EUROPEAN QUALIFYING EXAMINATION 1994

PAPER B
CHEMISTRY

This paper comprises:

INSTRUCTIONS TO CANDIDATES

In this paper, you should assume that a European patent application for all the Contracting States comprising the appended documents * has been filed and that the European Patent Office has issued the annexed official communication.

You should accept the facts given in the paper and base your answers upon such facts. Whether and to what extent these facts are used is your responsibility.

You should not use any special knowledge you may have of the subject-matter of the invention, but are to assume that the prior art given is in fact exhaustive.

Your task is now to draft a full response to the official communication. The response should be a letter to the EPO, accompanied, if appropriate, by an amended set of claims. No amendments to the description should, however, be made.

The claims should afford the broadest protection possible while meeting the requirements of the Convention. In your letter of response you should set out your arguments in support of the patentability of the independent claim(s).

If your response includes a proposal to make any part of the application the subject of one or more divisional applications, you should in a note, clearly identify the subject-matter of the independent claim of such divisional application(s) and the justification for this. However, it is not necessary to draft the wording of the independent claim for the or each divisional application.

In addition to your chosen solution, you may – but this is not mandatory – give, in a note, the reasons for your choice of solution, for example, why you selected a particular form of claim, a particular feature for an independent claim, a particular piece of prior art as starting point or why you rejected or preferred some piece of prior art. Any such note should however be brief.

It is assumed that you have studied the examination paper in the language in which you have given your answer. If this is not so, please indicate on the front page of your answer in which language you have studied the examination paper. This always applies to candidates who – after having filed such a request when enrolling for the examination – give their answer in a language other than German, English or French.

Different sets of claims for those states which have made reservations under Article 167 (2) EPC are not required.

* These documents do not necessarily constitute the only or best solution to the task set in Paper A (Chemistry).

Description of the Application

The present invention relates to emulsifiers and foaming agents based on polyglycerol fatty acid esters, especially for use in the food industry. More specifically, the invention is concerned with the problem of producing food which has a reduced caloric value - in accordance with the trend towards "healthier" eating and the use of slimming products - but do not involve a loss of optical and other sensory qualities.

It has become apparent that many of the emulsifiers hitherto used in the food industry, especially esters of sugar alcohols and their polyoxyethylene derivatives, are not without physiologically undesirable effects. Document I therefore suggests the use, as suitable emulsifiers, of water-soluble esters and partial esters obtained from polyglycerols and fatty acids having a relatively short chain-length. The document indicates that the polyglycerols can comprise 2 to 10 glycerol units bound to each other and have 4 to 12 hydroxyl groups. Accordingly, the number of fatty acids esterified thereto may range from 1 to 12. The compounds exhibit different degrees of water-solubility, depending on their composition. Short polyglycerol chains, long-chain fatty acids and high rates of esterification are said to reduce water-solubility to an undesirable extent. Only two esters of hexanoic and octanoic acid are cited as examples which were investigated.

Document II describes a calorie-reduced and shelf-stable edible emulsion, especially a butter-like spread with a slightly foamed consistency which was prepared using 5 to 7% by weight of a polyglycerol fatty acid ester or a mixture of such esters. These esters and their properties are not described in more detail.

The present invention relates to a group of new compounds which can be employed for various purposes as emulsifiers or foaming agents.

With the help of these compounds products of varying texture, ranging from creamy, slightly expanded substances to products resembling highly foamed whipped cream can be prepared. The properties of such products are significantly influenced by the emulsifiers or foaming agents used. In particular, according to a preferred embodiment of the invention, these compounds can be used to make an ice-cream substitute.

Although polyglycerol fatty acid esters are known, in principle, from the above-mentioned documents, the specific compounds according to the invention have not yet been described. These are certain esters from glycerine derivatives with a range of fatty acids.

Products of the above-mentioned type are normally based on aqueous emulsions. A common feature of the products stabilised with the present emulsifiers is that they have a significantly lower caloric value than their conventional equivalents because they make it possible, for example, to reduce the proportion of fatty ingredients or indeed to replace such ingredients altogether. One of their advantageous features is that the substitution of ingredients with a low caloric value for the usual materials does not impair taste and other oral sensations (mouthfeel).

The invention relates not only to the esters themselves but also to a new method of preparing them and a particularly elegant way for processing and using them.

The subject-matter of the invention therefore comprises, as its first aspect, polyglycerol esters having from 3 to 10 glycerol units linked to each other by ether groups in a polyglycerol chain, one or more of the hydroxyl groups in the said chain being esterified with saturated or unsaturated straight-chain fatty acid residues each having 12 to 26 carbon atoms.

Suitable fatty acids range from those straight-chain fatty acids having a total of 12 carbon atoms (lauric acid) to those having a total of 26 carbon atoms (cerotic acid), including those with 14 (myristic acid), 16 (palmitic acid), 18 (stearic acid) and 20 (arachidic acid) carbon atoms. These can be used to prepare compounds which are completely water-soluble or compounds which are completely oil-soluble.

The compounds suitable for our purposes proved to be those with one or two fatty acid ester groups, preferably those which are not water-soluble but show good water-dispersability. The palmitic and arachidic esters yield particularly stable emulsions which lend themselves well to further processing and can be foamed. The stearates are even better suited to our purposes. Here, special mention is made of hexaglycerol distearate and decaglycerol distearate. The best product of all is triglycerol monostearate.

A second aspect of the invention involves a process for the preparation of such esters, by converting the relevant polyglycerol with an ester of such a straight-chain fatty acid in the presence of a fatty acid soap and a catalyst. Especial mention is made of methyl esters, or esters with another alcohol boiling at up to about 100°C.

Almost any fatty acid soap can be used for the process, provided that a certain proportion of it has a fatty acid chain length of less than 15 carbon atoms. This proportion should be at least 8% by weight of the total amount of the fatty acids bound in the soap. Soaps with a very short chain length (6 carbon atoms or more) may be used, but best results are obtained using soaps with a chain length of 10 to 12 carbon atoms.

The molar ratio between the reactants is also very important. The ratio of soap to polyol must be between 0.1:1 and 2.5:1; with

regard to yield and reaction time, the optimum ratio is approximately 1.6:1. The ratio of ester to polyol must be between 10:1 and 20:1.

Any of the normal catalysts for this type of reaction may be used; for example, any strong base, such as sodium or potassium hydroxide, may be used. Solvents can also be used. The pressure is adjusted so that the low-boiling alcohol (for example, methanol) released during the reaction can be removed by distillation. The temperature is normally maintained within the range of 100 to 180°C, preferably within the range of 110 to 150°C.

Once the polyglycerol esters have been prepared, they have to be converted into a usable form. The problem is that they have a wax-like consistency which makes it difficult to blend them. One known process for handling wax-like compounds involves blending them in a molten state - at a temperature above their melting-point, e.g. at least 70°C - with some of the other solid ingredients with which they are to be further processed. Another known method of processing wax-like products is to grind the deep-frozen materials to a powder at temperatures ensuring that they remain sufficiently brittle. However, at this grinding the process conditions must be controlled in a very complicated way and the grinder often becomes clogged.

A further aspect of the invention consists in the conversion of the ester according to the invention into a finely divided form by means of a particular method. This is achieved by passing the molten ester through a spray dryer into cold air (at a temperature of less than 30°C), in such a way that, on emerging from the spray nozzle, the material solidifies into fine particles. At this stage of the process - as in the case of the grinding method - other ingredients may be added if necessary to prevent the resultant fine particles from sticking together.

The polyglycerol ester has a sufficient emulsifying effect in amounts of at least 0.3% by weight. The texture of the resultant emulsion varies according to the amount of the ester. If the concentration exceeds 5% by weight, the product takes on a fatty, butter-like consistency, even if whipped with air. In the course of our experiments we found that a concentration of 2 to 5% by weight of the polyglycerol ester yields a mix, which does not resemble butter and which can be foamed to provide a high degree of expansion and is suitable for use as a topping resembling whipped cream. The amount of expansion is determined by the extent of whipping or mixing.

For this purpose a suitable amount of hot water and the other ingredients are added to the polyglycerol ester, and so much air is then beaten into the mixture with a mechanical mixer (an ordinary household electric mixer will do) that the resultant foam does not expand any further. The temperature of the water is not particularly important: it can be anywhere within the range of 50 to 100°C. However, to improve the texture of the mixture, the temperature at the time of whipping must be between 50 and 60°C, preferably between 52 and 57°C.

Other ingredients may also be added: for example, fats, flavouring, colouring and bodying agents such as milk powder, whey powder, dried egg, sugar or artificial sweetener. Dextran is an example of a suitable bodying agent, if a very low caloric value is desired.

The fully expanded foam products collapse after a short time unless a hydrophilic vegetable gum is added as a foam stabiliser, in an amount ranging from 0.2 to 3.5% by weight of the aqueous phase. Gum arabic (acacia gum), xanthan gum, guar gum or carrageenan are particularly suitable. However, it must be remembered that

vegetable gums tend to inhibit foaming or even prevent it altogether. When preparing fully expanded foams (e.g. for toppings), the gums can therefore only be added after the foam has developed. The resultant mixture is smooth and substantially tasteless.

After numerous unsuccessful attempts we found that, for frozen desserts such as ice-cream, the amount of bodying agents and the amount of the above-mentioned non-aqueous ingredients altogether should not exceed, respectively, 45 and 55% by weight of the total mixture. Thereto the polyglycerol ester according to the invention (0.5-1% by weight of the total) and water are added. Blending and whipping are adjusted to provide a 0.5 to 1.1-fold expansion (a so-called overrun of 50 to 110%), in order to obtain a stable emulsion with good mouthfeel.

As well as acting as a stabiliser, the vegetable gum also improves the texture of the final product. For example, it delays or prevents unwanted crystallisation of ice or sugar. For frozen desserts, a liquid melt is desired. Excess stabiliser prevents this and leads to the formation of a stiff, pudding-like melt - a phenomenon known as "melt resistance". In the present case, the amount of stabiliser is therefore limited to between 0.2 and 0.5% by weight.

The process described in the second aspect of the invention for producing polyglycerol esters according to the invention is also suitable for producing other esters on the basis of polyols having at least 3 hydroxyl groups and of fatty acids which are in a liquid state at the reaction temperature. However, the method is best suited to the polyglycerol esters cited above.

The following examples are intended to serve as further illustrations of the invention. The percentages quoted refer to proportions by weight.

Example 1

Step 1: 690 g (7.5 mol) of glycerol and 6 g of KOH were charged under nitrogen in a flask with a mechanical mixer and heated to about 260°C until approximately 90 g of water had distilled off. The yellow viscous oil was then dissolved in distilled water, treated with a little activated charcoal and filtered off. The water was removed by distillation. A virtually colourless and odourless triglycerol was obtained.

Step 2(a): 18 g (75 mmol) of the triglycerol obtained in step 1 was dissolved in a beaker at room temperature with 1.05 g of 85% KOH solution (16 mmol KOH) and 25 ml of water.

Step 2(b): 314 g (about 1060 mmol) of methyl ester of soybean oil fatty acids (>95%, C_{14} to C_{20}) was combined with 20.8 g (about 120 mmol) of a commercial mixture of fatty acids (mainly having a chain length of 10 carbon atoms). The resultant mix was then neutralised with an aqueous solution of 85% KOH (120 mmol KOH).

Step 3: The solutions from Steps 2(a) and 2(b) were mixed at a temperature of 60°C and a pressure of 3 mbar (3hPa). These conditions were maintained constant for 30 minutes. Conversion to a mixture of triglycerol mono- and di(soybean oil fatty acid) esters was almost complete. The product was washed several times with an aqueous soda solution and isopropyl alcohol. Further purification was carried out by extraction and steam distillation. The resultant solid was melted and passed through a spray dryer into air having a temperature of 25°C. By this means, a finely comminuted product was obtained which stored well for an extended period at temperatures below 30°C.

Example 2

In the following example, 8 g of triglycerol monostearate was dispersed in 8 g of water and kept at 52-57°C overnight. On the next day, the following additives and water were added to this dispersion to provide a total of 1000 g:

Skim milk solids	166.2 g
Sugar	184.9 g
Guar gum	2.0 g
Carrageenan	1.0 g
Polysorbate 80	0.4 g
Water	629.5 g

The mix was then pasteurised at 74°C for 20 seconds. Flavours and colours having a total weight of 2 g were added, and the mixture was homogenised and loaded into a commercial soft-serve ice-cream freezer. The freezer was adjusted to provide for 60% overrun. An extremely light-textured ice-cream was obtained.

Almost identical results were achieved using hexaglycerol distearate and decaglycerol diarachidinate. However, the texture of the foam was not so fine, and with the arachidic ester, the foam was somewhat coarser than with the distearate.

Example 3

A calorie-reduced concentrate for toppings was produced using 46 parts by weight of sucrose (sugar), 25 parts by weight of a hydrogenated coconut oil and 5 parts by weight of a triglycerol monoester with fatty acid derived from dehydrated castor oil (mainly octadecadienic acids, $C_{18}H_{30}COOH$), with 24 parts by weight of water. The sugar and emulsifier were combined and then dispersed in the water at a temperature of 45°C. The hydrogenated oil was then added in a high-speed mixer.

The concentrate was added to an the same amount by weight of c
milk and whipped for 3 minutes at 5°C in a household mixer runni
at maximum speed to achieve a 5 to 6-fold expansion. One part by
weight of gum arabic was then carefully worked into the mixture.
The product had a pleasant texture with good mouthfeel and flavour.
It was suitable for use as a stiff, stable "cream" topping.

Claims

1. Polyglycerol esters having from 3 to 10 glycerol units linked to each other by ether groups in a polyglycerol chain, one or more of the hydroxyl groups in the said chain being esterified with saturated or unsaturated straight-chain fatty acid residues each having 12 to 26 carbon atoms.

2. A process for the preparation of fatty acid esters by reacting a polyol having at least 3 hydroxyl groups with an ester of a straight-chain fatty acid being in the liquid state at the reaction temperature, in the presence of a fatty acid soap and a catalyst.

3. A process as claimed in Claim 2, characterised in that the polyol used is a polyglycerol having from 3 to 10 glycerol units linked to each other by ether groups in a polyglycerol chain and that the straight-chain fatty acid used has 12 to 26 carbon atoms.

4. A process for converting the ester as claimed in Claim 1 into a finely divided form, characterised in that the ester in molten form is passed through a spray dryer into cold air in such a way that, on emerging from the spray nozzle, the material solidifies into fine particles.

5. The use of the polyglycerol ester as claimed in Claim 1 in foamed food products, in quantities of 0.3 to 5% by weight.

6. The use as claimed in Claim 5, characterised in that the food product is a topping.

7. The use of the polyglycerol ester as claimed in Claim 5, characterised in that the food product in question is an ice-cream substitute.

Communication

1. Polyglycerol esters having from 3 to 10 glycerol units bound to each other and obtained with C_{12} to C_{26} fatty acids are known per se. Triglycerol monostearate is cited in Documents III and IV, while Document IV refers to the mono- and diesters of tri-, tetra-, hexa- and decaglycerols with stearic, palmitic and arachidic acids as well. In the application, these compounds are said to be preferred. Claim 1 therefore lacks novelty under Articles 52(1) and 54(1) and (2) EPC.

2. Document V describes the conversion of polyols with fatty acids in the presence of short-chain soda soaps and caustic soda solution (NaOH) as a known process. Specific reference is made to glycerol, i.e. a triol, and to liquid or molten fatty acids, including soybean oil fatty acids, which were also used in example 1 in the present application. Claim 2 therefore also lacks novelty.

3. The novelty of Claim 3 is acknowledged, since none of the documents I to V disclose all the features of Claim 3 (dependent on Claim 2) in conjunction with one another. However, having regard to the process disclosed in Document V, it is currently not apparent where the inventive step could be found. Claim 3 does not therefore appear to meet the requirements of Articles 52(1) and 56 EPC.

4. The use of polyglycerol esters as emulsifiers in food products in amounts specified in claim 5 is already disclosed in Document IV. The subject-matter of Claim 5 therefore also lacks novelty.

5. Although Documents II and IV do not describe the use of the known emulsifiers in toppings or ice-cream substitutes, it is not apparent where the inventive step could be found vis-à-vis these documents in the case of the subject-matter of Claims 6 and 7. Particularly because both documents also refer to the foamed texture of the food product in question and that the use of such emulsifiers in amounts of 2.5% by weight - even in highly foamed products - is already known from Document III.

6. Moreover, the subject-matter of Claim 2 does not appear to belong to the group of inventions to which Claims 1 and 3 to 7 relate. Claims 1 and 3 to 7 relate exclusively to emulsifiers with certain special technical features purporting to distinguish the claimed subject-matter according to page 1 from the cited Documents I and II. Claim 2 does not appear to refer to these special features and the contribution they make to the invention vis-à-vis the prior art (see Article 82 and Rule 30(1) EPC).

7. You are therefore requested to file claims which take account of the above objections.

   In your reply, you should also specify how the new claims differ from the state of the art and indicate the significance of that difference; furthermore, you should describe the invention in such a way that the technical problem and its solution vis-à-vis the state of the art can be understood (see Rule 27(1)(c) EPC).

8. According to the Guidelines for Examination (C-III, 4.4), an independent claim should specify clearly all of the essential features needed to define the invention. This means that each independent claim must specify all the features needed to solve the problem to which the invention relates.

With regard to this point, Claim 3, for example, does not m the requirements of Article 84 EPC. The description indicates that the fatty acid soaps used in the reaction have to contain certain amounts of specific fatty acids having a chain length of less than 15 carbon atoms. The molar ratio in the reaction mixture is evidently also of key importance.

The temperature of the cooling medium in Claim 4 also appears to be crucially important.

9. You are reminded that the application may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed (Article 123 (2) EPC). Bearing mind the requirements of the Guidelines (E-II, 1 and C-VI, 5.4), you should also specify how any new features of newly-worded claims are directly and unambiguously derivable from the information presented in the original application documents.

DOCUMENT I (State of the Art)

(This document is identical to Document I of Paper A)

Recent amendments to the legislation governing food, drugs and cosmetics have imposed strict limits on the use of emulsifiers in the food industry. Due to recent results in research many of the emulsifiers which were widely employed in the past may now only be used in very small quantities. These formerly popular emulsifiers include esters of sugar alcohols and their polyethoxylated derivatives, for example, the polyoxyethylene sorbitan esters, which are now only allowed in extremely low concentrations because they are not broken down in the body but they must be excreted or they are possibly deposited in certain organs in the body. They may give rise to cumulative effects.

Under these circumstances there was a need for physiologically acceptable water-soluble emulsifiers with broad applicability. We have identified a class of polyglycerol esters which largely meets these requirements. These compounds in question are obtained from polyglycerols and fatty acids having a relatively short chain-length which are bound to one or more hydroxyl groups of the glycerol component. We have investigated a number of these compounds and found that water-solubility is insufficient if at least two of the following conditions apply: short polyglycerol chains, long-chain fatty acids, and/or high rates of esterification.

The polyglycerols have 4 to 12 hydroxyl groups, depending on the number of glycerol units which can be between 2 and 10. In theory,

therefore, the number of fatty acids bound to the polyglycerol be between 1 and 12. Combinations of different fatty acids can be used.

The compounds which we investigated included tetraglycerol mono-octanoate and decaglycerol tetrahexanoate, to mention two specific compounds.

DOCUMENT II (State of the Art)

(This document is identical to Document II of Paper A)

The invention relates to a food product comprising a shelf-stable emulsion with a low caloric value, prepared with the following ingredients (proportions by weight):

0.1 to 1 parts neutral fat
1 part water
1 to 2 parts dextran
6 to 8% (relative to the total weight of the emulsion) of polyglycerol fatty acid esters serving as emulsifiers, and flavouring and colouring or combinations thereof.

Food products with a low caloric value have repeatedly been prepared in the past. However, the results of these experiments have always lacked the necessary shelf-stability which is especially important for industrial use. For example, an edible emulsion comprising sorbitan monostearate, sugar and water has been disclosed, but it was found that after only a short period of storage at room temperature, an emulsion of this type takes on the stiff consistency of a non-spreadable shortening.

Other known preparations showed better storage-stability but were highly viscous and had an objectionable flavour, owing to the fact that they contained a high proportion of potassium oleate - i.e., a soap.

As well as being appreciably more stable, the present product has

excellent spreading properties; it also shows good resistance microbial spoilage and is void of any soapy flavour.

Example

A stable aqueous emulsion was prepared using a mixture of poly-glycerol esters as an emulsifier. The emulsion concentrate was made up of 20% fat, 25% water, 49% dextran and 6% emulsifier. A quantity of butter colour and flavour was added.

The emulsion concentrate was prepared by blending all the ingredients except the water, which was subsequently added at a temperature of 85°C. The mixture was stored for 24 hours at room temperature and mechanically whipped to obtain a slightly expanded butter-like spread.

DOCUMENT III (State of the Art)

We have found that a shaving foam can be prepared by foaming polyglycerol fatty acid esters in an aqueous phase. In general, 1.5 to 7% based on the total weight is a sufficient amount. The preferred quantity is 2.5 to 5%. To improve the consistency of the foam from 2 to 10% by weight of a water-insoluble powder such as dextran, cellulose, talc, silica, sodium silicoaluminate, Fuller's earth, clay, etc. is preferably included. Suitable perfumes can be included to impart fragrance, and a preservative may be added to safeguard against microbial attack. The result is a unique shaving cream free of soap, fat and oil, and which functions without additional water. It allows an extremely close shave, and the residue may be wiped off or washed away. It leaves the skin with the feeling of having been treated with cooling cream.

Example

6.5 g of glycerol, 2.5 g of triglycerol monostearate and 6.5 g of water were formed into a homogeneous cream-like paste by warming to 57°C. The mixture was then allowed to cool and mixed with 80 g of water, 3 g of sodium silicoaluminate, 1.5 g of a 5% solution of menthol in alcohol and 0.03 g of a preservative consisting of 1 part by weight of propylparaben and 4 parts by weight of methylparaben. The resultant product was used as the liquid fill for an aerosol dispenser (a pressurised storage container and dispenser serving to deliver the desired quantities of foam). Suitable propellants and foaming agents are volatile inorganic or organic compounds which are at least partly dissolved in the liquid fill and have already been used in aerosols - for example, carbon dioxide, fluoro(chloro)hydrocarbons, air, or low-boiling hydrocarbons such as propane.

DOCUMENT IV (State of the Art)

The invention relates to an emulsion suitable for preparing spreads delivered from a pressurised dispenser. For this purpose, nitrous oxide or a low-boiling fluorohydrocarbon is added to the emulsion in the container.

When dispensed through the valve of the aerosol container, the extruded product may be spread easily and evenly on bread or any other suitable base. In terms of appearance and other sensory properties - depending on the flavours and colours added to the emulsion - the product is substantially identical with whipped butter or margarine.

The emulsion, which has an extremely low caloric value, is made up of filler, salt, vegetable gum, flavour and colour, emulsifiers and water. The key ingredient is the emulsifier, which is used in quantities of 4 to 9% by weight. The emulsifiers in question are polyglycerol esters of fatty acids. This class of materials, described in Document I, has already been used in the preparation of spreads (see Document II). We have found that certain of the many possible compounds yield particularly good results. Triglycerol esters - especially the triglycerol mono- and diesters of stearic, palmitic and arachidic acid - have proved particularly suitable because of their excellent dispersability. The corresponding esters of these acids with tetraglycerol, hexaglycerol and decaglycerol can also be used. Examples of these compounds are triglycerol mono- and distearate, hexaglycerol mono- and distearate, and decaglycerol mono- and distearate.

For example, a whipped spread was prepared by mixing the following ingredients at about 75°C in a closed vessel having no free air

space above the liquid. The mixture is then mechanically homogenised, fed into the aerosol container and provided with the propellant:

Water 170.0 g (89.6%)
Triglycerol monostearate 9.5 g (5.0%)
Sodium silicoaluminate 0.2 g (0.1%)
Gum arabic 5.0 g (2.6%)
Xanthan gum 1.0 g (0.5%)
Salt 3.5 g (1.8%)
Butter flavour and colour 0.54 g (0.3%)

When the final product is expelled through the valve of a conventional aerosol container, it forms a milky emulsion with the consistency of whipped butter, which it also substantially resembles in terms of organoleptic character (taste, mouthfeel). The product retains its slightly foamed texture for an extended period.

DOCUMENT V (State of the Art)

The caloric content of butter can be substantially reduced by separating the butter fat and blending it with emulsifiers, bodying agents and water to prepare a paste-like spread. The emulsifiers used are partial esters of polyols, especially glycerol and sugar alcohols (for example, sorbitan), with liquid or molten fatty acids, for example, those derived from whale blubber, dehydrated castor oil, palm oil, soybean or copra.

The emulsifiers can easily be prepared according to a known method, by reacting the polyols with fatty acids in the presence of short-chain soda soaps and caustic soda solution. This involves reacting the free fatty acids or esters made up of such acids and low-boiling alcohols with the polyol. The process takes place under conditions allowing the low-boiling alcohol or water released during the reaction to distill off.

The spread is prepared as in the following example. Fifty parts of butter fat, obtained by passing melted butter through a centrifuge, are heated to 70°C. Six parts of an ester made up of sorbitan and a fatty acid derived from dehydrated castor oil are then added, and the mixture is allowed to cool to 28°C.

A solution comprising 0.75 parts of propylene glycol alginate, 1.5 parts of common salt and 0.05 parts of citric acid in 50 parts of water is then prepared at 40°C. The solution is also allowed to cool to 28°C.

The aqueous solution is gradually added in small amounts to the fat phase in a high-speed mixer, and the mix is homogenised twice at a temperature of 28°C and a pressure of 7.1 MPa, reducing the droplet size of the water in the water-in-oil emulsion to 2 - 3 μm. The homogenised emulsion is then slowly cooled to 15°C. Finally it is shaped and packaged.