or polyglycerol monoester in
5 mixture with a di-or polyglycerol di-or polyester or another food emulsifier and the said composition exhibiting, in aqueous phase, a cubic or hexagonal structure encapsulating or combining said food ingredient, the monoglyceride containing between 0 and 30% saturated compounds. The content of unsaturated compounds is expressed relative to the unsaturated compounds alone: the content of unsaturated compounds is normally 90%
10 maximum.

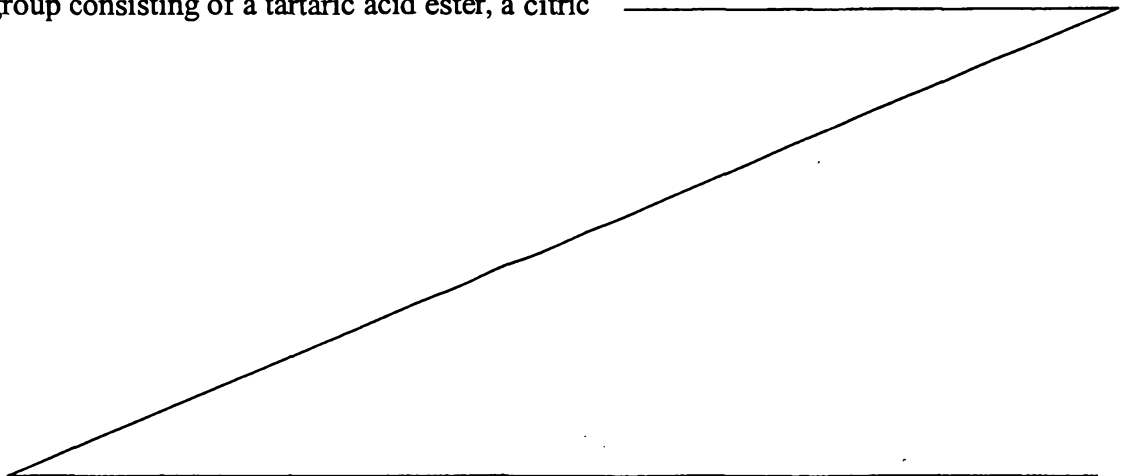
Preferably, a monoglycerol monoester comprising from about 60 to about 90% monoolein or a monoglycerol monoester comprising from about 60 to about 90% monolinolein is used.

"Encapsulating" in the present description is understood to mean that the food
15 ingredient is solubilized in the mesomorphic structure of the monoglyceride.

"Combining" in the present description is understood to mean that the food ingredient is adsorbed at the surface of the mesomorphic structure of the monoglyceride.

The monoglyceride used according to the invention allows to create a big cubic zone.

20 The monoglyceride used according to the invention normally contains between 0 and 30% of saturated compounds. This monoglyceride is enriched with unsaturated compounds with up to 30% of monoolein and up to 80% of monolinolein. The monoglyceride may be used alone or in the form of a mixture with a monoglyceride derivative or another emulsifier which are compatible in the food sector, chosen from the
25 group consisting of a tartaric acid ester, a citric

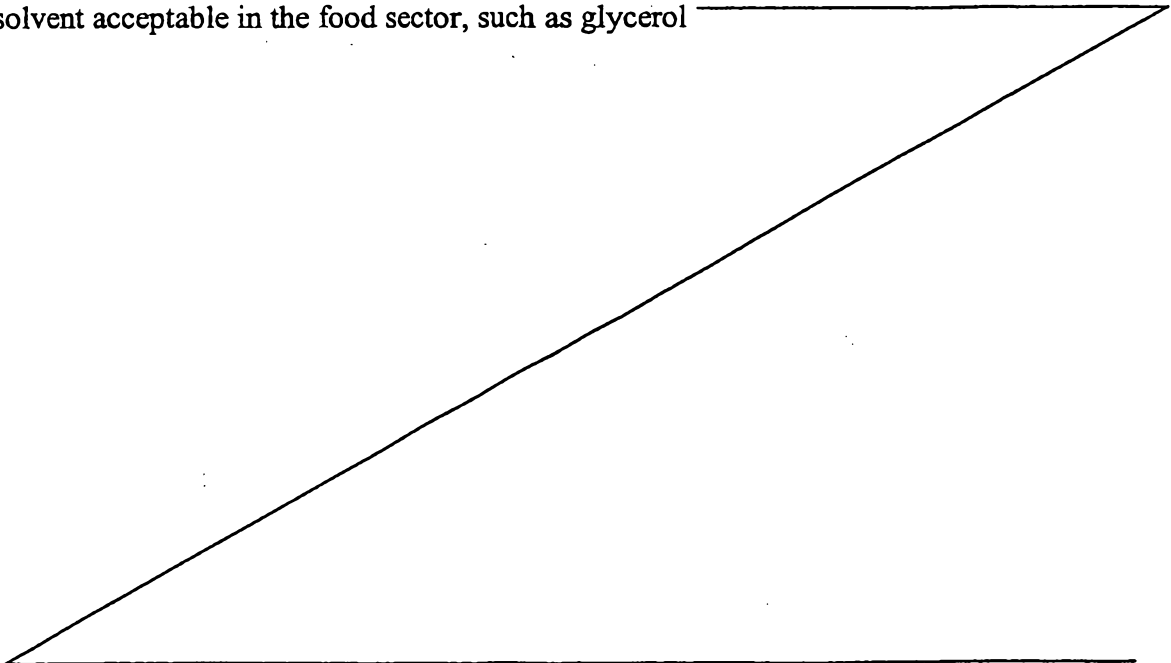


acid ester, a sucrose ester, a phospholipid, a polyglycerol ester such as the ester of propylene glycol and sodium stearoyl lactilate. These compounds may be used in a quantity such that they maintain the cubic, lamellar or hexagonal structure, that is to say the encapsulation of the food ingredient induced by the monoglyceride.

5 It is also possible according to the invention to use as monoglyceride a saturated or unsaturated di- or polyglycerol monoester, but in this case, for obtaining the required mesomorphic structure, it is obligatory to make a mixture with a di- or polyglycerol di- or polyester or another food emulsifier. This food emulsifier is the same as the one mentioned here above, that is to say it is selected from the group consisting of tartaric
10 acid ester, citric acid ester, sucrose ester, phospholipid, polyglycerol ester, propylene glycol ester and sodium stearoyl lactilate.

The present invention also relates to solubilizing food ingredients in monoglyceride aggregates, such as (cubic, lamellar or hexagonal) liquid crystalline phases so as to obtain a controlled release or an effect of chemical stabilization (for
15 example stabilization against oxidation) of the solubilized ingredients. The ingredient used is chosen from the group consisting of a seasoning, a flavoring, a salt, a sugar, an oligosaccharide, an amino acid, a peptide, a protein, an enzyme, a polysaccharide and a coffee flavor. "Seasoning" is understood to mean any food product which gives flavor.

The solubilizing agent according to the invention is a monoglyceride or a mixture
20 of this monoglyceride with another food emulsifier, which gives a crystalline liquid phase, preferably a cubic phase, when it is brought into contact with water or another solvent acceptable in the food sector, such as glycerol



or ethanol. A commercially available monoglyceride, such as that sold by the company DANISCO under the trademark DIMODAN LS, is preferably used.

5 "Food composition" is understood to mean any type of composition comprising said food ingredients, alone or in the form of a mixture.

The composition according to the invention may either be used as such, or may be an intermediate composition which is added so as to make it into a
10 finished product.

If it is made into an intermediate product, it is possible for example to envisage encapsulation of a flavoring which is then incorporated into a dehydrated soup. In this case, the content of food ingredient may
15 be up to 50% of the monoglyceride. Said encapsulated flavoring being present in an amount of 1 to 5% in the dehydrated soup.

In the present description, all the percentages are given by weight.

20 In the normal case, the composition according to the invention is used as such. In one embodiment, a composition with a high water content, for example a ready-to-drink beverage, is available. In this case, a water content of between 80 and 99.8%, a dry matter
25 content of between 0.2 and 20% and a monoglyceride content of between 0.1 and 2% exists. The proportions are given relative to the total composition. The dry matter is in this case either coffee dry extract, or tea or cocoa extract or any other extract for making a
30 cold or hot beverage. In this case, the presence of monoglyceride can allow and to control the release of the flavoring in the mouth and to stabilize the aromatic components of the drink considered.

It is also possible according to the invention
35 to prepare a food composition having a higher dry matter content, for example of between 40 and 50%. In

this case, the monoglyceride content is between 0.1 and 2%, calculated over the total composition.

According to another embodiment of the composition according to the present invention, the latter is provided in the form of an instant powder containing between 0.1 and 4% of monoglyceride. This embodiment may be very appropriate for making coffee powder, tea powder, cocoa powder and the like. The encapsulation with the monoglycerides then allows, during the reconstitution of this powder in water, to delay the release of certain specific flavors of said food ingredient.

It has been observed during the trials carried out that the crystalline structure which made it possible to obtain the best delayed release was the cubic structure. The measurements for demonstrating the structure are made with a polarized light microscope.

In some embodiments, for example in the case of a composition with a high water content, it is essential to add to said composition a stabilizing agent in order to stabilize the cubic crystalline phase. This agent is chosen from the group of compounds such as starch, modified starch, milk proteins, soya bean proteins, surfactant hydrocolloids, such as guar gum, carob gum and other low-molecular weight emulsifiers, such as lysolecithin, sucrose esters and the like. The quantity of these stabilizing agents is then of the order of 0.1 to 5%.

In the present description, all the proportions are given relative to the final composition.

The measurements of controlled release of the volatile flavorings are made by gas chromatography or by an electronic nose.

As possible examples of seasonings which can be used, the following compounds may be mentioned: diacetyl, furfural, guaiacol, limonene, methyl

pyrizine and vanillin. These compounds are used in a content of between 1.5 and 5%.

According to a second aspect, the invention provides a process for producing the composition according to the first aspect, wherein the food ingredient is mixed with the monoglyceride and the desired quantity of water is added thereto so as to form the cubic,
5 lamellar or hexagonal structure and said ingredient is added to the remainder of the composition. This process depends, as regards its implementation, on the monoglyceride used. Indeed, depending on the monoolein content of the monoglyceride, a more or less viscous composition will be formed in the form of a mixture with water, which it will therefore be possible to work more or less satisfactorily at room temperature. Otherwise,
10 it will be necessary to envisage an incorporation of the food compound at a higher temperature. The only condition in this case is to treat a food compound which is not sensitive to heat. If it is desired to encapsulate a food product which is sensitive to heat, the only possibility remains in this case the treatment close to room temperature.

The process according to the invention consists in mixing, at room temperature,
15 the food ingredient with water, so as to obtain a mixture having a water content of between 20 and 45%, and it is added to the remainder of the composition. The food ingredient is added to the liquid monoglyceride, and the required quantity of water, which may also contain another food ingredient, is then added thereto. The monoglyceride takes up the water and the crystalline liquid phase, in which the food
20 compound is solubilized, is formed. This means that the charged particles are formed in situ. The application of a mechanical energy (such as a moderate stirring or a homogenization) fragments the liquid crystalline phase into small particles. The aggregates are stabilized with respect to flocculation with the aid of a stabilizing agent which is present in the aqueous phase.

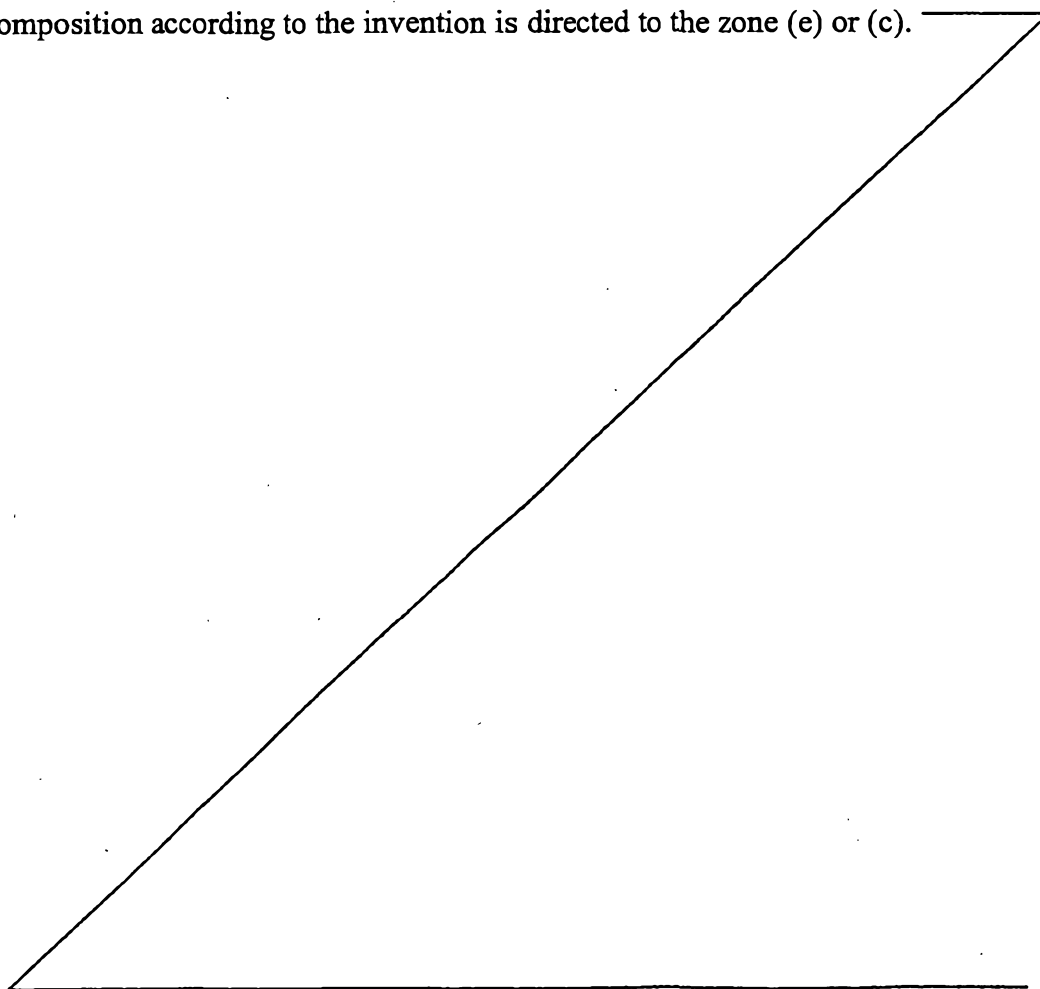
25 In a second embodiment of the process according to the invention, work is again carried out at room temperature, namely the food ingredient is mixed in aqueous phase with the monoglyceride, and this mixture is added to the remainder of the composition so as to obtain a composition having a water content greater than 90% and an aseptic filling is carried out so as to obtain a ready-to-use beverage. In this case also, as
30 mentioned above, it is necessary to add a stabilizing agent.

Unless the context clearly requires otherwise, throughout the description and the claims, the words 'comprise', 'comprising', and the like are to be construed in an

inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

The remainder of the description is made with reference to the single figure which gives the phase diagram with a specific monoglyceride For this diagram, a monoglyceride is taken which contains 10.6% of saturated compounds, 21.3% of C18 compounds with a single unsaturation and 66.8% of C18 compounds with two unsaturations. The x-axis gives the increasing content of water and the y-axis the temperature in °C. If the monoglyceride is mixed at room temperature with the water, the microemulsion zone (a) is first obtained, then with 10 to 15% of water, there is a passage to a lamellar liquid phase (f), then with the water content between 20 and 30% a cubic phase (e) and finally a phase (c) in equilibrium with the water and the cubic phase. If the mixing was carried out at a temperature of the order of 70°C, a hexagonal structure (d) is arrived at with a mixture containing 20% of water, and if the water content is again increased, an equilibrium (b) between the water and the hexagonal phase is arrived at.

15 The composition according to the invention is directed to the zone (e) or (c).



In the figure, if the arrows 1 and 2 are considered, the first embodiment of the process according to the invention exists. The remainder of the description is made with reference to the examples.

5

Example 1

A cubic liquid crystalline phase is formed by mixing 7 g of the monoglyceride of the same composition as that used to make the phase diagram in the figure, containing 10 mg of a pure flavoring with 3 g of water, the whole is heated to a temperature of 90°C. The mixture is vigorously stirred at 90°C for a few seconds and then cooled to room temperature. The cubic phase is then formed. The release of flavoring from the cubic phase was studied with a gas detection system in which it appears that the release of said flavoring is reduced if it is compared with an untreated flavoring.

20

Example 2

2 g of the monoglyceride of Example 1 containing 100 mg of flavoring is mixed with 100 ml of an aqueous phase containing 20 g of modified starch. The mixture is heated to 90°C, homogenized and cooled. A cubic phase having particle sizes of the order of 50 microns is obtained. The release of the solubilized flavoring is measured in the head space by gas chromatography. A modified release profile is observed.

30

Example 3

35

A dispersion of cubic particles containing a mixture of coffee flavor is formed by mixing 0.5 g of the monoglyceride of Example 1 (which contains 100 mg of a special mixture of coffee flavor) with 100 g of a coffee extract liquor at room temperature. The coffee liquor thus obtained is spray-dried or freeze-dried to obtain a powder. After reconstitution of this treated powder, a more controlled release of the flavoring and of the taste is obtained by reducing the kinetics of release, if it is compared with a reconstituted powder not containing the monoglyceride.

Example 4

A dispersion of cubic particles is obtained by mixing 0.1 g of the monoglyceride of Example 1 in 100 g of coffee liquor containing 100 mg of a mixture of coffee flavor. The coffee liquor is then spray-dried or freeze-dried.

Example 5

2 g of the monoglyceride of Example 1 containing coffee flavor are dispersed in 100 ml of an aqueous solution containing 20% of skimmed milk powder and the mixture is homogenized at 70°C. 10 to 20% of this dispersion is then added to a ready-to-drink coffee beverage.

Example 6

A dispersion of cubic particles containing flavorings as described in Example 2 is freeze-dried or spray-dried and added to a freeze-dried soup.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Food composition comprising at least one food ingredient and provided in the aqueous form or in the form of an instant powder, containing a monoglyceride, said monoglyceride selected from the group consisting of monoglycerol monoester
5 comprising from 0 to about 90 % of C18:1 monoolein, the remainder being C18:2 monolinolein and/or saturated monoglycerol monoester, monoglycerol monoester comprising from 0 to about 90 % of C18:2 monolinolein, the remainder being C18:1 monoolein and/or another saturated monoglycerol monoester and a saturated or unsaturated di- or polyglycerol monoester in mixture with a di- or polyglycerol di- or
10 polyester or another food emulsifier and the said composition exhibiting, in aqueous phase, a cubic or hexagonal structure encapsulating or combining said food ingredient, the monoglyceride containing between 0 and 30% of saturated compounds.
2. Food composition according to Claim 1, wherein in addition to the monoglyceride, it contains at least one monoglyceride derivative or another food emulsifier, chosen from
15 the group consisting of a tartaric acid ester, a citric acid ester, a sucrose ester, a phospholipid, a polyglycerol ester such as the ester of propylene glycol and sodium stearyl lactilate.
3. Food composition according to Claim 1, wherein the saturated or unsaturated di- or polyglycerol monoester contains a food emulsifier selected from the group consisting of
20 a tartaric acid ester, a citric acid ester, a sucrose ester, a phospholipid, a polyglycerol ester such as the ester of propylene glycol and sodium stearyl lactilate.
4. Food composition according to any one of Claims 1 to 3, containing a stabilizing agent chosen from the group consisting of starch, modified starch, milk proteins, soya bean proteins, surfactant hydrocolloids, such as guar gum, carob gum.
- 25 5. Food composition according to any one of Claims 1 to 4, wherein the food ingredient is chosen from the group consisting of a seasoning, a flavoring, a salt, a sugar, an oligosaccharide, an amino acid, a peptide, a protein, an enzyme, a polysaccharide, a coffee flavor and a mixture thereof.
6. Food composition according to any one of Claims 1 to 5, provided in aqueous form,
30 and having a dry matter content of between 0.2 and 20% and containing between 0.1 and 2% of monoglyceride, calculated over the total composition.

7. Food composition according to any one of Claims 1 to 5, provided in aqueous form, and having a dry matter content of between 40 and 50% and a monoglyceride content of between 0.1 and 2%, calculated over the total composition.
8. Food composition according to any one of Claims 1 to 5, provided in the form of an
5 instant powder and containing between 0.1 and 4% of monoglyceride.
9. Composition according to any one of Claims 1 to 8, wherein the monoglyceride is enriched with unsaturated compounds with up to 30% of monoolein and up to 90% of monolinolein, said unsaturated compounds representing up to 90% of the total composition of said monoglyceride.
- 10 10. Process for producing the composition according to any one of Claims 1 to 9, wherein the food ingredient is mixed with the monoglyceride and the desired quantity of water is added thereto so as to form the cubic or hexagonal structure and said ingredient is added to the remainder of the composition.
11. Process according to Claim 10, wherein the food ingredient is mixed at room
15 temperature with the monoglyceride and with the water so as to obtain a mixture having a water content of between 20 and 45%, and it is added to the remainder of the composition.
12. Process according to Claim 10, wherein the food ingredient is mixed, at room temperature, with the monoglyceride, and this mixture is added to a composition
20 comprising essentially water so as to obtain in situ the cubic or hexagonal structure and an aseptic filling is carried out so as to obtain a ready-to-drink beverage.
13. A food composition, substantially as herein described with reference to any one of the examples but excluding comparative examples.
14. A process for producing a food composition, substantially as herein described with
25 reference to any one of the examples but excluding comparative examples.

DATED this 24th Day of January 2003

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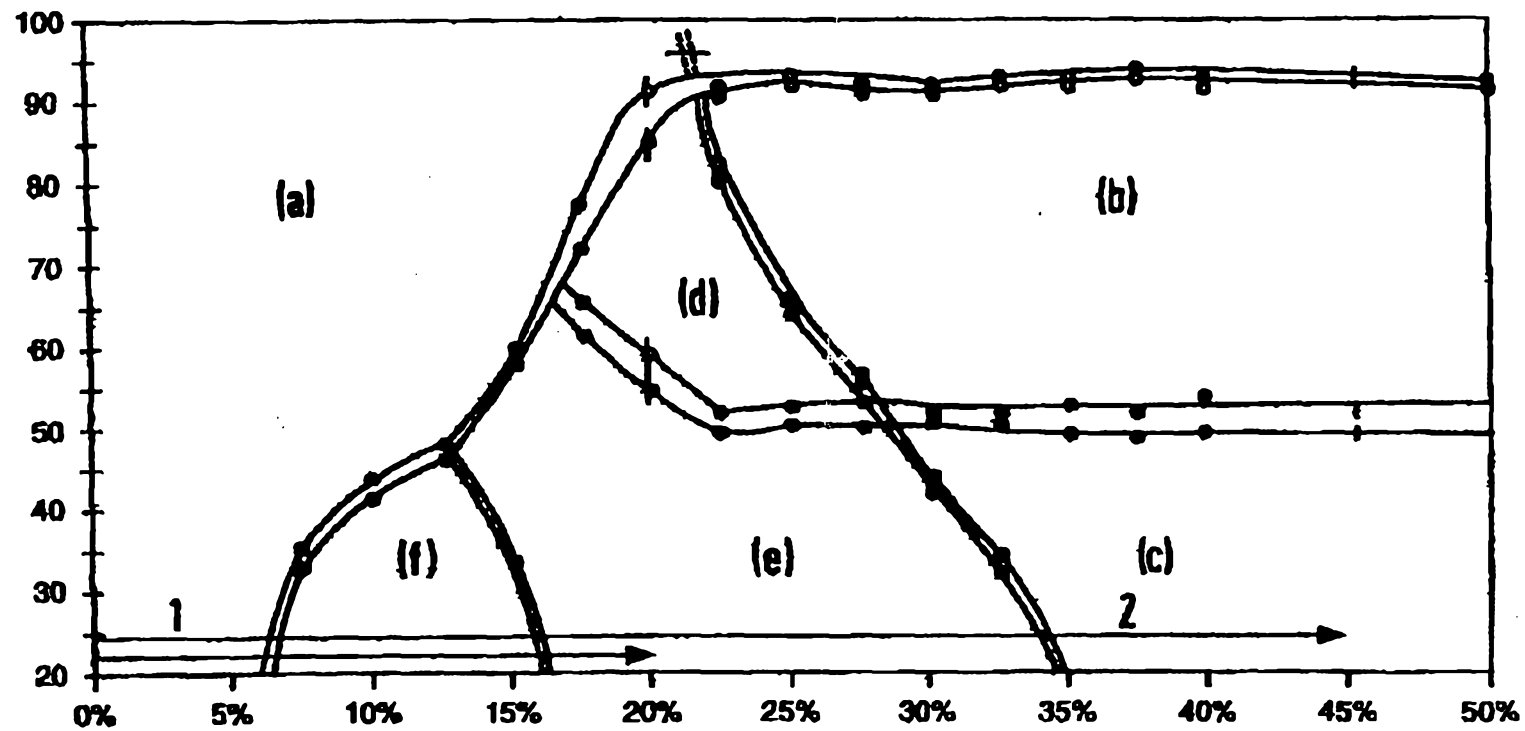


FIG. 1