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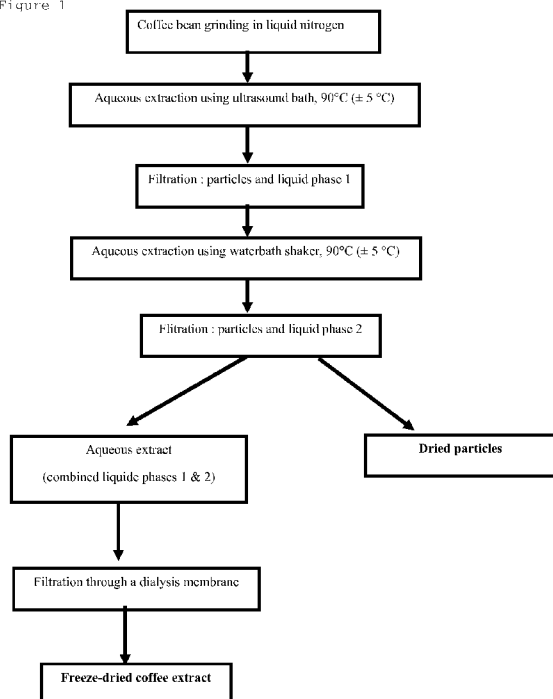
Declarations under Rule 4.17:

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[Continued on next page]

(54) Title: STABILIZING SYSTEM FOR FOAM

Figure 1



(57) Abstract: The present invention relates to a stabiliser system for foam. The stabilizer system comprises at least one coffee bean extract preferably selected from roasted coffee extract, green coffee extract and mixtures thereof. Furthermore, the use of such stabiliser system to enhance the foam stability of aerated food products, and such food products, for example dairy foams, aerated confectionery or beverage foams.



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- *of inventorship (Rule 4.17(iv))*
- Published:**
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Stabilizing system for foam

Field of the invention

The present invention relates to a stabilizing system for
5 foam comprising coffee extracts, optionally in admixture with
coffee particles. The use of such system to enhance foam
stability of aerated food products, as well as aerated food
products such as dairy foams, aerated confectionery, frozen
confectioneries, comprising that stabilizing system are also
10 objects of the invention. A process for the preparation of
such aerated food products is also part of the invention.

Background of the invention

Stability against coarsening, drainage and phase separation
15 is a major problem for many aerated food products, for
example frozen aerated food products, in particular when it
is desired to avoid the use of synthetic ingredients.

Proteins have been used as agents to stabilize aerated food
products, where they can act as emulsifiers, surface active
20 agents and/or bulking agents to stabilize emulsions and
foams. When using proteins as stabilizing agents, a problem
is to have products that combine nutritional value,
sufficient foam stability and good texture.

Protein modification resulting in some level of aggregation
25 has also been described as a way to improve the functionality
of proteins in foamed products. Numerous processes leading to
different types and levels of aggregation can therefore be
found in the prior art.

EP 1839492 describes for example the preparation of whey
30 protein micelles or spherical agglomerates of denatured whey

protein as well as their use in food preparation. The document describes the energetically favourable configuration of these aggregates which provides good stability of these structures in a hydrophilic environment. However, the foaming properties of those aggregates are limited.

Another form of protein aggregates is described in WO 2004/049819 which relates to a method for improving the functional properties of globular proteins providing at least partial aggregation of the proteins in the form of fibrils.

The use of such protein fibrils in the preparation of food stuffs, such as dairy products, for example (aerated) desserts, yogurts, flans, in bakery or confectionary applications, such as frappe, meringue, marshmallows, in cream liqueurs or in beverage foamers, such as cappuccino foamers is also described. The use of fibrils is described as thickening agent, foaming agent, viscosity enhancing agent and/or gelling agent.

However, the production of those fibrils is high in energy and cost due to the prolonged heating time and temperature.

Therefore, there is still a need to provide good foam stability of aerated products at a reasonable price while not compromising on the quality of the product.

Object of the invention

The present invention proposes a solution consisting in using coffee extracts possibly in admixture with coffee particles to improve the foam stability of aerated food products.

Summary of the invention

In a first aspect, the present invention pertains to a stabilizing system for foam comprising at least one coffee bean extract selected from roasted coffee extract, green coffee extract and mixtures thereof, wherein the extract
5 comprises at least 40 wt% dry matter of macromolecules with a molecular weight comprised between 3.5 and 1600 KDa. According to a particular embodiment, the stabilizing system further comprises coffee particles selected from green coffee particles, roasted coffee particles or mixtures thereof with
10 a particle size comprised between 10 and 200 μm .

The present invention further relates to the use a stabilizing system as described above to enhance the foam stability of an aerated food product, and to an aerated food
15 product comprising from 1 to 20 wt% of such a stabilizing system.

A process for the preparation of an aerated food product comprising the steps of preparing a foaming mix comprising
20 from 0.1 to 20 wt% of at least one coffee bean extract selected from green coffee, roasted coffee or mixtures thereof; incorporating air into the foaming mix to provide a foam with an overrun comprised between 30 and 400%; preparing an ingredient mix suitable for the preparation of an aerated
25 food product and gently adding the ingredient mix to the foaming mix or vice-versa is also an object of the invention.

An alternative process wherein the foaming mix further comprises coffee particles is also an object of the
30 invention.

Brief Description of the Figures

Figure 1 shows a flow chart of a process for the preparation of coffee extracts and coffee particles used in embodiments of the present invention.

5

Detailed description of the invention

Unless otherwise specified, percentages given correspond to percentages by weight of the end product.

10 In the context of the invention, "extract" is meant to designate aqueous extracts obtained after aqueous extraction followed by filtration aiming at separating liquid phase from solid phase (see figure 1). Preferably, extracts have a solubility limit of 2 mg/L.

15 In the context of the invention, "particles" is meant to designate solid extract obtained after extraction followed by filtration aiming at separating liquid phase from solid phase.

20 Surprisingly, it has been found that certain coffee extracts as well as mixtures of coffee extracts with coffee particles from green coffee or roasted coffee beans had good foamability and foam stability over time, therefore providing a new natural alternative to the use of known foaming agent in aerated products such as dairy products, for example (aerated) desserts, yogurts, flans, bakery or confectionary applications, such as frappe, meringue, marshmallows, in
25 cream liqueurs or in beverage foamers.

According to the present invention, the stabilizing system for foam is characterised by the presence of at least one coffee bean extract. Preferably such extract is selected from
30 roasted coffee extract, green coffee extract and mixtures thereof. According to a particular embodiment, it comprises

at least 40wt%, preferably at least 50wt% and preferably less than 60 wt% dry matter of macromolecules with a molecular weight comprised between 3.5 and 1600 KDa. According to a particular embodiment, the stabilizing system further comprises coffee particles selected from green coffee particles, roasted coffee particles or mixtures thereof with a particle size comprised between 10 and 200 μm .

These coffee extracts have been found by the applicant as having suitable foamability and foam stabilizing properties and as susceptible of being used in a foam stabilizing system for aerated products such as dairy products, for example (aerated) desserts, yogurts, flans, bakery or confectionary applications, such as frappe, meringue, marshmallows, in cream liqueurs or in beverage foamers. In particular, such a stabilizing system has proven to stabilize the air-water interface and increase foamability and foam stability.

The stabilizing system for foam of the invention comprises at least one coffee extract, preferably selected from roasted coffee extract, green coffee extract and mixtures thereof. That extract preferably comprises at least 40wt%, more preferably at least 50 wt% dry matter of macromolecules with a molecular weight comprised between 3.5 and 1600 KDa.

Said extracts are obtainable by a method including the steps of separating an extract from a raw material using filtration, then separating the active fraction using membrane filtration, heating during the extraction and finally freeze drying to have the extract lyophilized.

According to a first embodiment, the stabilizing system for foam of the invention includes a roasted coffee extract comprising from 15 to 35 wt%, preferably from 20 to 30 wt%

dry matter of polysaccharides; and from 15 to 30 wt%, preferably from 20 to 25 wt% dry matter of melanoidins proteinous part.

- 5 The polysaccharides present in this extract can be further characterised by a specific carbohydrate profile. Preferably, the extract comprises from 5 to 7 wt% dry matter of arabinose, from 10 to 13 wt% dry matter of galactose, from 9 to 10 wt% dry matter of mannose, from 0.1 to 1 wt% dry matter
10 of glucose, from 0.2 to 1 wt% dry matter of rhamnose.

Typically, roasted coffee extracts used in the system according to the invention have a roasting degree comprised between CTn 80 and CTn 100.

15

Preferably, the extract has a solubility limit of 2 mg/ml.

- According to a second embodiment, the stabilizing system for foam of the invention comprises at least one green coffee
20 extract comprising from 5 to 25 wt%, preferably from 10 to 20 wt% dry matter polysaccharides and from 35 to 50 wt%, preferably from 40 to 45 wt% dry matter of proteins with a molecular weight comprised between 3.5 and 500 KDa.

- 25 Green coffee extracts used in the stabilizing system for foam of the invention preferably comprise from 2 to 3 wt% dry matter of arabinose, from 5 to 7 wt% dry matter of galactose, from 1 to 2 wt% dry matter of mannose, from 1 to 4 wt% dry matter of glucose, from 0.2 to 1 wt% dry matter of rhamnose
30 and from 1 to 2 wt% dry matter fructose.

Preferably said green coffee extract has a solubility limit of 0.5 mg/ml.

According to a particular embodiment, the stabilizing system further comprises coffee particles selected from green coffee particles, roasted coffee particles or mixtures thereof with a particle size comprised between 10 and 200 μm .

5

In a particular embodiment the ratio between coffee extracts and coffee particles is comprised between 1: 99 and 99: 1. According to a preferred embodiment, a ratio is comprised between 40:60 and 60:40.

10

According to a particular embodiment, the coffee particles are green coffee particles and comprise from 10 to 15wt% dry matter proteins and from 10 to 20 wt% dry matter polysaccharides.

15

According to another embodiment, the coffee particles are roasted coffee particles and comprise from 10 to 20 wt% dry matter melanoidins proteinous part and from 10 to 20 wt% dry matter polysaccharides.

20

The stabilizer system for foam of the invention may be used in the manufacture of aerated food products such as dairy products, for example (aerated) desserts, yogurts, flans, bakery or confectionary applications, such as frappe, meringue, marshmallows, in cream liqueurs or in beverage foamers. For example, it may be used in the same way as traditional stabilizing systems for foam in the manufacture of such aerated food products. It presents not only the advantage of improving foam stability of such products, but also the advantage that it contains natural ingredients.

30

An aerated food product comprising a stabilizing system for foam comprising at least one coffee extract is also an object of this invention. Preferably, the aerated food product

comprises from 1 to 20 wt%, preferably from 2 to 10 wt% of the stabilizing system. According to one embodiment an aerated food product according to the invention comprises from 0.1 to 20 wt% of at least one coffee bean extract, preferably from 0.1 to 19.1 wt%, more preferably from 1 to 10 wt% of at least one coffee bean extract. In some embodiments the aerated food product comprises from 0.1 to 19.1 wt% of at least one coffee bean extract and from 0.9 to 8 wt% of coffee particles. In one preferred embodiment the aerated food product comprises from 1 to 10 wt% of at least one coffee bean extract and from 1 to 8 wt% of coffee particles.

According to a particular embodiment, the aerated food products of the invention are aerated with an overrun ranging from 30 to 400%, preferably from 20 to 250%. In one embodiment from 80 to 150%, such as from 100 to 120%.

The overrun is defined as follows: (Reference : Robert T. Marshall, Douglas Goff and Richard W. Hartel, 2003, Ice Cream - 6th Edition, Ed.Kluwer Academic/Plenum Publishers (New York), ISBN 0-306-47700-9, page 144.)

$$\% \text{overrun} = \frac{\text{wt of mix} - \text{wt of same vol. of aerated product}}{\text{wt of same vol. of aerated product}} * 100$$

The aerated food product may preferably be selected from the group consisting of indulgent dairy foams, aerated confectionery products, beverage foamers and frozen confectionery products.

The invention further pertains to a method for the manufacture of an aerated food product comprising the steps of preparing a foaming mix comprising from 0.1 to 20 wt% of at least one coffee bean extract selected from green coffee,

roasted coffee or mixtures thereof; incorporating air into the foaming mix to provide a foam with an overrun comprised between 30 and 400%; preparing an ingredient mix suitable for the preparation of an aerated food product and gently adding the ingredient mix to the foaming mix or vice-versa. One of ordinary skill in the art can determine mixing time and conditions to obtain the desired aerated homogeneous mass. The food product may be coloured and flavoured as desired.

According to one embodiment coffee bean extracts that can advantageously be used in the aerated products of the inventions are obtainable by a process comprising separating an extract from the raw material using filtration under heating and then separating the active fraction using membrane filtration. Preferably freeze drying is then used to have the extract lyophilized.

More particularly, the extracts are obtainable by a method which comprises the following steps:

a) Grinding coffee beans in liquid nitrogen

b) Performing a first aqueous extraction using an ultrasound bath

c) Filtrating the liquid phase and keeping it

d) Performing a second aqueous extraction on the solid phase using waterbath

e) Filtrating the liquid phase and keeping it

f) Combining the liquid phases from step c) and step e)

g) Filtrating through a dialysis membrane to obtain the active extract.

According to one embodiment coffee particles that can advantageously be used in the aerated products of the invention are obtainable by a process comprising grinding coffee beans in liquid nitrogen; performing two aqueous extractions preferably using an ultrasound bath, then a water

bath; filtrating the liquid phase from the solid part and drying the solid part to provide coffee particles.

Examples

Example 1: Coffee extracts and coffee particles preparation

Figure 1 is a flow chart of the process described in this example.

Green coffee beans, respectively roasted coffee beans with a roasted degree of CTn 90 were subjected to the following extraction steps followed by filtration through a dialysis membrane to get the active fraction:

➤ Extraction steps

1. Grinding of coffee raw material in liquid nitrogen.

2. Adding hot water 90°C (± 5 °C) to the ground coffee raw material placed in an ultrasound bath for 30 minutes (± 2 minutes).

3. Filtration under vacuum (Buchner-type filtration), followed by filtration in a spinner at 2200 rpm for 20 minutes (filter pore size: 20-50 microns). Keep the liquid phase.

4. Place the solid part in hot water 90°C (± 5 °C) with stirring (waterbath shaker) for 60 minutes (± 10 minutes). Note: add 2.5 L hot water (± 0.1 L).

5. Filtration under vacuum (Buchner-type filtration), followed by filtration in a spinner at 2200 rpm for 20 minutes (filter pore size: 20-50 microns). Keep the liquid phase.

6. Combine the two liquid phases, evaporate using a rotary evaporator, and reduce the water volume to 6 L (± 1 L).

➤ Filtration through a dialysis membrane to get the active fraction

1. Isolate the coffee fraction with the molecular weight equal or higher than 3.5 KDa using dialysis tubing (cut-off: 3.5 KDa). Dialyse for 2 days in tap water in a cold room (4-8 °C) with 2 water exchanges per day (every 3 hours ± 1 hour). Note: use 10 L tap water (± 0.5 L) for 1.5 L coffee fraction.

2. Freeze-dry the coffee extract for 2 days.
3. Store the extract at -20°C.

5 Example 2: Coffee extracts characterization

The green coffee extract obtained from the method described in Example 1 was characterized in terms of protein molecular weight using size exclusion chromatography. Protein molecular weights were found ranging from 3.5 to 470 KDa. Said extract had a protein concentration ranging from 40 to 45 wt% dry matter and a polysaccharide concentration ranging from 11 to 17 wt% dry matter. The total carbohydrate content was determined using ionic chromatography:

Compounds	% of dry matter
Arabinose	2.3 - 2.8
Galactose	5.2 - 6.7
Mannose	1.1 - 1.4
Glucose	1.2 - 3.6
Rhamnose	0.6 - 0.8
Fructose	1.2

The roasted coffee extract obtained from the method described in Example 1 was characterized in terms of melanoidins molecular weight using size exclusion chromatography.

Melanoidins molecular weight were comprised between 3.5 and 1600 KDa Said extract had a melanoidins concentration ranging from 19 to 25 wt% dry matter and a polysaccharide concentration ranging from 26 to 29 wt% dry matter. The total carbohydrate content was determined using ionic chromatography:

Compounds	% of dry matter
Arabinose	5.1 - 6
Galactose	10.9 - 12
Mannose	9.4 - 9.5
Glucose	0.2 - 0.5
Rhamnose	0.6 - 0.7

Example 3: Coffee particles characterization

- 5 The coffee particles obtained from the method described in Example 1 were characterized in a way similar to what is described in example 2 for the extracts.

3.1 Green coffee particles:

Protein concentration: 12-12.23% dry matter.

- 10 Total carbohydrate content (using ionic chromatography):

Compounds	% of dry matter
Arabinose	0.86
Galactose	6.6
Mannose	7.3
Glucose	2.7

Lipid content: 8.5% dry matter

3.2 Roasted coffee particles:

Melanoidin proteinous part: 14-14.16% dry matter

- 15 Polysaccharide concentration : 15% dry matter

Total carbohydrate content (using ionic chromatography):

Compounds	% of dry matter
Arabinose	0.57
Galactose	5.3
Mannose	6.7
Glucose	2.4

Lipid content: 5.9%

Example 4: Foamability and foam stability

5

Sample number	Description	Concentration in water [wt%]
1	Roasted coffee extract	4%
2	Roasted coffee particles	4%
3	Green coffee extract	4%
4	Green coffee particles	4%
5	Roasted coffee extract / roasted coffee particles [1:1]	8%
6	Roasted coffee extract / Green coffee particles [1:1]	8%
7	Green coffee extract/Roasted coffee particles [1:1]	8%
8	Green coffee extract/green coffee particles	8%
9 (reference)	Beta-lactoglobulin	1%

Samples 2 and 4 are outside the invention. Samples 1 to 8 are within the scope of the invention.

10 Aqueous solutions were foamed using a Hobbart mixer.

Foamability and foam stability evolution over time was observed visually. Visual inspection of samples 1 to 4 showed that only the samples prepared with the coffee extracts foamed and had foam stability overtime, while the samples with coffee particles did not foam.

Visual inspection of the samples 1, 5 and 6 showed that while the profile of sample 5 is relatively similar to that of the extract alone, sample 6 shows an improvement in stability overtime.

From samples 3, 7 and 8 it was observed that the addition of particles to the extract (samples 7 and 8) improved the foamability and stability overtime.

Example 5: Chocolate mousse comprising a stabilizing system according to the invention

Recipe:

Ingredient	Concentration [g]
Egg yolk	50
Dark Chocolate	100
Water	92
Roasted coffee extract*	4
Green coffee particle*	4
Total	250

*prepared as described in example 1.

Preparation:

-Chocolate was melt at 50°C in an oven

-Coffee extracts and particles were dispersed in water, foamed using Hobbart for 3 minutes, speed 3

-Egg yolk was added to melted chocolate and mixed with a spatula

-Chocolate was added and mixed gently with the foam

-Chocolate mousse obtained was poured into a plastic container

-chocolate mousse was stored at 4°C.

- 5 The product had an overrun of 120%. Small bubbles were dispersed in the entire sample. After 24 hours of storage the product had kept its appearance, and texture was light and airy.

Claims

- 5 1. A stabilizing system for foam comprising at least one coffee bean extract preferably selected from roasted coffee extract, green coffee extract and mixtures thereof.
- 10 2. A stabilizing system according to claim 1, wherein the extract comprises at least 40 wt%, preferably at least 50wt% dry matter of macromolecules with a molecular weight comprised between 3.5 and 1600 KDa.
- 15 3. A stabilizing system according to claim 1 or 2, further comprising coffee particles preferably selected from green coffee particles, roasted coffee particles or mixtures thereof, with a particle size comprised between 0.1 and 500 μ m, preferably between 10 μ m and 200 μ m.
- 20 4. A stabilizing system according to claim 3, wherein the ratio between coffee extracts and coffee particles is comprised between 1:99 and 99:1.
- 25 5. A stabilizing system according to any one of claims 1 to 4, wherein the coffee extract comprises less than 60 wt% dry matter of macromolecules with a molecular weight comprised between 3.5 and 1600 KDa.
- 30 6. A stabilizing system according to any one of claims 1 to 5, wherein the coffee extract comprises
 - from 15 to 35 wt%, preferably from 20 to 30 wt% dry matter of polysaccharides;

- from 15 to 30 wt%, preferably from 20 to 25 wt% dry matter of melanoidins proteinous part.

7. A stabilizing system according to claim 6, wherein the extract has a solubility limit up to 2 mg/mL.

8. A stabilizing system according to any one of claims 1 to 5, wherein the extract comprises

- from 5 to 25 wt%, preferably from 10 to 20 wt% dry matter of polysaccharides;
- from 35 to 50 wt%, preferably from 40 to 45 wt% dry matter of proteins with a molecular weight comprised between 3.5 and 500 KDa.

9. A stabilizing system according to any one of claims 2 to 8, wherein the particles comprise from 10 to 15 wt% dry matter proteins and from 10 to 20 wt% dry matter polysaccharides.

10. A stabilizing system according to any one of claims 2 to 8, wherein the particles comprise from 10 to 20 wt% dry matter melanoidins proteinous part and from 10 to 20 wt% polysaccharides.

11. Use of a stabilizing system according to any one of claims 1 to 10 to enhance the foam stability of an aerated food product.

12. An aerated food product comprising from 1 to 20 wt% of a stabiliser system according to any one of claims 1 to 10.

13. An aerated food product according to claim 12, characterised in that it comprises from 0.1 to 20 wt% of at least one coffee bean extract.

14. An aerated food product according to claim 13 which comprises from 0.1 to 19.1 wt% of at least one coffee bean extract and from 0.9 to 8 wt% of coffee particles.

5 15. An aerated food product according to any one of claims 11 to 14, selected from the group consisting of indulgent dairy foams, aerated confectionery products, beverage foamers and frozen confectionery products.

10 16. A process for the preparation of an aerated food product comprising

a) preparing a foaming mix comprising from 0.1 to 20 wt% of at least one coffee bean extract selected
15 from green coffee, roasted coffee or mixtures thereof;

b) incorporating air into the foaming mix to provide a foam with an overrun comprised between 30 and 400%;

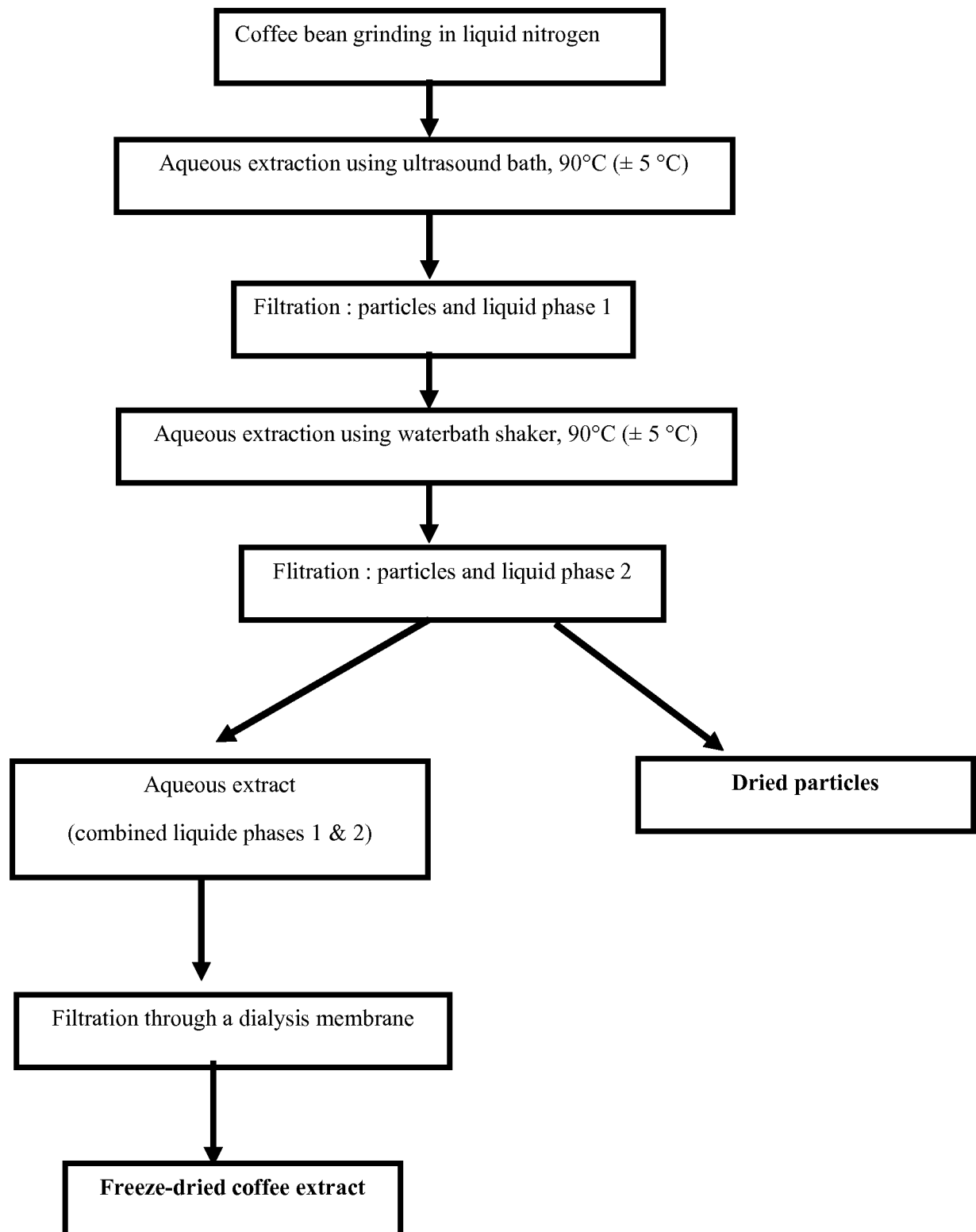
c) preparing an ingredient mix suitable for the
20 preparation of the aerated food product;

d) gently adding the ingredient mix to the foaming mix or vice-versa.

25 17. A process according to claim 16, wherein the foaming mix comprises from 0.1 to 19.1 wt% of at least one coffee bean extract and from 0.9 to 8wt% of coffee particles selected from green coffee particles, roasted coffee particles or mixtures thereof.

30

Figure 1



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER		
INV.	A23G1/52 A23G9/42	A23L2/40 A23F5/24 A23G3/52 A23L1/09
ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) A23G A23L A23F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data, FSTA		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	EP 1 021 957 A1 (ILLYCAFFE SPA [IT]) 26 July 2000 (2000-07-26) claims 1,3; examples 1-4 ----- -/-	1-3, 11, 13
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 27 February 2014		Date of mailing of the international search report 28/03/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Groh, Björn

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Information on patent family members

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