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(72) Inventeurs/Inventors:
HUIZINGA, HINDRIK, NL;
VAN IMMERSEEL, ANTON REID, NL;
PELAN, EDWARD G, NL

(73) Propriétaire/Owner:
UNILEVER PLC, GB

(74) Agent: RIDOUT & MAYBEE LLP

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(54) Title: EDIBLE EMULSION SPREAD

(57) **Abrégé/Abstract:**

Edible W/O-emulsion spread, which spread possesses ambient emulsion stability in the absence of partial glycerides, which spread comprises a dispersed aqueous phase which contains at least X wt.% on aqueous phase of a natural thickening agent, preferably a natural starch, which agent is characterized by a peak value in the temperature related viscosity graph of an aqueous dispersion of the thickener and where the thickener concentration X is chosen such that an aqueous dispersion with that concentration has a peak viscosity which is at least 70 Brabender Units and an end viscosity which preferably is at least 60 Brabender Units. The found aqueous phase ensures that a reduced (25-40 wt.%) fat emulsion spread, without the addition of partial glycerides, remains stable at an ambient temperature of 15°C for at least seven days.



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(71) Applicant (for AE, AL, AM, AT, AZ, BA, BE, BF, BG, BJ, BR, BY, CF, CG, CH, CI, CM, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, FR, GA, GE, GN, GQ, GR, GW, HR, HU, ID, IS, IT, JP, KG, KP, KR, KZ, LC, LR, LT, LU, LV, MA, MC, MD, MG, MK, ML, MR, MX, NE, NL, NO, PH, PL, PT, RO, RU, SE, SI, SK, SN, TD, TG, TJ, TM, TN, TR, UA, UZ, VN, YU only): **UNILEVER N.V.** [NL/NL]; Weena 455, NL-3013 AL Rotterdam (NL).

(71) Applicant (for AG, AU, BB, BZ, CA, CY, GB, GD, GH, GM, IE, IL, KE, LK, LS, MN, MW, MZ, NZ, OM, SD, SG, SL, SZ, TT, TZ, UG, ZA, ZM, ZW only): **UNILEVER PLC** [GB/GB]; UNILEVER HOUSE, Blackfriars, London, Greater London EC4P 4BQ (GB).

(71) Applicant (for IN only): **HINDUSTAN LEVER LTD** [IN/IN]; HINDUSTAN LEVER HOUSE, 165 - 166 Back-bay Reclamation, 400 020 Mumbai (IN).

(72) Inventors: **HUIZINGA, Hindrik**; Unilever R & D Vlaardingen, Olivier van Noortlaan 120, NL-3133 AT

Vlaardingen (NL). **VAN IMMERSEEL, Anton, Reid**; Unilever R & D Vlaardingen, Olivier van Noortlaan 120, NL-3133 AT Vlaardingen (NL). **PELAN, Edward, G**; Unilever R & D Vlaardingen, Olivier van Noortlaan 120, NL-3133 AT Vlaardingen (NL).

(74) Agent: **SIKKEN, Antonius, H,J,M**; Unilever NV, Patent Department, Olivier van Noortlaan 120, NL-3133 AT Vlaardingen (NL).

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(57) Abstract: Edible W/O-emulsion spread, which spread possesses ambient emulsion stability in the absence of partial glycerides, which spread comprises a dispersed aqueous phase which contains at least X wt.% on aqueous phase of a natural thickening agent, preferably a natural starch, which agent is characterized by a peak value in the temperature related viscosity graph of an aqueous dispersion of the thickener and where the thickener concentration X is chosen such that an aqueous dispersion with that concentration has a peak viscosity which is at least 70 Brabender Units and an end viscosity which preferably is at least 60 Brabender Units. The found aqueous phase ensures that a reduced (25-40 wt.%) fat emulsion spread, without the addition of partial glycerides, remains stable at an ambient temperature of 15°C for at least seven days.



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EDIBLE EMULSION SPREAD

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The present invention deals with an edible fat-continuous emulsion spread which does not need partial glycerides for stabilisation.

15

BACKGROUND AND PRIOR ART

Present manufacturing processes for edible W/O-emulsion spreads generally use mono- and/or diglycerides (partially esterified glycerol, also denoted as partial glycerides) as emulsifiers. Particularly reduced fat spreads with a high content of dispersed aqueous phase can not be prepared without efficient surfactants such as monoglycerides for obtaining emulsion stability (The Lipid Handbook, first edition, page 227).

Since long partial glycerides and particularly monoglycerides are a very effective and safe emulsifier for food manufacture, but, since they are obtained by a chemical process, partial glycerides are not considered as natural.

ECO-certified food fulfills a need of a fast growing group of consumers. Its ingredients must comply with the officially acknowledged provisions (EU regulations 2092/91)

for ECO-food certification. Each ingredient must be natural which means that it has a natural origin, has been obtained by natural processes only and consequently has not been exposed to any chemical treatment whatsoever.

5

Presently, it is not possible to manufacture a spread with a reduced (about 40 wt.%) fat content and an ambient temperature stability of at least one week, which spread may be qualified as ECO or at least as natural.

10

Some butter fat based spreads are qualified as ECO. Butter fat is not refined and generally contains up to 3 wt.% of natural emulsifiers: phospholipids and partial glycerides which have been formed by spontaneous hydrolysis of the butter fat. Therefore a spread when prepared with a dairy ingredient may be stabilized by its natural emulsifier. Generally, for food manufacture fats are used from which any partial glyceride has been effectively removed by refining.

20 WO 00/16638, WO 93/10665 and US 4882187 describe spread manufacturing processes where no emulsifier needs to be added. A dairy product, particularly butter fat is on the ingredients list. However, none of those references addresses the particular problem of preparing a spread with
25 a reduced fat content.

Some isolated references contain recommendations for the stabilisation of W/O-emulsions which are alleged to be free of added emulsifiers:

30

JP 2000236810 employs instead of an emulsifier a starch, which, however, is a chemically modified, so non-natural starch. Moreover, the reference lacks information on how to adapt the process to the preparation of spreads with a
35 reduced fat content.

JP 10/295271 deals with the preparation of a margarine which is said to be emulsifier free. However, the ingredients comprise dairy ingredients and the process
5 requires non-natural hydrogenated fats, such as hydrogenated rapeseed oil. Moreover the peculiar emulsion stability problems of spreads with a reduced fat content are not addressed.

10 Also EP 422 712 and EP 422 713 deal with emulsifier free W/O-spreads. Emulsion stability is realised with the help of special equipment including a homogenizer and an additional scraped surface heat exchanger (SSHE), but the production of reduced fat spreads with ambient stability is
15 not exemplified.

Sometimes (EP 420315, US4591507 and EP 584835) native starches are used for thickening the aqueous phase, but always accompanied by a partial glyceride which is
20 believed to be responsible for emulsion stability. Apparently, starches when used on their own are not able to stabilize the emulsion.

The present invention deals with the preparation of a
25 spread with a reduced fat content which possesses ambient temperature stability in the absence of partial glycerides.

SUMMARY OF THE INVENTION

30

We have found a method for manufacturing an edible reduced fat spread which possesses ambient temperature stability in the absence of partial glycerides, which method uses for the aqueous phase preparation specific thickeners and a
35 specific process.

The present invention comprises a W/O-emulsion spread according to claim 1. The spread is considered to possess ambient temperature stability according to claim 1 when it passes with a score being 1 or 2. at least test c. of the assessment procedure which forms part of this specification. It means that the spread remains stable for at least seven days at an ambient temperature of 15°C and even at least ten weeks at 5°C.

10

The invention also comprises a manufacturing process for preparing the claimed reduced fat spread.

15 DETAILS OF THE INVENTION

The present invention makes use of thickening agents (also denoted as thickeners) which are characterized by their functionality to increase the viscosity of an aqueous phase which is used in the preparation of a food composition.

An aqueous phase in which a sufficient, but relatively small amount of a thickener has been dispersed at elevated temperature becomes a thick, but pourable liquid when cooled down to ambient temperature.

Some thickeners, however, when dispersed in relatively high concentrations in a heated aqueous phase, cause the aqueous phase to become gelled when the aqueous phase cools down to ambient temperature. Such thickeners are called gelling agents, but they make gels only when applied beyond their critical concentration. When used below that concentration only a viscous liquid results. A gel is characterized in that it no longer behaves as a liquid. It retains the form of the container in which it has been formed even when it is removed from that container.

Thickening agents exist in an abundant variety. Some form gels when used at elevated concentrations, others only increase viscosity, even when used in high concentrations. In the context of the present patent a thickening agent
5 refers to a substance increasing the viscosity of the aqueous phase in which it has been dispersed, but always for so far applied in a concentration that no gellation of the aqueous phase occurs at temperatures above 15°C.

- 10 In the context of the present invention ambient temperatures are found in the range of 15°C and upwards. It is obvious that extremely high ambient temperatures (30°C and more) adversely affect the emulsion stability of any spread, including the spread of the present invention.
- 15 Stability at ambient temperature is meant to denote the property that no storage temperatures below 15°C are necessary to maintain emulsion stability.

We have found that an ambient temperature stable reduced
20 fat spread can be made with an aqueous phase which contains a thickener having a specific viscosity profile. Those thickeners are selected from a large group of substances known as such and comprising starches, pectin, cellulose and cellulose derivatives, xanthan, carrageenan,
25 galactomannans and proteins. Several of them qualify as natural. Their special influence on spread stability is caused by a specific preparation of the aqueous phase containing such thickener. has been prepared by a specific process.

30

Of those thickeners natural starches and modified starches are well known ingredients for food preparation. Starches are denoted as natural when they have not been subjected to any modification treatment other than an exposure to heat,
35 an acid or a bleaching agent. The manufacturing processes

of emulsion spreads usually employ modified, non-natural starches. When natural starches are present, without exception these starches are used without special aqueous phase treatment and together with the addition of partial
5 glyceride, otherwise no stable emulsion results.

The present invention uses thickeners, particularly natural starches for imparting emulsion stability. The presence of partial glycerides is not necessary. We have found which
10 natural thickeners qualify for that use and which processing is needed for the preparation of a proper aqueous phase containing such thickeners.

Since partial glycerides are redundant, the invention
15 allows the preparation of a stable ECO-grade spread with an ECO-qualified thickener, particularly with a native starch, a preferred thickener of the present invention.

The starches and other thickeners which qualify for use in
20 the present invention are characterized by a peak value in the Brabender viscosity graph of its aqueous dispersion. For the dispersion used in the viscosity measurement such thickener concentration must be used that for the dispersion with that concentration a peak viscosity is
25 measured which is at least 70 BU. Preferably, the end viscosity of the same aqueous dispersion is at least 60 BU. The viscosity graph is measured according to the Brabender Viscograph protocol, where viscosities and protocol are as defined elsewhere in this specification.

30

For preparing an aqueous phase which is suitable for a spread according to the invention, the thickener is used in at least the same concentration as used for giving the Brabender measurement dispersion the claimed minimum peak
35 viscosity. The thickener concentration may be increased

beyond that value but without exceeding the critical concentration which changes the thickener into a gelling agent.

5 A common feature of many starch thickeners which qualify for the invention is their low amylose content. These starches are unable to form a gel, at least when used in the concentrations applied for the present aqueous phase. These starches are preferably natural starches,
10 particularly native starches. In the context of this specification a starch is considered natural when it has not been subjected to any modification treatment other than an exposure to heat, an acid or a bleaching agent. Preferred native starches are potato starch, tapioca starch
15 and waxy maize starch.

Xanthan, pectin and certain proteins are examples of non-starch thickening agents which are natural and which impart to a properly prepared reduced fat spread the desired
20 emulsion stability. Thickeners as e.g. rice starch and waxy rice starch, although widely used in spread preparation, have appeared to be unsuited for use in the present invention. The co-presence of partial glycerides is always required for emulsion stability.

25

Thickeners which qualify may be used in any combination and in any suitable ratio for spread preparation, provided the combination possesses the claimed critical viscosity values.

30

Surprisingly, the spreads of the present invention in the absence of partial glycerides remain stable for at least seven days at an ambient temperature of 15°C and, depending on the spread's composition, even for six weeks at 25°C.

35 Preferably, the spread is prepared with solely natural

ingredients. However, non-natural ingredients may be included as well.

The spread according to the present invention does not contain a substantial amount of added partial glyceride. Since for emulsion stability present a spread must contain at least 0.1 wt.%, anyway at least 0.05 wt.% of partial glycerides, the content of partial glycerides in a spread according to the present invention is 0 - 0.1 wt.%, preferably 0 - 0.05 wt.%. These ranges cover small amounts of natural partial glycerides formed by fat hydrolisation. Such concentrations are not high enough for producing an ambient stable low fat spread.

15 An additional benefit of the invention is that expensive thickeners, such as gelatin and modified starches as used in current aqueous phase compositions, can be substituted by a much cheaper thickener, particularly a native starch, provided, of course, the aqueous phase is prepared according to the present invention.

For reasons of convenience the aqueous phase may be prepared with a pre-gelatinised starch which is a starch prepared from one of the starches as specified hereinbefore and which dispersed in an aqueous phase has been subjected to the heat treatment as described for the claimed process, but which thereafter has been dried e.g by spray drying. Such pre-gelatinised starch only needs to be dissolved with the other ingredients in the aqueous phase, without subsequent heating of the aqueous phase up to the peak temperature.

Without wishing to be bound by theory we believe that the starch thickener selected and processed according to the present invention exists in the aqueous phase for 90 - 100

wt.% in the form of particles swollen by water absorption and for 0 - 10 wt.% as disintegrated starch particles. The swollen starch particles disintegrate in the course of subsequent spread processing, but some survive and in the 5 final product can be identified by microscopy.

Manufacturing processes for obtaining low fat spreads starting with a fat phase and the present aqueous phase are well known to the man skilled in the art. These can be 10 found with all details in various textbooks such as K.A. Alexandersen, Margarine Processing Plants and Equipment (Vol.4, Bailey's Industrial Oil and Fat Products, Wiley and Sons Inc., New York 1996).

15 The Brabender Viscograph is the well known device for measuring temperature dependent viscosity behaviour of dispersed starches and other thickeners. The standard protocol for establishing the Brabender viscograph of a dispersion of starch or another thickening agent is 20 specified elsewhere in this patent. From the resulting viscograph the previously mentioned peak viscosity can be read, as well as the end viscosity which is the viscosity of the thickener dispersion when cooled down to 30°C at the end of the viscosity measurement.

25

Viscosities of thickener dispersions are concentration dependent. The viscograph of starches is established for an aqueous dispersion with a 3.3 wt.% starch content. The claimed viscosities at the peak temperature and the end 30 temperature relate to starch dispersions with that concentration.

When the viscograph of a non-starch thickener has to be established, first a few concentrations should be tried to 35 see whether for the dispersion a viscograph can be

established which shows a maximum when the heating proceeds according to the protocol. The minimum concentration for use of that thickener in the process for the spread preparation is the lowest concentration for which in the
5 viscosity measurement a peak viscosity of 70 BU is realized. Preferred thickeners moreover have an end viscosity of at least 60 BU at the same concentration. When the critical peak viscosity can not be attained by adapting the thickener concentration, that thickener does not
10 qualify for use in the invention.

For starch the minimum concentration has appeared to be about 2 wt.%, for xanthan about 0.5 wt.%, for pectin about 0.7 wt.% and for protein about 3.5 wt.%. Although the end viscosity value is not critical for obtaining a good
15 spread, it has appeared that low-fat emulsions prepared with a thickener having a >60 BU end viscosity withstand clearly better high ambient temperatures, of course in the absence, of partial glycerides.

20 Generally, the manufacture of the invented reduced fat spreads starts with preparing a pre-emulsion which either is fat continuous or water continuous. In the latter case the processing steps include an inversion of the initial O/W-emulsion into the desired W/O-emulsion. Processing
25 conditions for such inversion are known from the prior art. The inversion option, starting with an O/W-emulsion, is recommended when the end viscosity of the aqueous phase is higher than 90 BU and even essential when the end viscosity is higher than 100 BU.

30 The processes of the invention are as defined in the claims.

The terms premix and pre-emulsion are used interchangeably and refer to the crude emulsion, also denoted as

dispersion, resulting from the initial mixing of the aqueous phase with the fat phase.

The aqueous phase is prepared by first mixing all aqueous phase ingredients including the selected thickener. Then the aqueous phase is heated up to the temperature of the thickener's peak viscosity (further denoted as "peak temperature"). When starch is the thickening agent, heating beyond the peak temperature causes disintegration of the swollen starch particles. Therefore, heating the aqueous phase is stopped, preferably, a few degrees centigrade below the peak temperature. Then the thickened aqueous phase is mixed with the fat phase. In case of a relatively high peak temperature the aqueous phase, before mixing, is cooled down to a suitable mixing temperature, e.g. 60°C.

The obtained pre-mix is subjected to the cooling and working treatments which are usual for spread preparation. The starch which is chosen for the invention may be a so-called pregelatinized starch. The treatment of the aqueous phase containing such starch remains the same as for ordinary starch described before.

Optionally, the preparation of a separate pre-mix is substituted by directly proportioning both prepared phases from their storage tanks into the first scraped surface heat exchanger (Votator A-unit).

The concentration of the thickener in the aqueous phase is at least the dispersion concentration necessary for attaining the critical peak viscosity value mentioned in the Brabender protocol. This concentration, however, should never exceed a concentration which causes the thickened phase to gel at temperatures above 15°C.

Suitable concentrations for some common thickeners are found in the following ranges, for starches: 2-6 wt.%, for xanthan 0.5-1.0 wt.%, for pectin 0.4-1 wt.%, for protein 3.5-10 wt.%.

5

Table I shows properties of an aqueous dispersion of various thickeners.

TABLE I

10

Type of Starch	Conc.aq. dispersion	Peak Viscosity	Peak Temperature	End Viscosity	Quali fy ? (*)
	[wt.%]	[BU}	[°C]	[BU]	
Potato starch	3.3	91	92	163	Y
Waxy maize starch	3.3	106	83	60	Y
Tapioca starch	3.3	76	79	95	Y
Heat treated potato starch	3.3	128	95	200	Y
Rice starch	3.3	29	90	46	N
Waxy rice starch	3.3	13	82	23	N
Xanthan	0.5	72	40.8	82	Y
Pectin	0.7	172	40.4	158	Y
Dairy protein	3.5	73	42.6	0	Y

(*)Qualify for use (Y/N) in an aqueous phase for spread preparation.

Equipment, ingredients and conditions employed for carrying out the process of the invention (as far as not specified hereinbefore) are those common in spread manufacturing.

5

The spread according to the present invention comprises 25 - 60%, preferably 25 - 40 wt.% of fat phase.

The fat of the fat phase comprises triglycerides selected from vegetable or animal sources. Such vegetable

10 triglycerides include soybean oil, sunflower oil, palm oil, palm kernel oil, both high and low erucic rapeseed oil, coconut oil, olive oil, sesame oil, peanut oil, corn oil and mixtures thereof. Triglycerides from animal sources include fish oil, tallow and dairy fat. The fat phase
15 usually consist of a mixture of oils and fats. Note that throughout this specification the terms oil and fat are used interchangeably. A fat which is liquid at ambient temperature usually is denoted with oil.

20 Usually a structuring fat, e.g. hydrogenated palm oil, forms part of the fat phase composition. Such fat may have been subjected to chemical and/or physical modification such as blending, hydrogenation, fractionation and/or interesterification.

25 Preferably, the fat contained in the present spreads consists of triglycerides from a vegetable source. Preferably, the fat qualifies as natural.

Generally, the composition of the fat in the fat phase is
30 not critical. For organoleptic reasons, it is preferred to employ a fat that has a solid fat content at 35°C of less than 5 wt.% (calculated on the weight of the fat), more preferably less than 3 wt.%. For good spreading the solid fat content at 20°C is suitably between 5 and 30 wt.%,
35 preferably between 5 and 20 wt.%. At 5°C the solid fat

content suitably is between 5 and 50 wt.%, preferably between 10 and 40 wt.%.

The solid fat content (N-value) indicates the amount of fat present in the solid state and is expressed as a weight percentage on total fat. The N-value can be determined conveniently by the method as described in Fette, Seifen, Anstrichmittel, 80 (1978), 180-186.

Specifically, the composition of the fat depends on the desired consistency of the final product which is either a stick, a hard tub or a soft tub spread.

Optional spread ingredients are flavouring agents, lactose, salt, preservatives, acidifiers, vitamins, and colouring agents. The compositions may comprise dairy ingredients, such as proteins, which can be derived from any dairy source.

The spread is given a pH in the range 3 to 10, preferably 3.5 to 5.5, with a suitable acidifier such as lactic acid or citric acid.

Optimum organoleptic characteristics (quick oral breakdown of emulsion, absence of waxy mouthfeel) are obtained when the fat phase completely melts in the range 20°-45°C, more preferably 30°-37°C.

For cooling and working the premix is conducted according to prior art methods through a sequence of scraped surface heat exchangers (A-units) and at least one pin stirrer (C-unit).

Preferably the premix is conducted through an A1-A2-A3-C sequence of three scraped surface heat exchangers and a pin stirrer. For the non-inversion process suitable exit temperatures after the A-units (shaft speeds 800 rpm) are

successively: (ex A1) $25 \pm 2^{\circ}\text{C}$, (ex A2) $18 \pm 2^{\circ}\text{C}$, (ex A3) $9 \pm 2^{\circ}\text{C}$. A suitable small scale pin stirrer has a volume of 3 liters, the stirrer speed being in the range of 150 - 600 rpm and typically is 250 rpm.

5 For the inversion process suitable exit temperatures after the A-units (shaft speeds 800 rpm) are successively: (ex A1) $20 \pm 2^{\circ}\text{C}$, (ex A2) $12 \pm 2^{\circ}\text{C}$, (ex A3) $7 \pm 2^{\circ}\text{C}$. The pin stirrer, where the inversion step takes place, is a high speed pin stirrer, preferably with a shaft speed of about
10 800 rpm.

Brabender Viscograph Protocol

15 The Brabender Viscograph is a common device for viscosity measurements usually of starch dispersions, which use has been a de facto standard in the starch industry for more than half a century. For deciding whether a thickener qualifies for use in the invented spread preparation a
20 Brabender "viscograph" of an aqueous dispersion has to be established. The viscograph is a graph of viscosity values plotted against temperature.

For establishing the viscograph e.g. of a starch, the
25 device measures the viscosity of a slurry prepared by dispersing in water 15 g of a starch (or another thickening agent) up to a total volume of 450 ml. The spindle of the Viscograph, rotating at a speed of 75 rpm, should be fully covered with the starch slurry. While the temperature of
30 the slurry is raised gradually, its viscosity is continuously monitored, measured and measured. The temperature variation follows a heating regime mentioned below. The viscograph consists of a graph of the measured

viscosities, expressed as Brabender units, and plotted against the slurry temperature.

The heating regime of the viscograph measuring protocol
5 comprises heating a slurry from 45°C up to 90°C at a constant rate of 1.5°C/minute, maintaining the temperature at 90°C for 15 minutes, cooling the slurry down to 30°C at a rate of 1.5°C/minute and maintaining the temperature at 30°C during a further 15 minutes.

10

The viscograph of a suited thickener dispersion shows a maximum viscosity, to be denoted as the "peak viscosity". The temperature at which the peak viscosity is attained is denoted as the "peak temperature" or, for a starch
15 thickener, the "gelatinisation temperature". The viscosity value measured at the end of the protocol (30°C) is the so called "end viscosity". The measured peak viscosity value should exceed the claimed value for qualifying the thickener for use in a suitable aqueous phase. The kind of
20 thickener and its found peak temperature are important parameters in the preparation of the aqueous phase.

Assessment of Emulsion Stability

25 Emulsion stability is assessed by an assay which is commonly used for establishing spread stability and which consists of vigorous spreading product samples on thick paper. The samples a., b. and c. are collected after storage of the spread samples for

30

- a. 1 week at 5°C,
- b. 10 weeks at 5°C,

- c. 1 week at 15°C, then storage for 2 days at 25°C and finally, storage for 1 day at 10°C (temperature cycling).

The assay uses the following scores:

5

- 1: excellent spreading: no softening during spreading
- 2: good spreading: products may be softer after spreading
- 3: moderate spreading: products shows visible oil or water droplets after spreading
- 10 4: unacceptable spreading: products shows large water or oil droplets
- 5: product is completely destroyed

Spreads are considered ambient stable according to claim 1
15 when they pass at least test c. with a score being 1 or 2.

The invention is illustrate by the following examples.

20 All percentages in this specification are weight percentages unless indicated otherwise.

25

EXAMPLES 1 - 6

Spread preparation using non-inversion process

The composition of the phases, the critical viscosity value
30 of the thickener and the scores of the stability assessment are summarized in Table II.

For cooling and working the pre-emulsion of both phases is
conducted through an A1-A2-A3-C sequence of three scraped
35 surface heat exchangers and a pin stirrer. Suitable exit

temperatures after the A-units (shaft speeds 800 rpm) are successively: (ex A1) $25 \pm 2^{\circ}\text{C}$, (ex A2) $18 \pm 2^{\circ}\text{C}$, (ex A3) $9 \pm 2^{\circ}\text{C}$. The pin stirrer has a volume of 3 liters and a stirrer speed of 250 rpm.

5

TABLE II

EXAMPLE	1	2	3	4	5	6
Fat phase	%	%	%	%	%	%
Fat	60.00	40.00	40.00	40.00	40.00	40.00
Lecithin	0.24	0.24	0.24	0.24	0.24	0.24
Natural colour agent	0.10	0.10	0.10	0.10	0.10	0.10
Aqueous phase						
Water	37.26	57.26	56.76	55.26	55.26	55.26
Maize starch					1.05	
Waxy maize starch	1.00	1.00	1.50	3.00	1.95	
Potato starch						3.00
Skimmed milk powder	0.40	0.40	0.40	0.40	0.40	0.40
Salt	1.00	1.00	1.00	1.00	1.00	1.00
W/O processing succesful ?	yes	no	no	yes	yes	no
Spread.test a.	1			1	1	
Spread.test b.	1			1	2	
Spread.test c.	1			1	1	
Viscosity (Brabender Units)						
Peak viscosity (aim >70)	100	60	95	140	105	135
End viscosity (aim pref. >60)	60	25	55	100	95	265

Only samples 1, 4 and 5 could be obtained with the non-10 inversion process as described above. When trying the

process for samples 2, 3 and 6, the oil-continuous pre-mix reverted into a water-continuous premix a few minutes after preparing the premix.

The same thickening agents have been successfully employed 5 in examples 9-12.

Samples 1, 4 and 5 were temperature stable according to the spreading tests a., b. and c.: no visible oil or water exudation. The spreads remained stable even when exposed to the temperature cycling test c.

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EXAMPLES 7 - 17

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Spread preparation using inversion process

The composition of the phases, the critical viscosity value of the thickener and the scores of the stability assessment 20 are summarized in Tables IIIa and IIIb.

For cooling and working the pre-emulsion of the phases is conducted through an A1-A2-A3-C sequence of three scraped surface heat exchangers and a pin stirrer.

25 Suitable exit temperatures after the A-units (shaft speeds 800 rpm) are successively: (ex A1) $20 \pm 2^{\circ}\text{C}$, (ex A2) $12 \pm 2^{\circ}\text{C}$, (ex A3) $7 \pm 2^{\circ}\text{C}$. The high speed pin stirrer, where the inversion step takes place, has a shaft speed of about 800 rpm.

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All samples were successfully obtained by the inversion process. Only samples 13 and 14 failed to pass the spreading tests, as could be expected from the inadequate BU-values of the used rice starch thickener.

TABLE IIIa

EXAMPLE	7	8	9	10	11	12
Fat phase	%	%	%	%	%	%
Fat	40	40	40	40	34	40
Lecithin	0.24	0.24	0.24	0.24	0.24	0.24
Natural colour agent	0.10	0.10	0.10	0.10	0.10	0.10
Aqueous phase						
Water	56.3	55.3	56.3	55.3	61.7	56.3
Tapioca starch	2.00	3.00				
Potato starch			2.00	3.00	4.00	
Waxy maize starch						2.00
Skimmed milk powder	0.40	0.40	0.40	0.40		0.40
Salt	1.00	1.00	1.00	1.00		1.00
Inversion process ?	yes	yes	yes	yes	yes	yes
Spread. test a.	1	2	1	1	1	1
Spread. test b.	1	2	1	1	2	1
Spread. test c.	1	2	1	1	1	1
Viscosity (Brabender Units)						
Peak viscosity (aim >70)	72	115	120	135	220	105
End viscosity (aim pref. >60)	105	130	240	265	325	70

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Sample 11, having the lowest fat content, was subjected to an extra severe temperature treatment. Even when stored for six weeks at 30°C, this "stability-sensitive" sample nevertheless remained stable and did not show oil or water exudation.

TABLE IIIb

EXAMPLE	13	14	15	16	17
Fat phase	%	%	%	%	%
Fat	40	40	38	38	38
Lecithin	0.24	0.24	0.24	0.24	0.24
Natural colour agent	0.10	0.10	0.10	0.10	0.10
Aqueous phase					
Water	55.3	55.3	60.6	60.4	51.1
Rice starch	3.00				
Waxy rice starch		3.00			
Xanthan			0.56		
Pectin (Vidochrem D)				0.7	
Skimmed milk powder (contains 35% dairy protein)	0.40	0.40			10.0
Salt	1.00	1.00	0.56	0.56	0.56
Inversion process ?	yes	yes	yes	yes	yes
Spread. test a.	4	3	1	1	1
Spread. test b.	5	5	1	1	1
Spread. test c.	4	5	2	2	2
Viscosity (Brabender Units)					
Peak viscosity (aim >70)	55	25	72	172	73
End viscosity (aim pref. >60)	70	65	82	158	0

5 Samples 15-17 refer to non-starch thickeners. With xanthan and pectin stable emulsions were obtained. Sample 17 showed storage stability which is good at 5°C, but less at ambient temperature. The dairy protein thickener has a good peak viscosity, but an inadequate end viscosity.

CLAIMS:

1. An edible fat continuous water in oil emulsion spread which is stable at ambient temperature, in which spread
5 partial glycerides are either absent or when present are an added ingredient resulting in a total concentration of up to 0.1 wt% on spread, which spread contains 25 - 60 wt% on spread of a continuous triglyceride fat phase and a dispersed aqueous phase which contains a concentration of at
10 least X wt% on aqueous phase of a thickening agent wherein a peak viscosity in a viscosity graph of an aqueous dispersion of said thickening agent of said concentration X is at least 70 BU, where said viscosity graph is established according to a Brabender Viscograph protocol comprising: a total
15 volume of said aqueous dispersion of 450 ml; the spindle of the Viscograph, rotating at 75 rpm being fully covered by said aqueous dispersion; heating the dispersion from 45°C to 90°C at a rate of 1.5°C/min.; maintaining the temperature at 90°C for 15 mins.; cooling at 30°C at a rate of 1.5°C/min.
20 and maintaining the temperature at 30°C for 15 mins.
2. The spread according to claim 1 containing 25 - 40 wt% on spread of said fat phase.
- 25 3. The spread according to claim 1 or 2, wherein the total concentration of partial glycerides is up to 0.05 wt%.
4. The spread according to claim 1, 2 or 3, wherein the thickening agent is a native starch.
30
5. The spread according to claim 4, wherein the starch is potato starch, tapioca starch, maize starch or waxy maize starch.

6. A spread according to claim 1, 2 or 3, wherein the thickening agent is pectin, cellulose, cellulose derivative, xanthan, carrageenan or galactomannan.

5 7. A spread according to claim 1, 2 or 3, wherein the thickening agent is a protein.

8. A spread according to claim 7, wherein said protein is a dairy protein or soy protein.

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9. A spread according to claim 1, 2 or 3, wherein an end viscosity in said viscosity graph is at least 60 BU.

10. A spread according to claim 1, 2 or 3, wherein the spread contains only natural ingredients and is obtained by natural processing.

11. A spread according to claim 1, 2 or 3, wherein the spread passes with a score of 1 or 2 an emulsion stability assay comprising: storing a sample of said spread for 1 week at 15°C, 2 days at 25°C and 1 day at 10°C to provide stored sample; vigorously spreading said stored sample on thick paper; and scoring as follows:

- 25
- 1: excellent spreading: no softening during spreading
 - 2: good spreading: products may be softer after spreading
 - 3: moderate spreading: products shows visible oil or water droplets after spreading
 - 30 4: unacceptable spreading: products shows large water or oil droplets
 - 5: product is completely destroyed.

12. A spread according to any one of claims 1 to 11, which is substantially free of partial glyceride.

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13. A process for the manufacture of an edible water in oil spread according to any one of claims 1 to 12 which comprises the steps:

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- a. preparing an aqueous phase and a fat phase,
 - b. mixing aqueous phase and fat phase to provide a pre-emulsion containing 25 - 60 wt% of continuous fat phase, and
 - c. subjecting the pre-emulsion to cooling and working to
- 10 provide a plastic water in oil emulsion spread, wherein the aqueous phase includes said thickening agent, and the aqueous phase before mixing with the fat phase is heated to the temperature of said thickening agent's peak viscosity and then is mixed with the fat phase.

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14. The process according to claim 13, wherein said pre-emulsion contains 25 - 40 wt% of continuous fat phase.

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15. A process for the manufacture of an edible water in oil spread according to any one of claims 1 - 12, which comprises the steps:

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- a. preparing an aqueous phase and a fat phase,
 - b. mixing aqueous phase and fat phase to provide a pre-emulsion containing 25 - 60 wt% of dispersed fat phase,
 - c. subjecting the pre-emulsion to cooling and working to
- invert the pre-emulsion and provide a plastic water in oil emulsion spread,
- wherein the aqueous phase includes said thickening agent and the aqueous phase before mixing with the fat phase is heated
- 30 to the temperature of the thickening agent's peak viscosity and then is mixed with the fat phase.

16. The process according to claim 15, wherein said pre-emulsion contains 25 - 40 wt% of dispersed fat phase.

17. The process according to any one of claims 13 to 15, wherein the thickening agent is a starch.

18. The process according to claim 17, wherein the starch
5 is a pre-gelatinized starch.

19. The process according to claims 17, wherein the thickening agent is a native starch.

10 20. The process according to claim 17, wherein the starch is potato starch, tapioca starch, maize starch or waxy maize starch.

21. The process according to any one of claims 13 o 16,
15 wherein the thickening agent is pectin, cellulose, cellulose derivative, xanthan, carrageenan or galactomannan.

22. The process according to any one of claims 13 to 16, wherein the thickening agent is a protein.

20

23. The process according to claim 21, wherein the protein is a dairy protein or soy protein.

24. The process according to any one of claims 13 to 16,
25 wherein the content of partial glycerides in the pre-emulsion is 0 - 0.1 wt%.

25. The process according to claim 23, wherein the content of partial glycerides is 0 - 0.05 wt%.

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26. The process according to claim 24 or 25, wherein the pre-emulsion is substantially free of partial glyceride.

27. The process according to any one of claims 13 - 22 and 26, wherein solely ingredients that qualify as natural are used.