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(71) Applicant *(for AU CA GB IE only):* UNILEVER PLC [GB/GB]; Unilever House, Blackfriars, London EC4P 4BQ (GB).

(71) Applicant *(for all designated States except AU CA GB IE):* UNILEVER N.V. [NL/NL]; P.O. Box 760, NL-3000 DK Rotterdam (NL).

(72) Inventors: BANACH, Gerald ; 5264 Candy Root Court, Columbia, MD 21045 (US). FIORI, Frank, Stephen ; 5797 Elkridge Heighs Road, Elkridge, MD 21227 (US). WESDORP, Leendert, Hendrik ; 3706 Valley Road, Ellicott City, MD 21042 (US).

(74) Agent: JOPPE, Hermina, L., P.; Unilever N.V., Patent Division, P.O. Box 137, NL-3130 AC Vlaardingen (NL).

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(54) Title: EXTRA LOW FAT SPREAD AND PROCESS OF PREPARING THE SPREAD

(57) Abstract

A water continuous margarine-like spread comprising less than or equal to 5 wt.% fat and comprising at least about 9 wt.% of casein, wherein the spread contains less than 1.05 wt.% ash, and is free of emulsifying salts.

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EXTRA LOW FAT SPREAD AND PROCESS OF PREPARING THE SPREAD

FIELD OF THE INVENTION:

The invention relates to extra low fat margarine-like spreads and to processes of preparing the spreads.

BACKGROUND OF THE INVENTION:

In light of the rising consumer demand for low fat, low calorie products, food scientists are faced with a challenging task of producing a spread which has the texture, spreadability, and organoleptic properties similar to margarine but which contains less than 80 wt% fat typically present in margarine. It is particularly difficult to attain the spreadability, body, texture, and taste of margarine in spreads containing 5 wt% or less fat, or in spreads containing practically no fat.

Cheese spreads containing fat at low levels have been disclosed. For instance, Baker discloses a method of preparing a low fat cream cheese; the method includes the steps of admixing milk, a fat-containing carrier and a stabilizer and heating the mixture to a temperature in the range of from to admixing dry cottage cheese curd, and homogenizing the curd mixture at pressures in the range 500 to 5000 psi. Cottage cheese curd comprises 70 to 85 wt% of the product. The fat content of the product is from about 0.7 wt% to less than about 2 wt%. The resulting low fat cream cheese type product resembles cream cheese in appearance, texture, and taste.

With respect to margarine-like products, a number of references disclose formulations, which although they contain lower levels of fat than margarine, still include more than 5 wt% fat. GB 2,229,077, for example, discloses a margarine containing 5-30% fat mixture containing hardened fat, 8-15% maltodextrin, optionally 0.5-3% modified starch, 1-2% whey protein concentrate, 0.4-0.6%

gelatin. The process disclosed in the '077 application for making the margarine employs a step of homogenizing a heated blend at a pressure of at least 11,600 psi. U.S. Patent 4,497,834, discloses a dairy-based non-cheese food product, which may contain from 5 to 40% fat. Non-fat milk solids comprise 15 to 50% of the product. The product may include a stabilizer, e.g. carboxymethylcellulose. U.S. Patent 4,103,037, discloses a low fat spread containing 25-65% fat, which includes carboxymethylcellulose, cheese curd, and gelatine.

U.S. Patent 5,013,573 discloses spreads containing 20-90% fat, and containing a demineralized, deacidified milk.

With respect to extra low fat margarine-like spreads (less than 5 wt% fat), U.S. Patent 4,956,193, disclose an edible plastic dispersion containing 1-10 wt% fat, which includes maltodextrin and gelatin. The Examples of this patent contain 9-12% maltodextrin. Small cheese particles may be included in the dispersion in order to obtain a cheese spread. EP 468,560 discloses a concentrated casein containing dispersion of substantially aggregated casein, preferably obtained from yoghurt or quark, which dispersion has a dry matter content of 10-80 wt%, pH of 4.8-5.2, the dispersion being free from live, milk fermenting bacteria. The dispersion is said to be useful as fat replacer in low fat or zero fat spreads.

Although stable and spreadable extra very low fat spreads may be produced according to the above disclosures, it has been found, as part of the present invention, that spreads which even more closely approximate the taste of margarine are desirable and may be obtained. Particularly, extra very low fat spreads containing casein have more acidic taste than is typically associated with margarine and it is desirable to decrease this acidic taste.

Accordingly, it is an object of the invention to provide a water-continuous spread which contains fat at a level not greater than 5 wt% yet is margarine-like in body, texture, and organoleptic perception.

It is another object of the invention to provide a water-continuous spread which contains fat at a level not greater than 3.25 wt%, or even at a level not greater than 0.25 wt%, yet is margarine-like in body, texture, and organoleptic properties.

It is another object of the invention to provide an extra very low fat margarine-like spread which contains casein and yet contains less than 1.05 wt%, or even less than 0.7 wt%, ash.

It is still another object of the invention to provide an extra very low fat spread prepared from an electrodialysed milk or electrodialysed milk ingredient.

It is yet another object of the invention to provide a process of preparing an extra very low fat water-continuous margarine-like spread.

It is still another object of the invention to provide a process of preparing an extra very low fat spread from a milk blend.

It is still another object of the invention to provide a process of preparing an extra very low fat spread from electrodialysed milk or electrodialysed dairy ingredient.

These and other objects of the invention will become more apparent from the detailed description and examples which follow.

SUMMARY OF THE INVENTION:

The above objects are attained by the present invention which includes a water-continuous margarine-like spread containing no more than 5 wt% fat, preferably less than 3.25 wt% fat. The spread according to the present invention contains casein at a level of at least 9 wt%, typically from about 9 wt% to about 15 wt%.

Protein, including serum (whey) protein and casein is present in the form of particles, which may or may not be aggregated. The diameter size of the particles or the aggregates is in the range of from 2μ to diameters of greater than 10μ, preferably the size ranges from 3μ to 8μ.

The casein contained in the spread is non-denatured. The serum (whey) protein in the spread is substantially non-denatured; preferably at least about 80 wt% of whey protein is non-denatured.

The inventive spread contains less than 1.05 wt% ash, preferably less than 0.7 wt% ash: since ash increases the buffering capacity of the spread, reducing ash levels decreases buffering capacity of the spread. Ash level is equivalent to the mineral content and may be determined by any suitable method. One suitable method is for example disclosed in AOAC (1990) page 837, 920.117. This means that smaller amounts of acid are required to obtain the desired pH, thereby resulting in reduced acid flavor.

The ash content in the inventive spread (or the acidity of the spread) may be reduced by replacing part of casein in the spread with a gel-forming system including a gelling agent A and a gelling agent B, wherein a gelling agent A is selected from the group consisting of gelatin, kappa-carrageenan, iota-carrageenan, alginate, agar, gellan, pectin, and mixtures thereof, and gelling agent B is selected from the group consisting of gelling starch,

denatured whey protein, denatured bovine serum protein, denatured soy protein, microcrystalline cellulose and mixtures thereof, wherein the amount of gelling agent A is from about 0.5 wt% to about 1.5 wt%, and the amount of gelling agent B is from about 2 wt% to about 12 wt%. Preferably, in order to improve organoleptic properties of the spread, the amount of gelling agent B is no greater than 8 wt%, preferably no greater than 4 wt%. The gelling system is also very helpful in preventing syneresis, i.e., improving the stability of the product.

Alternatively, or in addition to using the gel-forming system, the ash content in the inventive spread may be reduced by utilizing electrodialysed milk or an electrodialysed dairy ingredient in the preparation of the spread. Electrodialysis procedures removes a number of cations and anions and results in demineralization of milk.

Reduction in ash content is indicative of the overall mineral reduction.

The inventive spreads do not contain emulsifying salts, e.g. phosphates, diphosphates, triphosphates, tripolyphosphates, pyrophosphates, hexametaphosphates, orthophosphates, aluminophopsphates, and citrates. Other melting salts include acetates and tartrates. All these salts are usually sodium salts and are typically employed to prevent the cheese-containing pasteurized food from breaking down and releasing fat and water.

The invention also includes a process of preparing an extra very low fat water-continuous margarine-like spread, the process including the steps of:

(i) preparing a mixture comprising fat at a level not greater than 5 wt%, at least about 9 wt% of casein, and

less than 1.05 wt% ash; (ii) homogenizing the mixture at a pressure in the range of from about 500 to about 14,000 psi to obtain a blend;
(iii) heating the blend to a temperature in the range of from about 71°C to about 82°C.
(iv) homogenizing the heated blend at a pressure in the range of from about 500 to about 14,000 psi to obtain the spread; and
(v) packing the spread at a temperature of at least 60°C.

According to the inventive process, the mineral content in the spread may be reduced by including in the process the step of electrodialysing milk or milk product and/or by incorporating a gel-forming system of a gelling agent A and a gelling agent B into the mixture of step (i). The inventive process preferably employs a double homogenization step in order to attain a stable emulsion despite extremely low fat levels. Particularly, homogenization prior to heating provides a stable emulsion so that as the product is heated, it is protected.

The inventive spread may be prepared from various dairy ingredients or from one raw material (milk blend) produced by any curd precipitation procedure, followed by separation of the curd from whey. According to the present invention, in order to reduce the ash content of the spread, the various dairy ingredients or the milk blend may be obtained from electrodialysed milk.

The products of the invention maintain the desired spreadability, mouth feel, flavor and body similar to margarine, while containing extra very low level of fat or practically no fat.

DETAILED DESCRIPTION OF THE INVENTION:

The ingredients used in the products and processes of the present invention are defined for purposes of this

specification as follows: "Milk" means the lacteal secretion, practically free from colostrum, obtained by the complete milking of one or more healthy cows, which may be clarified and may be adjusted by separating part of the fat therefrom to produce concentrated milk, reconstituted milk, and dry whole milk. Water, in a sufficient quantity to reconstitute concentrated and dry forms, may be added.

"Nonfat milk" means skim milk, concentrated skim milk, reconstituted skim milk, and nonfat dry milk. Water, in a sufficient quantity to reconstitute concentrated and dry forms, may be added. Nonfat dry milk is defined in detail in 21 CFR, Part 131, Section 125 incorporated by reference herein.

"Cream" means cream, reconstituted cream, dry cream, and plastic cream. Water, or milk, or skim milk, in a sufficient quantity to reconstitute concentrated and dry forms, may be added.

"Dry cottage cheese curd" and "quark" mean soft uncured curd cheese containing less than 0.5 wt% milkfat and not more than 80 wt% moisture.

"Low fat cottage cheese" means soft uncured curd cheese containing not less than 0.5% and not more than 2% milkfat and not more than 82.5% moisture.

"Ricotta" is a soft uncured curd cheese produced by thermal setting of whey or a mixture of whey and cream and/or milk at a predetermined pH. Ricotta typically contains 2 to 16 wt% fat. The Ricotta cheese employed in the present process preferably contains at most 10 wt% fat, most preferably about 7 wt% to 8 wt% fat. "Ricottone" is a soft uncured curd cheese produced by thermal setting of whey at a predetermined pH. Ricottone contains 0 wt% fat.

Cream cheese is a soft, uncured cheese prepared from cream or a mixture of cream and milk. Cream cheese typically contains 33-40 wt% fat. Neufchatel is a soft uncured cheese similar to cream cheese except that Neufchatel contains fat at a level of from 20 to 33 wt%.

A water continuous margarine-like spread according to the present invention contains at least about 9 wt%, preferably from about 9 wt% to about 15 wt%, of casein. The ash content of the spread indicates the overall acidity of the product: decreasing ash content indicates decreasing acidity. The inventive spread preferably contains less than 1.05 wt% ash, more preferably less than 0.7% ash, and optimally less than 0.5 wt% ash. The acidity of the casein-containing spread may be reduced, according to the present invention, by replacing part of casein with a gel-forming system including a gelling agent A and a gelling agent B wherein a gelling agent A is selected from the group consisting of gelatin, kappa-carrageenan, iota-carrageenan, alginate, agar, gellan, pectin, and mixtures thereof, and gelling agent B is selected from the group consisting of gelling starch, denatured whey protein, denatured bovine serum protein, denatured soy protein, microcystalline cellulose and mixtures thereof, wherein the amount of gelling agent A is from about 0.5 wt% to about 1.5 wt%, and the amount of gelling agent B is from about 2 wt% to about 12 wt%. Preferably, in order to improve organoleptic properties of the spread, the amount of gelling agent B is no greater than 8 wt%, preferably no greater than
4 wt%. The gel-forming system is also very helpful in preventing syneresis, i.e. improving the stability. A preferred gelling agent A is gelatin; a preferred gelling agent B is gelling starch, such as Paselli maltodextrin SA2^{R} (a hydrolysed starch product).

Alternatively, or in addition to including the gel-forming system, the ash content of the inventive spread may be reduced by utilizing electrodialysed milk in preparing the spread. The electrodialysis (i.e. demineralization) and optionally, deacidifcation of milk is preferably carried out according to the disclosure of U.S. Patent 5,013,573. As noted in that patent, demineralization of the milk or milk product is carried out for a period of time long enough to obtain:

0-950	and preferably 0-350	mg potassium/kg.	
0-500	and preferably 0-150	mg sodium/kg.	
0-720	and preferably 0-250	mg calcium/kg.	
0-80	and preferably 0-20	mg magnesium/kg.	
0-800	and preferably 0-200	mg chloride/kg.	
0-800	and preferably 0-600	mg phosphorus/kg. (organic +inorganic)	
0-1000	and preferably 0-400	mg citrate/kg and	
0-10000	and preferably 0-2500	mg lactage/kg.	

The spread of the present invention preferably includes a cellulose gum, in order to maximize the smoothness of the spread. Sodium carboxymethyl cellulose is preferably used according to the present invention. Various types of carboxymethyl cellulose may be used, regardless of degree of substitution, such as for example, CMC 7HF^{R}, CMC 740F^{R} and CMC 944F^{R} (FMC Corp.). Typically, the cellulose gum is employed in an amount of from about 0.1 wt% to about 5 wt%, preferably at least 0.3 wt% is employed. Most preferred cellulose gum, due to is availability and low cost, is sodium carboxymethyl cellulose. In addition to, or in the alternative to carboxymethyl cellulose, high methoxyl pectin (or high ester pectins), i.e. pectins with degree of esterification above 50% may be employed.

The spread according to the present invention preferably includes a further thickening agent selected from the group consisting of guar gum, locust bean gum, sodium alginate, propylene glycol alginate, xanthan gum, and mixtures thereof, which may be included at a level of from about 0.1

wt% to about 1.0 wt%, preferably at a level of from about 0.1 wt% to about 0.7 wt%, most preferably at a level of from about 0.25 wt% to about 0.5 wt%. Most preferably, a combination of guar gum and locust bean gum is employed: guar gum at a level of from about 0.1 wt% to about 0.3 wt% and locust bean gum at a level of from about 0.1 wt% to about 0.5 wt%.

The inventive spread may be prepared by any process which accomplishes homogenization, pasteurization (in any order), and packing of the product while hot. Preferably the inventive spread is prepared according to a process which is also a part of the present invention. The preferred process attains optimum smoothness and stability of the product. In the first step of the process, a mixture is prepared which contains the desired level of casein. The mixture may be obtained by combining various dairy ingredients. The dairy ingredients contribute mainly fat and protein. Thus, the amounts of various dairy ingredients must be such that the casein level of at least about 9 wt%, preferably from about 9 wt% to about 15 wt%, and the fat level of no greater than 5 wt%, preferably less than 3.25 wt% result.

The dairy fat source is typically selected from cream, Neufchattel, cream cheese, and mixtures thereof. Typically, from about 5 wt% to about 25 wt% of the fat source is employed, more preferably from 10 wt% to about 20 wt%. The preferred fat source is acid precipitated fresh cheese, due to its reduced mineral content. The dairy protein source is selected from the group consisting of cottage cheese, low fat cottage cheese, dry curd cottage cheese, quark, creamed cottage cheese, ricotta cheese, ricotone cheese, fresh cheese and mixtures thereof. Typically, from about 30 wt% to about 70 wt% of the dairy protein source is employed, more preferably from about 35

wt% to about 55 wt%, and most preferably from about 40 wt% to about 50 wt%.

The preferred protein source, in order to minimize the acidity of the spread is a mineral reduced, acid precipitated curd. According to the present invention, such curd is preferably prepared by electrodialysing and milk or milk product and obtaining a precipitated curd from such product.

Curd can be separated from whey by various concentration techniques. Examples of suitable techniques include but are not limited to bag drainage, ultrafiltration, diafiltration, centrifugation, cheese vats, ion exchange and combinations thereof. Milk may be acidified prior to, during, or after electrodialysis.

Alternatively, the precipitated curd may be commercially obtained, e.g., dry curd cottage cheese.

It should be emphasized that the dairy ingredients are labeled as "fat source" and "protein source" only due to the main function performed by the ingredient. In other words, a "fat source" contributes protein in addition to fat, and a "protein source" contributes fat in addition to protein.

The mixture may include nonfat dry milk, in order to increase the solids and protein content, typically in an amount up to about 8 wt%, more preferably in the amount of from about 4 wt% to about 6 wt%. The solids content of the inventive spread is in the range of from about 10 wt% to about 35 wt%, preferably from about 15 wt% to about 30 wt%, most preferably from about 25 wt% to about 30 wt%. The protein (casein and whey) content of the spread is in the range of from about 9 wt% to about 18 wt%, preferably in the range of from about 10 wt% to about 15 wt%. Instead of non-fat dry milk, it is preferred

to use reduced mineral non fat dry milk, or whey powder (mineral reduced), or whey protein powder (mineral reduced), or total milk protein (mineral reduced), or mixtures thereof, used in the amount to attain the desired solids and protein content.

It has been found, as part of the present invention, that the acidity of extra very low fat casein-containing spreads may be reduced when mineral reduced dairy ingredients are employed. Accordingly, dairy ingredients with reduced mineral content are preferably employed in the inventive spread.

All ingredients are mixed preferably utilizing high speed mixing in any suitable mixer, e.g., Stephan mixer. According to the inventive process, as an alternative to mixing various dairy ingredients, the desired levels of casein, fat, and other chemical components could be contributed by one raw material (milk blend) customized through the starting mix and produced by various concentration procedures, such as bag drainage, ultrafiltration, diafiltration, centrifugation, cheese vats and combinations thereof. When ultra filtration is applied, it should preferably be carried out using a membrane that passes lactose, water, and other soluble milk components, whereas larger molecular components such as casein, whey proteins and fat are retained.

Again, in order to reduce the mineral content of the product, milk is preferably electrodialysed prior to the concentration procedure. Thus, the in a preferred embodiment, the inventive process preferably includes a step of electrodialysing milk in order to prepare either a single raw material, or various dairy ingredients from which casein and other chemical components of the spread are derived. Alternatively, reduced mineral level is attained by a treatment of milk or milk ingredient with ion

exchange resins. The inventive process may also include a step of concentrating one or more raw materials by any concentration procedure mentioned above. It should be noted that various concentration procedures, i.e. bag drainage, ultrafiltration, diafiltration, centrifugation, cheese vats, and combinations thereof, result in further reduction of the mineral content.

In order to attain the spread according to the present invention containing less than about 0.25 wt% fat spread, various dairy ingredients or the single raw material are prepared from skim milk.

The mixture may include optional ingredients, such as cellulose gums, thickeners, nonfat dry milk, salt, as discussed above. Also, the mixture prepared in the first step of the inventive process preferably includes the gel-forming system as discussed above, in order to decrease the acidity of the spread, particularly when the practitioner chooses to omit the step of electrodialysing milk. In a variation of the inventive process, gelling agent A and gelling agent B may be predissolved at a temperature sufficient to induce full hydration of the gelling agents and added to the mixture. When maltodextrin is employed, the temperature is typically in the range of from 65° to 90°C.

In the second step of the process, the mixture of various dairy ingredients or the single raw material and any optional ingredients are homogenized at a temperature in the range of 0°C to 60°C at a pressure in the range of from about 500 to about 14000 psi, preferably from 500 to 5000 psi, most preferably at a pressure in the range of from 1500 to 2000 psi.

The first homogenization step is carried out in order to mix the ingredients thoroughly, so that a stable emulsion is produced.

According to the inventive process, the homogenized blend is then pasteurized, i.e., the blend is heated to a temperature in the range from about 71°C to about 82°C, preferably to a temperature in the range of from about 71°C to about 77°C, most preferably to about 74°C. A number of techniques may be employed to heat the blend. The examples include but are not limited to heating in a kettle, or a scrape surface heat exchanger. Mixing should be carried out during heating. Whenever the blend contacts a hot surface during heating, side wall scraper agitation should be employed.

Heating may be accomplished by steam injection, in which case side wall scraper agitation is not necessary, but mixing during the steam injection should be maintained.

A preferred heating technique is heating in the kettle, with mixing and side wall scraper agitation.

The pasteurized blend is then homogenized again using the same apparatus as used in the first step. The pressure is in the range of from 500 to 15,000 psi, preferably from 2000 to 10000 psi, and most preferably from 8000 to 10,000 psi. Preferably, the pressure is higher in the second homogenization step to improve smoothness and increase viscosity. During the second homogenization step, the temperature of the blend should be maintained at a temperature in the range of from about 71°C to about 82°C.

Other optional ingredients include natural flavoring ingredients, vitamins such as Vitamin A or other vitamins and minor amounts, i.e. 0.1 wt% to 1.5 wt%, preferably 0.25 wt% to 1 wt% of kitchen salt. Up to 2 wt%, preferably 0.01

wt% to 0.5 wt% of natural flavoring ingredients and 3,000 to 10,000 I.U. per pound, preferably about 6,000 I.U. per pound of Vitamin A may be used in the preparation of the spreads of the invention. Flavoring ingredients and vitamins are preferably added after pasteurization but prior to the second homogenization step. Up to 2% of edible acids, such as lactic acid, citric acid, tartaric acid, phosphoric acid and malic acid, and from 0.2% to 1.5% of melting salts may be employed in the preparation of the inventive products.

All steps of manufacture of the margarine-like, extra low fat spread product, including packing, are carried out under sanitary conditions. The product is packed while the product's temperature is above 60°C. This ensures good storage stability of the product. The product is stable for at least three months at refrigerator temperatures.

Further describing the inventive extra low fat spreads, the detailed preferred and optimum chemical component composition of the spreads is as follows (wt%):

	Preferred	Optimum
Solids: 10-35%	15-30%	25-30%
Casein: at least 9%	9-15%	10-13%
Whey proteins	0.5-3%	1-2%
Carbohydrates	1-5%	3-5%
Fat	0.1-5%	< 3%
Ash	<1.05%	<.7%
Carboxymethyl Cellulose	0.2-.5%	0.3%
Guar Gum	0.1-.25%	0.1-0.25%
Salt 0.5-1.5%	0.8-1.2%	
Locust Bean Gum	0.1-0.5%	0.1-0.3%
Maltodextrin	4-12%	3-5%
Gelatin	0.5-1.5%	0.5-1.0%

The pH of the product is generally in the range of from 4.6 to 5.5, preferably from 5.0 to 5.3.

The following specific examples further illustrate the invention but the invention is not limited thereto.

EXAMPLES

Spreads of examples 1-3 contained less than 5% fat, yet were margarine-like in body, texture, and organoleptic properties.

Example 2 used less Neufchatel than Example 1; thus, Example 2 contained less fat than Example 1 and its total acidity was lower than in Example 1. Example 3 used reduced mineral TMP (total milk protein) and cream (which carries less acid than Neufchatel); the use of reduced mineral dairy ingredients in Example 3 resulted in a spread that was less acidic than Example 1, i.e., the total acidity in Example 3 was lower than in Example 1.

Total acidity indicates the amount of acid (as lactic acid) present in the product.

EXAMPLE 1

	%	Pounds Batch	Grams Batch	wt% Fat	wt% Solids	wt% Protein	wt% Lactose	cal/g Calories	mg/g Cholesterol	wt% Salt	wt% Ash
Water	28.6011	2.86	1297.32								
Neufchatel	20.0000	2.00	907.18	21.75	36.00	9.00	2.30	2.53	0.73	0.25	1.50
Dry Curd Cottage Cheese	40.0000	4.00	1814.36	0.42	20.08	16.06	2.00	0.82	0.07		0.70
Non Fat Dry Milk	5.0928	0.51	231.00	1.50	97.00	34.92	49.47	3.96	0.02		7.90
Paselli Maltodextrin SA2^{R}	4.0000	0.40	181.44	0.00	90.00	0.00	0.00	3.60	0.00		
Gelatin	0.7500	0.08	34.02	0.10	100.00	85.60		3.36			
Salt	1.0000	0.10	45.36		100.00			4.00		100.00	
Carboxymethyl Cellulose	0.3000	0.03	13.61		88.00			3.52			
Guar	0.1500	0.02	6.8039		90.50			0.20			
Natural Butter Flavor	0.0200	0.00	0.4536	100.00	100.00			9.00			
Locust Bean Gum	0.0361	0.00	1.6375		85.00			0.00			
1% Beta Carotene CWS*	0.0500	0.01	2.2680	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	100.0000	10.0000		4.62	25.97	10.64	3.78	125.85	17.50	1.05	0.98
Per Serving				0.65	3.64	1.49	0.53	17.62	2.45	0.15	0.14

pH = 5.23
Total Acidity = 0.90 wt%

1. Mix all ingredients cold in Stephan.
2. Homogenize at 2000 psi through Rannie Homogenizer
3. Transfer back to the Stephan and heat to 67°C
4. Homogenize at 8000 psi through the Rannie Homogenizer
5. Package hot upside down and store @ 32-40°F

* Cold water soluble

EXAMPLE 2

	%	Pounds Batch	Grams Batch	wt% Fat	wt% Solids	wt % Protein	wt % Lactose	cal/g Calories	mg/g Cholesterol	wt% Salt	wt % Ash
Water	35.6767	107.03	48547.78								
Neufchatel	13.1700	39.51	17921.34	21.75	36.00	9.00	2.30	2.53	0.73	0.25	1.50
Dry Curd Cottage Cheese	40.0000	120.00	54430.80	0.42	29.00	23.20	2.00	1.18	0.07		0.70
Non Fat Dry Milk	5.0000	15.00	6803.85	1.50	96.00	34.56	48.96	3.92	0.02		8.2
Paselli Maltodextrin SA2^{R}	3.9029	11.71	5310.95	0.00	90.00	0.00	0.00	3.60	0.00		
Gelatin	0.7317	2.20	995.68	0.10	100.00	85.60		3.36			
Salt	0.9715	2.91	1321.99		100.00			4.00		100.00	
Carboxymethyl Cellulose	0.2931	0.88	398.84		88.00			3.52			
Guar	0.1463	0.44	199.08		90.50			0.20			
Natural Butter Flavor	0.0240	0.04	16.3292	100.00	100.00			9.00			
Locust Bean Gum	0.0351	0.11	47.7630		85.00			0.00			
1% Beta Carotene CWS	0.0487	0.15	66.2695	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	100.0000	300.00		3.13	26.80	12.82	3.55	121.77	12.51	1.00	0.89
Per Serving				0.44	3.75	1.79	0.50	17.05	1.75	0.14	0.07

pH = 5.32
Total Acidity = 0.85 wt %

1. Mix all ingredients cold in Stephan.
2. Homogenize at 2000 psi through Rannie Homogenizer
3. Transfer back to the Stephan and heat to 165°F
4. Homogenize at 8000 psi through the Rannie Homogenizer
5. Package hot upside down and store @ 32-40°F

EXAMPLE 3

	%	Pounds Batch	Grams Batch	wt% Fat	wt % Solids	wt % Protein	wt % Lactose	cal/g Calories	mg/g Cholesterol	wt% Salt	wt% Ash
Water	39.6739	3.97	1799.57								
Cream (36% Butter Fat)	8.0000	0.90	362.87	36.00	41.63	2.03	2.87	3.47	1.37		0.4449
Dry Curd Cottage Cheese	40.0000	4.00	1814.36	0.42	20.08	16.06	2.00	0.82	0.07		0.7
TMP 1240	3.5000	0.35	158.76	1.10	95.70	89.60	0.20	3.88	0.10		5
Lactose	2.5200	0.25	114.30	0.00	100.00	0.00	100.00	4.00	0.00		
Paselli Maltodextrin SA2^{R}	4.0000	0.40	181.44	0.00	90.00	0.00	0.00	3.60	0.00		
Gelatin	0.7500	0.08	34.02	0.10	100.00	85.60		3.36			
Salt	1.0000	0.10	45.36		100.00			4.00		100.00	
Carboxymethyl Cellulose	0.3000	0.03	13.61		88.00			3.52			
Guar	0.1500	0.02	6.8039		90.50			0.20			
Natural Butter Flavor	0.0200	0.00	0.4536	100.00	100.00			9.00			
Locust Bean Gum	0.0361	0.00	1.6375		85.00			0.00			
1% Beta Carotene CWS	0.0500	0.01	2.2680	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	100.0000	10.0000		3.11	23.03	10.36	3.56	106.55	14.11	1.00	0.49
Per Serving				0.44	3.22	1.45	0.50	14.92	1.98	0.14	

pH = 5.31
Total Acidity = 0.78 wt %

1. Mix all ingredients cold in Stephan.
2. Homogenize at 2000 psi through Rannie Homogenizer
3. Transfer back to the Stephan and heat to 165°F
4. Homogenize at 8000 psi through the Rannie Homogenizer
5. Package hot upside down and store @ 32-40°F

The ingredients included in the Examples, unless already mentioned in the specification or examples, may be obtained from the following suppliers:

Ingredient	Tradename	Supplier
Carboxymethylcellulose		CMCAqualou Company P.O. Box 271 Hopewell, VA 23860
Dry Curd Cotttage Cheese		Baucroft Dairy 440 E. Patrick St. Frederick, MD 21701
Non Fat Dry Milk		Mid America Farms 3253 East Chestnut Springfield, MO 65302
Paselli SA2^{R}		Avebe Avebe-wag 1 9607 PT Foxhol The Netherlands
Gelatin		Extraco Stidsvig 5-264 00 Klippen Sweden
Salt	Morton Salt	Morton International, Inc.
Guar Gum	Dycol 400FC^{R}	Tic Gums Inc.
Locust Bean Gum		Hercules Incorporated Hercules Plaza Wilmington, DE 19894
1% β-Carotene CWS		Roche Vitamins & Fine Chemicals 340 Kingsland Street Nutley, NJ 07110-1199
Neufchatel Cheese		Emkay Trading Corp. 58 Church Street Arcade, NY 14009

CLAIMS

1. A water continuous margarine-like spread comprising less than or equal to 5% fat and comprising at least about 9% of casein, wherein the spread contains less than 1.05% ash, and is free of emulsifying salts.

2. A water-continuous margarine-like spread comprising less than or equal to 5% fat and comprising
(a) at least about 9% of casein, and
(b) a gel-forming system including a gelling agent A and a gelling agent B wherein a gelling agent A is selected from the group consisting of gelatin, kappa-carrageenan, iota-carrageenan, alginate, agar, gellan, pectin, and mixtures thereof, a gelling agent B is selected from the group consisting of gelling starch, denatured whey protein, denatured bovine serum protein, denatured soy protein, microcystalline cellulose and mixtures thereof, wherein the amount of gelling agent A is from about 0.5% to about 1.5%, and the amount of gelling agent B is from about 2% to about 12%.

3. The spread of claim 1 or 2 wherein the spread comprises less than 0.7% ash.

4. The spread of claim 1 or 2 wherein the casein is derived from an electrodialysed dairy ingredient.

5. The spread of claim 1 or 2 comprising from about 9% to about 15% of casein.

6. The spread of claim 1 or 2 comprising less than 3.2% fat.

7. The spread of claim 2 comprising from about 2% to about 8% of gelling agent B.

8. The spread of claim 1 or 2 comprising from about 10% to about 35% total solids.

9. A process of preparing a water-continuous margarine-like spread the process comprising:

(i) preparing a mixture comprising fat at a level not greater than 5 wt%, at least about 9 wt% casein, and a gel-forming system including a gelling agent A and a gelling agent B wherein a gelling agent A is selected from the group consisting of gelatin, kappa-carrageenan, iota-carrageenan, alginate, agar, gellan, pectin, and mixtures thereof, a gelling agent B is selected from the group consisting of gelling starch, denatured whey protein, denatured bovine serum protein, denatured soy protein, microcystalline cellulose and mixtures thereof, wherein the amount of gelling agent A is from about 0.5 wt% to about 1.5 wt%, and the amount of gelling agent B is from about 2 wt% to about 12 wt%;

(ii) homogenizing the mixture at a pressure in the range of from about 500 to about 14,000 psi to obtain a blend;

(iii) heating the blend to a temperature in the range of from about 71°C to about 82°C;

(iv) homogenizing the heated blend at a pressure in the range of from about 500 to about 14,000 psi to obtain the spread; and

(v) packing the spread at a temperature of at least 60°C.

10. A process of preparing a water-continuous margarine-like spread the process comprising:

(i) preparing a mixture comprising fat at a level not greater than 5 wt%, at least about 9 wt% of casein, and less than 1.05% ash;

(ii) homogenizing the mixture at a pressure in the range of from about 500 to about 14,000 psi to obtain a blend;

(iii) heating the blend to a temperature in the range of from about 71°C to about 82°C;

(iv) homogenizing the heated blend at a pressure in the range of from about 500 to about 14,000 psi to obtain the spread; and

(v) packing the spread at a temperature of at least 60°C.

INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 93/00437

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A23C9/15; A23D7/00; A23C19/076

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	A23C ; A23D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X,P	EP,A,0 500 257 (KRAFT GENERAL FOODS) 26 August 1992 see page 6 - page 7; claims 1-11 ---	2
X	US,A,5 079 024 (L.CRANE) 7 January 1992 see claims 1,16,27,29,30; example 1 ---	2
A	EP,A,0 463 688 (UNILEVER) 2 January 1992 see column 5, line 18 - line 22; claims 1-12 ---	1
A	EP,A,0 379 747 (UNILEVER) 1 August 1990 see claims 1-6,10; example 6 ---	1,2

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° Special categories of cited documents : [10]

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

"E" earlier document 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

"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

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
25 JUNE 1993	20.07.93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	DESMEDT G.R.A.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	EP,A,0 298 561 (UNILEVER) 11 January 1989 see page 6, line 30 - line 49; claim 1 see page 7, line 32 - line 37	1,2
A	US,A,4 379 175 (D. BAKER) 5 April 1983 see claims 1-7; example 1	1,10
A	FOOD PRODUCT DEVELOPMENT vol. 9, no. 9, 1975, pages 68 - 74 S. SEAS ET AL. 'Development of cheese-flavored spreads with controlled fat content' see page 68, column 2; tables 1,2	1,10
A	GB,A,2 229 077 (KRAFT EUROPE R&D INC) 19 September 1990 cited in the application see claim 1; example 3	1,2

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9300437
SA 71045

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 25/06/93

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