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(54) **Title:** USE OF STERILE MESOMORPHIC PHASES IN FOOD PRODUCTS

(57) **Abstract**

A process for the preparation of a sterile mesomorphic phase of surfactants, comprising the sequential steps of: (a) preparing a premix comprising surfactants and water at a temperature above the Krafft temperature of the surfactant; (b) sterilising the premix at a temperature above 115 °C; and (c) cooling the premix to below the Krafft temperature of the surfactants, said process also comprising (before, during or after step c) the aseptically filling into a suitable package.

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USE OF STERILE MESOMORPHIC PHASES IN FOOD PRODUCTS

The present invention relates a process for the preparation of sterile mesomorphic phases and to products containing said sterile mesomorphic phases.

It is known from WO 92/09209 to incorporate mesomorphic phases of edible surfactants in food products, for example as fat-replacer, structuring agent and whipping agent. This patent also describes the pasteurization of zero fat spreads containing the mesomorphic phase.

A problem with pasteurized products is that, although they are substantially free from microorganisms, they often still contain spores. Therefore pasteurized products either need a preservative or a low pH, in order to become ambient stable. A further problem with products as described in WO 92/09209 is that sometimes their whippability sometimes is limited.

It is an object of the invention to solve one or more of the above problems. Surprisingly it has been found that this can be achieved if the mesomorphic phase is prepared in a special process.

Accordingly the present invention relates to a process for the preparation of a sterile mesomorphic phase of surfactants, comprising the sequential steps of:

(a) preparing a premix comprising surfactants and water at a temperature above the Krafft temperature of the surfactant;

(b) sterilising the premix at a temperature of more than 115 ^{o}C; and

(c) cooling the premix to below the Krafft temperature of the surfactants.

said process also comprising before, during or after step c, the aseptically filing into a suitable package.

Although applicants do not wish to be bound by any theory, it is believed that the following occurs in steps (a) to (c) as indicated above.

During step (a) it is believed that some form of structuring of the surfactants occurs, resulting in the formation of a "liquid" mesomorphic system. If the premix is heat-treated in step (b) after the formation of these "liquid" mesomorphic structures then surprisingly said structures are not irreversibly destroyed during the heating step. The cooling in step (c) then results in the formation of the sterile mesomorphic structure.

Step (a) involves the preparation of a premix comprising one or more surfactants and water at a temperature above the Krafft point of the surfactants. The Krafft point of the surfactants will generally vary in a broad range. If the Krafft point is above ambient temperature, then step (a) will involve a heating step. Either the ingredients will be premixed and then heated, or the surfactants are added to heated water. For example, if saturated monoglycerides are used as surfactants, preferably step (a) involves the heating to a temperature of 30 - 75 °C, more preferred 50 - 70 °C. The time of keeping the premix at a temperature above the Krafft point is preferably at least 5 seconds, more preferred 1 to 100 minutes. When desired, other ingredients may be added to the premix. If this occurs between step (a) and (b), (partial) cooling, for

example below the Krafft point, may be desired.

Suitable sterilising times and temperatures in (b) result in sterile products, i.e. product having a Clostridium Botulinum spore reduction of at least 10^{-12} as compared to the non-sterilised product. Preferably the sterilising conditions render the mesomorphic phase substantially free from Clostridium Botulinum spores (less than 1 spore per 1000 kg). Preferably step (b) involves the heating to a temperature of at least 120 °C, more preferred 120 - 155 °C, most preferred 130 -150 °C. The time of heating will generally be from 0.1 second to 100 minutes, depending on the temperature of sterilisation, for example for 120 °C the heating time will generally be from 1 - 30 minutes; for 130 °C 1 to 500 seconds and for 130 to 150 °C 0.1 to 180, more general 1 to 25 seconds. In this context the heating to temperatures of 130 - 150 °C, say around 140 °C is preferred because, surprisingly, around this temperatures a good balance is found between spore reduction (rapid increase with temperature), costs of heating (increase with an increase of temperature), time of heating (decrease with an increase of temperature) and the development of off-flavours, side-reactions etc (increase with an increase of temperature).

Step (c) involves the cooling of the mesomorphic phase to below the Krafft temperature. Generally this cooling will be to an ambient temperature or lower, for example refrigerator temperatures (5°C).
Preferably cooling is done in a short period e.g. ambient or refrigerator temperature are preferably reached within 5 minutes after sterilizing, more preferred in 0.5 to 3 minutes, for example about 1 or 2 minutes. This quick cooling is believed to be advantageous because this helps

in avoiding the sometimes less desired formation of stable cubic mesomorphic phases.

Before, during or after step c, the product is aseptically filled into a suitable package for further use. However, it is preferred that the product is subjected to continuous (as opposed to batch) sterilisation, i.e. sterilisation before packaging. Food products of the invention are preferably packed into single use packs, i.e. packs which contain an amount of product which is to be used at the same time, for example portion packs. Other suitable packs may be multiple use packages e.g. containing 1 to 10,000 g. of product. For maintaining the sterilised nature of the product that package should preferably be closed e.g. sealed. Equally, before, during or after step c the product may be mixed with further ingredients, e.g. to form a food product or other product. Preferably these ingredients are mixed either before sterilisation or after sterilisation under sterile conditions. This ensures the sterile nature of the final aseptically filled product.

Sterile mesomorphic phases as described above may suitably be used in various products, for example skin creams, other personal products etc. Most preferred however, the sterile mesomorphic phases are used in food products. For this purpose the mesomorphic phases are made of edible surfactants. Suitable food products are for example spreads, dressings, cheese, sauces, meat products, whippable products such as bavarois, non-dairy cream and mousses and dough products for example batters, pizza doughs and bread doughs. Especially preferred is the use of sterile mesomorphic phases of edible surfactants in ambient stable food products which preferably have pH of at least 4.6. Most preferred is the use of these sterile mesomorphic phases in

ambient stable food products having a pH of at least 4.6 and which are free of preservatives. These products could previously not be made. Another preferred embodiments involves the use of sterile mesomorphic phases in whippable products, i.e. products which after whipping in standard whipping equipment have a specific volume of more than 1.25 litre per kg. A further preference is the use of sterile mesomorphic phases in dough products, for example as aerating agent in batters or as a bread improver ingredient.

The mesomorphic phase and its method of preparation is known to food scientists. In the "Lipid Handbook" of Gunstone, Harwood and Padley (Chapman and Hall, 1986) such phases are mentioned at page 227. Further detail may be found in "Food emulsions" of S. Friberg (Marcel Decker, 1976 at page 82).

For the purpose of the invention the term mesomorphic phase is intended to include all semi-ordered phases of water and edible surfactant materials. Examples of mesomorphic phases are cubic, hexagonal, coagel and lamellar phases. Preferred mesomorphic phases for use in accordance with the invention are lyotropic phases; especially preferred are lamellar phases. For the purpose of the present invention, the term lamellar phase refers to any system having a pattern of alternating bilayers of surfactants and water. Examples of lamellar phases are lamellar droplet phases, lamellar gel phases and lamellar phases containing extended parallel layers of surfactants and water. Not within the scope of the invention are mesomorphic structures e.g. liposomes which act as carrier materials e.g. for fats or flavouring.

The presence of mesomorphic phases e.g. in food products may be detected by any method suitable for the detection of regular arrangements of surfactant materials. Suitable methods include for example NMR, Electron microscopy, Differential scanning calorimetry, light microscopy and X-ray diffraction.

For some applications the sterile mesomorphic phase preferably is a lamellar phase, for example an alpha-gel phase. These phases are particularly preferred, because they can include a sensational amount of water, e.g. 98 or even 99 wt.%, based on the product. Especially preferred are products which contain a stable lamellar structure, i.e. an alpha-gel structure that during storage for two weeks at ambient temperature or lower does not significantly (less than 50 % conversion) convert to non-lamellar structures. Under certain circumstances, for example at higher temperatures, it may occur that a hexagonal or cubic viscous isotropic mesophases are formed. Sometimes this is less preferred because of the rheological properties of this phase.

Another preferred element of the present invention is the presence of bulk regions of mesomorphic phases in food products. Most preferred is the presence of bulk regions of mesomorphic lamellar phases. Bulk phases preferably consist of either a more or less continuous mesomorphic phase or of discrete particles of mesomorphic phase, for example having a number average particle size of between 1 μm and 10,000 μm, more preferred more than 5 μm, e.g. 15 to 1500 μm.

Preferably food products in accordance to the invention contain at least 1% by weight of sterile mesomorphic phase

of edible surfactant, more preferred 2-100 wt%, for example 3-20 wt%.

According to the present invention any surfactant may be used although lipidic substances are preferred. For food products any edible surfactant may be used. However, the use of other, non lipidic surfactants, for example carbohydrates is not excluded. In general the preferred edible surfactants are selected from the group consisting of nonionic surfactants, anionic surfactants and cationic surfactants.

Preferred non-ionic or zwitterionic surfactants are edible monoglycerides, diglycerides, poly-glycerol esters, non-ionic phospholipids e.g. phosphatidylcholine, non-fatty carboxylic acid esters of fatty acid esters, partial sugar-fatty acid esters and, partial fatty acid esters of polyols, alkali metal salts of fatty acids and mixtures thereof.

Preferred cationic surfactants are cationic non-fatty carboxylic acid esters of fatty acid esters and mixtures thereof.

Preferred anionic surfactants are lactylated fatty acid salts, anionic phospholipids, anionic non-fatty carboxylic acid esters of fatty acid esters and their metal salts, fatty acids and their metal salts and mixtures thereof.

The fatty acid chains used in these surfactants can be of any type and origin. Preferably, however C_{8-28} fatty acid chains are present, more preferred C_{12-22}, for example C_{14-18}. The fatty acids may for example be saturated, unsaturated, fractionated or hydrogenated and be derived from

natural (for example dairy, vegetable or animal) source or synthetic sources.

Preferred surfactants for use in products of the invention comprise as part or all of the surfactants a material of the group monoglycerides, lecithin (or other phospholipids) and lactylated fatty acid salts.

While foodstuffs according to the present invention can comprise a mesomorphic phase comprising 99-5 wt.% of water, it is preferred that the mesomorphic phase comprises 98-60 wt.% and in particular 97-80 wt.% of water, the percentages being based on the total weight of the mesomorphic phase. The total water level of products of the invention may for example be up to 99%, for example 10-90%, conveniently 20-80%. The balance of the mesomorphic phase may be the above defined surfactants e.g. at a level of at least 0.5 wt% up to say 30 wt% on mesomorphic phase, more preferred 1-20 wt%, most preferred 2-12 wt%.

Preferably the total level of edible surfactants in food products of the invention is from 0.1 to 30%, more preferred 0.2-15%, most preferred 0.5-10% by weight of the foodstuff.

Typical embodiments of the invention as illustrated hereafter by example comprise as the sterile mesomorphic phase, a combination of a major amount of a non-ionic surfactant and a minor amount of an ionic co-surfactant. If biopolymers are present, these may become part of the mesomorphic structure.

Preferably, the mesomorphic phase comprises 1-30%, more preferred 2-10 wt.% of non-ionic surfactant for example

monoglycerides and 0.005-10% more preferred 0.01-1 wt.% of ionic co-surfactant for example an alkali metal salt of a lactylated fatty acid, preferably sodium stearoyl lactylate the percentages being based on the total weight of the mesomorphic phase.

The classification "non-ionic", "cationic" and "anionic" for the surfactants is of course dependent on the pH-value of the foodstuff in which the surfactants are used.

Preferably the nonionic surfactant and the ionic surfactant are used in weight ratios of from 100 : 1 to 1 : 10, more preferred 50 : 1 to 1 : 1, for example 40 : 1 to 10 : 1.

Preferred non-ionic surfactants are monoglycerides, alkali metal salts of fatty acids, lactylated esters of monoglycerides and phospholipids. Preferred ionic co-surfactants are alkali-metal salts of lactylated fatty acids, e.g. sodium stearoyl lactylate (SSL), citric acid esters, ionic phospholipids (phosphatidic acid (PA), succinated esters, diacetyl tartaric acid ester of monoglyceride (DATEM).

While foodstuffs according to the invention generally will comprise 0 to 80% by weight of fat, the preferred level of this ingredient is 0-79 wt.% fat, for example 0 to 40%. As indicated above a preferred function of the sterile mesomorphic phase is as a fat-replacer for part or all of the fat normally present in the food product. Preferably the food-product has a caloric content which is at least 30 % less than the comparable full-fat product, also preferred are products wherein the fat level is less than 50 % of the full fat product.

Surprisingly it has also been found that the mesomorphic phase, which is used according to the invention, can be used in foodstuffs containing relatively high levels of electrolyte, without affecting the structuring capability of the system. One example of electrolytes that may be incorporated is be sodium chloride. The amount of electrolytes such as salt in foodstuffs according to the invention preferably ranges from about 0.01 - 5 wt.%, more preferred 0.1 to 5%, for example 0.2 to 3% based on the total weight of the food product.

A very preferred embodiment of the present invention concerns the use of biopolymers. These biopolymers are preferably added to the system in step (a) as indicated above. Although applicants do not wish to be bound by any theory, it is believed that the addition of these materials in step (a) may lead to the incorporation of part of the biopolymer material into the "liquid" mesomorphic phase, which after sterilising (step b) and cooling leads to a sterile mesomorphic phase which is particularly stable during storage. Suitable bio-polymers are for example carbohydrates e.g. gums such as guar, LBG and xanthan, starches and carrageenan, or proteins e.g. milk protein, gelatin, soy protein. Especially preferred is milk protein as part or all of the biopolymers. Suitable sources for this protein are for example skimmed milk, skimmed milk powder, butter milk powder, whey powder, whey, egg protein and sodium caseinate.

Preferably the level of biopolymer materials is from 0.1 to 60 wt % based on the weight of the product. With respect to the surfactants it is preferred that the weight ratio of surfactant to biopolymers in from 10 : 1 to 1 : 50.

For preparing food-products containing the sterile mesomorphic phase in accordance to the invention, it is possible to prepare the sterile mesomorphic phase separately and add this phase as an ingredient to the other ingredients of the product, or it is possible to add one or more other ingredients of the composition to the premix under (a). Preferably, however the ingredients are added such that the final food product is sterile. This can be achieved by adding the ingredients prior to sterilisation or by adding sterile ingredients.

The invention will be further illustrated by means of a number of specific embodiments: it will be evident that the scope of the invention is not limited to these specific embodiments.

A first embodiment of the invention relates to dressings or mayonnaise. Generally dressings or mayonnaise are oil in water emulsions. The oil phase of the emulsion generally is 0 to 80 % by weight of the product. For non-fat reduced products the level of triglycerides is generally from 60-80%, more preferred from 65-75% by weight. For salad dressings the level of fat is generally from 10-60%, more preferred from 15 to 40%. Low or no-fat content dressings may for example contain triglyceride levels of 0, 5, 10 or 15% by weight.

Other fatty materials such as for example polyol fatty acids ester may be used as a replacement for part or all of the triglyceride materials.

In addition to the above mentioned ingredients dressings in accordance to the present invention optionally may contain one or more of other ingredients which may suitably be

incorporated into dressings and/or mayonnaise. Examples of these materials are emulsifiers, for example egg-yolk or derivatives thereof, stabilisers, acidifiers, bulking agents, flavours, colouring agents etc. The balance or the composition is water, which could advantageously be incorporated at levels of from 0.1-99.9%, more preferred 20-99%, most preferred 50 to 98% by weight.

The sterile mesomorphic phase of edible surfactant in the mayonnaise of dressing may either be prepared separately before adding the other ingredients of the composition, or may be formed in the presence of other ingredients.

Another embodiment of the invention is the use of sterile mesomorphic phases of edible surfactants, as generally specified in the above, in spreads. Especially preferred is their use in spreads as a fat replacer.

Spreads according to the embodiment generally contain from 0-80% by weight of edible triglyceride materials. Suitable edible triglyceride materials are for example disclosed Bailey's Industrial Oil and Fat Products, 1979. In spreads of non-reduced fat content (margarines), the level of triglyceride material will generally be from 60-80%, preferably from 70 to 79% by weight. In spreads of reduced fat content the level of triglycerides will generally be from 30-60%, more general from 35 to 45% by weight. In very low fat spreads the level of triglycerides will generally be from 0-40%, for example 30%, 25%, 20% or even 10% or about 0%. Other fatty materials, for example sucrose fatty acid polyesters may be used as a replacement for part or all of the triglyceride material.

The edible surfactant material for use in spreads is preferably used at a level of from 0.1 to 15%, more preferred from 1-10%, most preferred from 2 to 8% by weight. Preferably the level of nonionic edible surfactant is from 0.1 to 15%, most preferred, 1-8%, most preferred, 2 to 6% by weight. Especially preferred are monoglycerides and lecithin as nonionic edible surfactants. Preferably the level of ionic edible surfactant is from 0 to 5%, more preferred 0.05 to 2%, most preferred 0.1 to 0.5%. Preferred ionic edible surfactants are lactylated fatty acid salts and diacetyl tartaric acid esters of monoglycerides.

In addition to the above mentioned ingredients, spreads in accordance to the invention may optionally contain further ingredients suitable for use in spreads. Examples of these materials are gelling agents, sugar, EDTA, spices, salt, bulking agents, flavouring materials, colouring materials, proteins, acids etc. The balance of the composition is generally water, which may be incorporated at levels of up to 99.9% by weight, more general from 10 to 98%, preferably from 20 to 97% by weight.

Spreads according to the invention may be fat and/or water continuous. The sterile mesomorphic phase can be used as a partial or entire replacement for the water phase and/or oil phase in the spread products.

In the preparation of spreads in accordance to the invention, the mesomorphic phase may either prepared before the addition of other ingredients, or the mesomorphic phase may be prepared while other ingredients of the composition are present.

A preferred embodiment of the invention is the use of sterile mesomorphic phases of edible surfactants in whippable, in particular whippable non-dairy creams, mousses, bavarois, etc. Preferred uses are a foam control agent and fat replacer.

Preferably the level of edible surfactant in whippable products is from 0.1 to 15% by weight, more preferred 1 to 10%, most preferred 2 to 8% by weight of the composition. Preferably the edible surfactant material comprises monoglycerides, for example at levels of 1 to 10%, more preferred 2 to 5% by weight. In addition to the monoglyceride co-surfactants may be present, for example at a level of 0 to 10%, more preferred 0.1 to 8%.

Preferably whippable products of the invention contain from 0.1 to 15 wt% of biopolymer materials. Preferred biopolymer materials are proteins, especially milk proteins.

In addition to the edible surfactant materials in the mesomorphic phase, whippable products in accordance to the invention may advantageously contain one or more other ingredients, for example sugar, emulsifiers, colorants, flavouring agents, fat (preferably vegetable fat), skimmed milk ingredients etc. For example the fat level may be from 0 to 80%, more preferred 0-40%, for example about 5%, 15% or 30%. The balance of the composition is preferably water.

As described above the sterile mesomorphic phase of edible surfactants may be prepared before mixing the remaining ingredients or may be formed in the presence of one or more other ingredients of the composition.

Another preferred embodiment of the invention relates to the use of sterile mesomorphic phases of edible surfactants in cheese products, for example processed cheese or semi-hard cheese. Preferred uses for the sterile mesomorphic phase in cheese products are in fresh cheese and processed cheese.

Cheese products in general often contain dispersed droplets of fat dispersed in a matrix, which is often structured by casein. For the purpose of the present invention the sterile mesomorphic phase may be used for replacing part or all of the dispersed phase, but also possible is that the mesomorphic phase is used as a replacement for all or part of the cheese matrix. In the former case, the mesomorphic phase will be present as a bulk phase consisting of discrete particles of the mesomorphic phase. In the latter case the mesomorphic phase may be a continuous bulk phase or may consist of discrete particles.

Preferably the level of edible surfactant in the cheese product will be from 0.1 to 15% by weight of the composition, more preferred 0.5 to 10%, most preferred 1 to 8%. Preferably the level of nonionic surfactant is from 0.1 to 8%, more preferred 0.5 to 5%. The level of ionic surfactants is preferably from 0 to 7%, more preferred 0.1 to 5%. Preferably the level of biopolymer materials is from 0.1 to 60 wt%. A preferred biopolymer material is protein, especially milk protein.

In addition to the mesomorphic phase of edible surfactant, cheese products of the invention may advantageously contain all types of ingredients which can be present in cheese, products. Examples of these ingredients are fat (preferably present at levels from 0-45%, more preferred 1-30%; other

fatty materials such as for example polyol fatty acid esters can replace all or part of the fat), electrolytes (for example $CaCl_2$ and/or NaCl at levels of 0 to 5%, more preferred 1-4%), rennet or rennin (for example at a level of 0.005 to 2%, more preferred 0.01-0.5%), flavours, colouring agents, emulsifiers, stabilisers, preservatives, pH adjusting agents etc. The balance of the product is generally water which may be present at levels of for example 0-99.5%, more preferred 5-80%, more preferred 30-75% by weight).

The cheese products of the invention may be prepared by any suitable process for the preparation of cheeses. As indicated above the mesomorphic phase of edible surfactants may be formed separately or may be formed in the presence of other ingredients of the cheese product. If the sterile mesomorphic phase is prepared separately, the phase thus formed is preferably added to the other ingredients in stage c as described above.

Other food products in accordance to the invention which could advantageously contain a sterile mesomorphic phase of edible surfactants, involve other edible emulsified systems, sauces, sweet spreads, liquid and semi-liquid dairy products, meat products, bakery cream, toppings etc and bakery products, for example doughs.

The invention will be illustrated by means of the following examples: All percentages in the examples are by weight of the composition unless indicated otherwise.

The following ingredients were used:

The surfactants named Hymono and Admul followed by a code all are trade names of Quest International. The various types of ß-carotene were obtained from Hoffmann-La Roche Ltd, Basel, Switzerland. BMP is butter milk powder. SMP is skimmed milk powder. Salt is sodium chloride.

Example 1

A mesomorphic phase of edible surfactant was made of the following ingredients:

water	89.0%
monoglycerides (*)	6.0%
skimmed milk powder	5.0%

Notes:

* Hymono 8803 (ex Quest Int.)

The water was heated in a water-jacketed vessel until a temperature of 60°C. At that point all other ingredients were added to the water and the mixture was stirred gently, using a 'ribbon stirrer', for about 30 minutes. The pH of the product was set to a value of 7.0 using sodium hydroxide. The product was sterilised by and UHT treatment for 10 seconds at 140 °C using an indirect system. The product was cooled to 40 °C and aseptically filled into containers of 1 kg. The products were stored at ambient temperature.

The resulting product was a sterile mesomorphic phase of the edible surfactants and biopolymers of the alphagel type. The product could be used in the preparation of food products in accordance to the invention.

Example 2

A mesomorphic phase was prepared with the following composition:

Monoglyceride (*)	8%
Sodium Stearoyl Lactylate (**)	0.4%
pasteurized skimmed milk	balance

Notes

* = Hymono 8903 (Quest Int)

**= Admul SSL 2012

All ingredients were hand blended at 65°C and the blend was neutralised with sodium hydroxide solution to a pH of 7.0. The resulting mixture was stirred for 5 minutes. The liquid mesomorphic phase thus obtained was UHT treated at 140 °C for 8 seconds. The product was cooled and aseptically filled into containers and stored at 5 °C or 20 °C. The resulting mesomorphic phase was sterile, ambient stable and of the alphagel type.

The whipping characteristics of the product were evaluated using a Hobart mixer at level 3. After 30 seconds of mixing the density was reduced from 1000 g/l to 440 g/l, further mixing resulted in a density of 40 g/l.

Similar results were obtained if the product was heated to 130 °C for 30 seconds.

Example 3

A low calorie bavarois was prepared of the following ingredients:

monoglyceride (Hymono 8803)	6.2 %
gelatin (Bloom 250, acid)	1 %
sugar	11 %
strawberry syrup	10 %
water	balance

The monoglyceride was mixed with the water at 62 °C in a stirred vessel. After 10 minutes the remaining ingredients were added. The pH was set to 7 using sodium hydroxide. The products was sterilised at 142 °C for 16 seconds. After cooling to 25 °C the product was aseptically packed and stored at ambient temperature. The sterile product contained a mesomorphic phase of the alphagel type and showed after whipping a proper consistency and gave a good fatty impression.

Example 4

An ambient stable whippable non-dairy cream was prepared of the following ingredients.

monoglyceride (Hymono 8903)	4.5 %
buttermilk powder	8 %
guar gum	0.2 %
bean oil	10 %
Triodan 55	0.3 %
beta-carotene (2% in bean oil)	0.01%
water	balance

The water was heated to 60 °C in a stirred vessel, whereafter the monoglycerides, buttermilk powder and guar gum were added under stirring in an Ultra Turrax (ex Jamke & Kunkel). The pH was set to 7.0 using sodium hydroxide. After 10 minutes the solution was cooled to 40 °C and mixed with he remaining ingredients. The mix was homogenised in a two-steps homogeniser (50 and 25 bar) and sterilised using a UHT indirect tubular heat exchanger at 140 °C for 10 seconds. After cooling to 40 °C the product was aseptically packed and stored at 5 °C and 20 °C.

The resulting product was whippable, sterile, ambient stable over a period of several weeks and had a distinct fatty oral impression. The product could be used in many applications where traditionally a high fat (around 45 %) whipped cream is used.

Example 5

Pizza doughs of the following compositions were prepared:

	wt%		
Composition	A	B	C
flour		62.01	
water		28.85	
margarine	4.61	2.30	--
mesomorphic phase (example 2)	--	2.31	4.61
sugar		1.90	
yeast		1.73	
salt		0.72	
spices		balance	

The dough was prepared in a Werner-Pfleiderer UC80. The ingredients were added in the order as specified above,

followed by 2 minutes kneading at 67 rpm and 4 minutes and 134 rpm. All doughs had good dough handling properties.

After baking for 16 minutes at 230 °C satisfactory pizza products were obtained.

CLAIMS

1. A process for the preparation of a sterile mesomorphic phase of surfactants, comprising the sequential steps of:

(a) preparing a premix comprising surfactants and water at a temperature above the Krafft temperature of the surfactant;

(b) sterilising the premix at a temperature above 115 °C; and

(c) cooling the premix to below the Krafft temperature of the surfactants,

said process also comprising (before, during or after step c) the aseptically filling into a suitable packgage.

2. A process according to claim 1, wherein the premix also comprises 0.1 to 30 wt % of biopolymers, preferably proteins.

3. A process according to claim 1, wherein step (b) involves heating to a temperature of 130 to 150 °C for a period of 0.1 to 180 seconds, more preferred 1 to 25 seconds.

4. A process according to claim 1, wherein the surfactants are edible surfactants.

5. A process according to claim 1, wherein the surfactants comprise a mixture of nonionic and ionic surfactants in a weight ratio of 100 : 1 to 1 : 10.

6. A process according to claim 1 wherein the sterile mesomorphic phase is a lamellar phase.

7. A process for the preparation of a food product, wherein the sterile mesomorphic phase as obtained in accordance to claim 1 is mixed with other ingredients of the food product.

8. A process for the preparation of a food product, wherein in the process according to claim 1, the premix under (a) contains other ingredients of the food product.

9. Food product comprising a sterile mesomorphic phase of edible surfactants.

10. Food product according to claim 9, wherein the sterile mesomorphic phase is a lamellar phase.

11. Food product according to claim 9, comprising bulk regions of the sterile mesomorphic phase.

12. Food product according to claim 9 being ambient stable and preferably having a pH of at least 4.6 and preferably being free from preservatives.

13. Food product according to claim 9, being selected from the group of spreads, dressings, cheese, meat products, sauces, whippable products and dough products.

14. Food product according to claim 13, being a whippable product selected from the group of bavarois, non-dairy cream and mousse.

15. Food product according to claim 13, being a dough product, selected from the group of batters, pizza dough and bread dough.

INTERNATIONAL SEARCH REPORT

Int. .onal Application No
PCT/EP 93/03549

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 A23L1/035 A23D7/00 A23L1/307

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)
IPC 5 A23L A23D C09K

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO,A,91 18514 (KANSAS STATE UNIVERSITY RESEARCH FOUDATION) 12 December 1991 see page 2, line 29 - page 4, line 15; claims 1,2,12-14; example 1 ---	1-11, 13-15
Y	DATABASE WPI Week 9250, Derwent Publications Ltd., London, GB; AN 92-411712 & JP,A,4 308 747 (KAO CORP.) 30 October 1992 see abstract --- -/--	1-11, 13-15

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 March 1994	09. 03. 94

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Kanbier, D

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INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/EP 93/03549

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO,A,92 09209 (UNILEVER NV) 11 June 1992 cited in the application see page 4, paragraph 3; claims 1,2,4-11 see page 6, paragraph 3 -paragraph 4 see page 9, paragraph 2 -paragraph 3 see page 10, paragraph 2 - page 12, paragraph 3 see page 16 - page 30	1-11, 13-15
Y	JOURNAL OF THE AMERICAN OIL CHEMISTS' SOCIETY vol. 42 , 1965 , CHAMPAIGN ILL. pages 1068 - 1070 E.S. LUTTON 'PHASE BEHAVIOR OF AQUEOUS SYSTEMS OF MONOGLYCERIDES' see page 1069; figure 1	1-11, 13-15
A	CA,A,1 180 250 (SCM CORP.) 1 January 1985 see page 4A - page 5; claims 1,5,6,8,10,11; examples 1-3,5	1,4-7,9, 10,12-15
A	EP,A,0 315 472 (CHINOIN GYOGYSZER ES VEGYESZETI TERMEKEK GYARA RT.) 10 May 1989 see column 2, line 16 - line 43; claims 1-5,9; examples 12-17,26,27 see column 3, line 40 - column 4, line 17	2,4-6
A	CEREAL CHEMISTRY vol. 58, no. 3 , 1981 , MINNEAPOLIS pages 158 - 164 N. KROG 'THEORETICAL ASPECTS OF SURFACTANTS IN RELATION TO THEIR USE IN BREADMAKING' see page 160, right column see page 162	1,2,4,6, 9,10,15

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ional Application No
PCT/EP 93/03549

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CA-A-1180250	01-01-85	NONE	
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		JP-A- 1188582	27-07-89
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