(19) DANMARK

(10) DK/EP 2672837 T4

(12) Oversættelse af ændret europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *A 23 L 29/30 (2016.01)* *A 23 D 7/00 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2022-09-26**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om opretholdelse af patentet i ændret form: **2022-06-22**

(86) Europæisk ansøgning nr.: **12745154.0**

(86) Europæisk indleveringsdag: **2012-02-10**

(87) Den europæiske ansøgnings publiceringsdag: **2013-12-18**

(86) International ansøgning nr.: **AU2012000135**

(87) Internationalt publikationsnr.: **WO2012106777**

(30) Prioritet: **2011-02-11 AU 2011900451**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **ERNÆRINGSSAMMENSÆTNING OG ANVENDELSER DERAF**

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DESCRIPTION

Technical Field

[0001] The present invention broadly relates to nutritional compositions comprising unstable materials and the use thereof in food products. More specifically, the invention relates to compositions comprising edible oils, in particular fatty acid-containing oils, and the use thereof in the preparation of food products such as infant formula.

Background of the Invention

[0002] The stabilisation of sensitive components within products that are susceptible to degradation in the product's storage environment is of particular importance in a number of fields, and in particular the food industry.

[0003] It is well known that long-chain polyunsaturated fatty acids are an important component of the human diet and that many people fail to consume an adequate amount of these compounds, and in particular docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA) and docosapentaenoic acid (DPA). Because DHA is a major lipid present in the brain with specific structural and functional roles in neurological development adequate consumption of DHA is critical for infants, and in particular pre-term infants.

[0004] Long-chain polyunsaturated fatty acids comprise multiple double bonds in the hydrocarbon chain rendering them susceptible to oxidation and also compounds that react with carbon-carbon double bonds. Accordingly, long-chain polyunsaturated fatty acids comprised in nutritional products are often stabilised by encapsulation. Materials used for encapsulation have included proteins, such as caseinates and whey protein concentrates. However, because of the possibility of allergic reactions in a large cross section of the population such materials are unacceptable.

[0005] Emulsifying starches such as octenylsuccinic anhydride-modified starch in combination with carbohydrates offer a useful alternative for stabilisation of long-chain polyunsaturated fatty acids. However, in the context of infant formula the maximum amount of octenylsuccinic anhydride-modified starch mandated by the relevant standards (CODEX STAN 074-1981, REV. 1-2006) is such that the stabilisation of a beneficial amount of long-chain polyunsaturated fatty acids is impossible.

[0006] Surprisingly, the present inventors have discovered that beneficial amounts of long-chain polyunsaturated fatty acids may be stabilised using amounts of octenylsuccinic anhydride-modified starch that comply with the relevant standards relating to infant formula.

[0007] Drusch, S. et al, (Food Biophysics, Vol. 4, No. 1, 2009, pages 4-48) discloses the use of glucose syrup having a DE value of 38 alone as a source of reducing sugar, and combinations of maltodextrin and either glucose or maltose.

[0008] Drusch, S. et al, (European Journal of Lipid Science and Technology, Volume 108, No. 6, 2006, pages 501 to 512) relates to the microencapsulation of fish oils using a matrix of octenylsuccinate derivatised starch and glucose syrup.

[0009] WO 2008/155536 relates to additives for animal feed products and to methods for spray drying such additives.

[0010] EP1371363 relates to modified starches and their use as encapsulating agents.

Summary of the Invention

[0011] The invention is defined in the claims.

[0012] In a first aspect, the present invention provides a composition comprising:

1. (i) an unstable material, wherein said material is an edible oil;
2. (ii) an octenylsuccinic anhydride-modified starch present in an amount between about 1% and 10% of the total weight of the composition; and;
3. (iii) at least one source of reducing sugars having a dextrose equivalent value between about 20 and 40, and the second source of reducing sugars has a dextrose equivalent value between 0 and 15, and wherein the first and second sources of reducing sugars are each maltodextrins.

The composition may be in the form of a powder.
The composition may be a spray-dried powder.
The composition may be in the form of an emulsion.
The unstable material referred to above is susceptible to oxidation.

[0013] The edible oil may comprise one or more long-chain polyunsaturated fatty acids (LCPUFAs).

[0014] The edible oil may comprise one or more omega-3 fatty acids and/or one or more omega-6 fatty acids.

[0015] The edible oil may comprise DHA and arachadonic acid (AA).

[0016] The DHA and AA may comprise between about 10% and 70% by weight of the total edible oil present in the composition.

[0017] The at least one source of reducing sugars may have a dextrose equivalent value between about 0 and 30, or between about 0 and 20, or between about 0 and 10, or between about 5 and 15.

[0018] The composition may comprise at least two sources of reducing sugars, wherein a first source of reducing sugars has a dextrose equivalent value between 20 and 40, and a second source of reducing sugars has a dextrose equivalent value between 0 and 15.

[0019] The composition may comprise at least two sources of reducing sugars, wherein a first source of reducing sugars has a dextrose equivalent value between 25 and 35, and a second source of reducing sugars has a dextrose equivalent value between 5 and 15.

[0020] The composition may comprise at least two sources of reducing sugars, wherein a first source of reducing sugars has a dextrose equivalent value of about 30, and a second source of reducing sugars has a dextrose equivalent value of about 10.

[0021] The first source of reducing sugars and the second source of reducing sugars may be present in a ratio between about 1:1 and 1:10; and between about 1:2 and 1:6 by weight,, or between about 1:1 and 1:8, or between about 1:1 and about 1:6, or between about 1:1 and 1:4, by weight.

[0022] The at least one source of reducing sugars may be corn syrup solids.

[0023] The composition may further comprise one or more antioxidants.

[0024] The composition may further comprise a low molecular weight emulsifier.

[0025] The octenylsuccinic anhydride-modified starch may be present in an amount between about 1% and 10%, or in an amount between about 1% and 6%, of the total weight of the composition.

[0026] The unstable material may be present in an amount between about 0.1% and 80% of the total weight of the composition, or in an amount between about 0.5% and 35% of the total weight of the composition, or in an amount

between about 5% and 35% of the total weight of the composition.

[0027] The source(s) of reducing sugars may be present in an amount between about 10% and 80% of the total weight of the composition.

[0028] The composition may be free of mannitol.

[0029] In a second aspect, the present invention provides use of the composition of the first aspect in the preparation of a food product.

[0030] In a third aspect, the present invention provides a food product comprising the composition of the first aspect.

[0031] The food product may be an infant formula or a pre-term infant formula.

[0032] In a fourth aspect, the present invention provides use of at least two sources of reducing sugars having a dextrose equivalent value as defined above in the preparation of a composition comprising one or more long-chain polyunsaturated fatty acids and octenylsuccinic anhydride-modified starch, wherein the amount of octenylsuccinic anhydride-modified starch as a percentage of the total weight of the composition is between about 1% and 10%.

[0033] The amount of octenylsuccinic anhydride-modified starch as a percentage of the total weight of the composition may be less than 10%, 9%, 8%, 7%, 6%, 5%, 4%, 3%, or less than 2%.

[0034] The long-chain polyunsaturated fatty acids may be DHA and/or AA.

[0035] The composition may be an infant formula or a pre-term infant formula.

[0036] The composition may be free of mannitol.

[0037] In a fifth aspect, the present invention provides a method for preparing an emulsion composition as defined herein above and in the claims comprising the following steps: preparing an aqueous mixture comprising octenylsuccinic anhydride-modified starch in an amount as defined above, at least one source of reducing sugars as defined above, and an oil phase in an amount between about 1% and 30% with respect to the total weight of the composition, the oil phase comprising one or more long-chain polyunsaturated fatty acids, and homogenising the mixture so as to provide an emulsion composition.

[0038] The long-chain polyunsaturated fatty acids may be DHA and/or AA.

[0039] The composition may comprise between about 20% and 55% water.

[0040] The octenylsuccinic anhydride-modified starch may be present in an amount between about 0.5% and 8%, or in an amount between about 1% and 6%, or in an amount between about 1% and 5%, with respect to the total weight of the composition.

[0041] The following statements apply to the fourth and fifth aspects.

[0042] The at least one source of reducing sugars may comprise a first source of reducing sugars having a dextrose equivalent value between 20 and 40, and a second source of reducing sugars having a dextrose equivalent value between 0 and 15.

[0043] The at least one source of reducing sugars may comprise a first source of reducing sugars having a dextrose equivalent value between 25 and 35, and a second source of reducing sugars having a dextrose equivalent value between 5 and 15.

[0044] The at least one source of reducing sugars may comprise a first source of reducing sugars having a dextrose equivalent value of about 30, and a second source of reducing sugars having a dextrose equivalent value of about

[0045] The first source of reducing sugars and the second source of reducing sugars may be present in a ratio between about 1:1 and 1:10, or between about 1:1 and 1:8, or between about 1:1 and about 1:6, or between about 1:1 and 1:4, or between about 1:2 and 1:6, by weight.

Brief Description of the Figures

[0046] A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings wherein:

Figure 1 shows the cross section of tangents to the time-pressure Oxipres curve corresponding to the induction period.

Figures 2 and 3 show the induction periods of microcapsules comprising LCPUFAs in accordance with the invention at 80 °C and 70 °C respectively.

Definitions

[0047] The following are some definitions that may be helpful in understanding the description of the present invention. These are intended as general definitions and should in no way limit the scope of the present invention to those terms alone, but are put forth for a better understanding of the following description.

[0048] Throughout this specification, unless the context requires otherwise, the word "comprise", or variations such as "comprises" or" comprising", will be understood to imply the inclusion of a stated step or element or integer or group of steps or elements or integers, but not the exclusion of any other step or element or integer or group of elements or integers. Thus, in the context of this specification, the term "comprising" means "including principally, but not necessarily solely".

[0049] In the context of this specification, the term "about" is understood to refer to a range of numbers that a person of skill in the art would consider equivalent to the recited value in the context of achieving the same function or result.

[0050] In the context of this specification, the terms "a" and "an" refer to one or to more than one (i.e. to at least one) of the grammatical object of the article. By way of example, "an element" means one element or more than one element.

[0051] In the context of this specification, the term "substantially free of protein" means that the amount of protein present in the composition is less than about 0.1%, or less than about 0.01%.

[0052] In the context of this specification, the term "unstable material" is understood to mean that the material to which it refers is susceptible to unwanted change, be it physical or chemical, under particular conditions, for example atmospheric conditions.

[0053] In the context of this specification, the term "hypoallergenic" is understood to mean that the composition to which it refers has a decreased likelihood of provoking an allergic reaction in a subject, and/or that the composition is free, or substantially free, of allergens.

[0054] In the context of this specification, the term "edible oil" means a non-toxic oil which is considered safe for consumption by humans. The edible oils may be liquids at a temperature of 25 °C and atmospheric pressure.

[0055] In the context of this specification, the term "free-flowing powder" means a particulate material that is capable

of being poured without agglomeration or adherence to contact surfaces.

[0056] In the context of this specification, the term "low molecular weight emulsifier" is understood to mean an emulsifying agent having a molecular weight of 1000 g/mol or less.

[0057] In the context of this specification, the term "infant formula" includes formulas that are intended as breast milk replacements or supplements, and also milk fortifiers, including emulsions. The term "infant formula" also encompasses pre-term infant formula.

[0058] In the context of this specification, the term "long-chain" is understood to refer to an unsaturated hydrocarbon chain having more than 12 carbon atoms.

Detailed Description of the Invention

[0059] The present invention, as defined in the claims, broadly relates to a composition comprising an unstable material, an octenylsuccinic anhydride-modified starch and at least two sources of reducing sugars having a dextrose equivalent value as defined in the claims.

[0060] The compositions of the invention may be in the form of a powder, and may be obtained by spray drying. In one embodiment, the composition is a free-flowing powder. The powder may have a mean particle size between about 10 µm and 1000 µm, or between about 50 µm and 800 µm, or between about 100 µm and 300 µm. In alternative embodiments the composition may be in the form of granules.

[0061] The unstable material may be part of a matrix comprising the octenylsuccinic anhydride-modified starch and the source(s) of one or more reducing sugars and may be microencapsulated. Solid compositions of the invention may be water-dispersible.

[0062] The compositions of the invention may be in the form of an emulsion, for example a liquid emulsion. The emulsion may be an oil-in-water emulsion or a water-in-oil emulsion. Preferably the emulsion is an oil-in-water emulsion.

[0063] The compositions may be free or substantially free of protein. The compositions may be free or substantially free of dairy products. In one embodiment, the compositions are hypoallergenic.

[0064] The compositions of the invention comprise one or more unstable materials. The unstable material may be present in an amount between about 0.1% and 80% of the total weight of the composition, or in an amount between about 1% and 60%, or in an amount between about 1% and 50%, or in an amount between about 1% and 45%, or in an amount between about 1% and 40%, or in an amount between about 1% and 35%, or in an amount between about 1% and 30%, or in an amount between about 5% and 50%, or in an amount between about 5% and 45%, or in an amount between about 5% and 40%, or in an amount between about 5% and 35%, or in an amount between about 10% and 50%, or in an amount between about 10% and 45%, or in an amount between about 10% and 40%, or in an amount between about 10% and 35%, or in an amount between about 15% and 50%, or in an amount between about 15% and 45%, or in an amount between about 15% and 40%, or in an amount between about 15% and 35%, or in an amount between about 20% and 40%, of the total weight of the composition.

[0065] In one embodiment the unstable material is a material that is light, heat, air, oxygen or moisture sensitive. In an alternative embodiment the unstable material is a material that is susceptible to oxidation. The unstable material may be an edible oil. The edible oil may comprise one or more components that are susceptible to oxidation, for example unsaturated fatty acids such as LCPUFAs.

[0066] Edible oils used in the compositions, uses and methods of the invention may be obtained from natural sources, for example plants, microbes and marine sources. The sources of the edible oils may be genetically modified or non-genetically modified. Edible oils may also be obtained synthetically. Suitable plant sources include,

but are not limited to, flaxseed, walnuts, sunflower seeds, canola oil, safflower oil, soy, wheat germ, leafy green plants such as kale, spinach and parsley, and corn oil. Suitable marine sources include, but are not limited to, crustaceans such as krill, molluscs such as oysters and fish such as salmon, trout, sardines, tuna, mackerel, sea bass, menhaden, herring, pilchards, kipper, eel or whitebait. Suitable microbe sources include algae and fungi. The edible oil may be present in a purified form and/or in the form of an extract from a suitable source.

[0067] In one embodiment, the edible oil is a fish oil. The fish oil may be obtained from, for example one or more of the following fish: tuna, salmon, trout, sea bass, menhaden, pilchards, mackerel, sardines, herring, kipper, eel, whitebait or any other "fatty fish".

[0068] The edible oil may be a mixture of oils from different sources, for example oil obtained from fish, oil obtained from plants and oil obtained from microbes, such as algae and fungi. Oil mixtures that find particular application in the compositions of the invention include those sold under the trade names DHASCO® and ARASCO® by Martek Biosciences Corporation, Maryland, USA, and HiDHA® by Nu-Mega Ingredients, Altona North, Victoria.

[0069] The edible oil may comprise one or more omega-3 fatty acids and/or one or more omega-6 fatty acids. In one embodiment, the edible oil comprises DHA and AA. The edible oil may comprise one or more of the following fatty acids: DHA, AA, EPA, DPA and stearidonic acid (SDA). The edible oil may comprise evening primrose oil.

[0070] Where the compositions of the invention comprise DHA and AA, the DHA and AA may be present in a ratio between about 1:10 and 10:1, or in a ratio between about 1:5 and 5:1, or in a ratio between about 2:1 and 1:2, or in a ratio between about 1:1 and 1:5, or in a ratio between about 1:1 and 1:4, or in a ratio between about 1:1 and 1:3, or in a ratio between about 1:1 and 1:2, or in a ratio of about 1:1.

[0071] In one embodiment of the invention, of the total amount of edible oil present in the composition, between about 10% and about 90%, or between about 25% and about 80%, or between about 40% and about 80%, or between about 40% and about 70%, or between about 10% and about 70%, or between about 10% and about 60%, or between about 10% and about 50%, may be DHA and/or AA.

[0072] Whilst it is preferred that the unstable material comprises LCPUFAs, those skilled in the art will appreciate that a range of alternative unstable materials (such as those susceptible to oxidation) may be included in the compositions of the invention, for example vitamins, minerals, fatty acids, conjugated polyene compounds, probiotics and prebiotics.

[0073] The compositions further comprise an octenylsuccinic anhydride-modified starch. The starch may comprise primary and/or secondary modifications and may be an ester or half ester. Suitable octenylsuccinic anhydride-modified starches include, for example, those based on waxy maize and sold under the trade names CAPSUL® IMF and HI CAP® IMF by National Starch and Chemical Pty Ltd, Seven Hills, NSW, Australia. The octenylsuccinic anhydride-modified starch may be present in an amount of less than about 10%, 9%, 8%, 7%, 6.5%, 6%, 5.5%, 5%, 4.5%, 4%, 3.5%, 3%, 2.5%, or less than 2%, of the total weight of the composition. The octenylsuccinic anhydride-modified starch may be present in an amount between about 1% and 10%, or in an amount between about 1% and 9%, or in an amount between about 1% and 8%, or in an amount between about 1% and 7%, or in an amount between about 1% and 6%, or in an amount between about 1% and 5%of the total weight of the composition.

[0074] Additional emulsifying starches may also be included in the compositions of the invention as desired, depending on the nature of the unstable material.

[0075] The compositions further comprise at least two sources of reducing sugars, wherein a first source of reducing sugars has a dextrose equivalent value between 20 and 40, or between 25 and 40, or between 25 and 35, and the second source of reducing sugars has a dextrose equivalent value between 0 and 15, or between 5 and 15. In these embodiments, the weight ratio of the first source of reducing sugars to the second source of reducing sugars may be between about 1:10 and 10:1, or between about 1:6 and 6:1, or between about 1:5 and 5:1, or between about 1:1 and 1:10, or between about 1:1 and 1:8, or between about 1:1 and 1:6, or between about 1:1 and 1:5, or between about 1:1 and 1:4, or between about 1:2 and 1:10, or between about 1:2 and 1:8, or between about 1:2 and 1:6, or

between about 1:2 and 1:5, or between about 1:3 and 1:10, or between about 1:3 and 1:8, or between about 1:3 and 1:6, or between about 1:4 and 1:10, or between about 1:4 and 1:8, or between about 1:4 and 1:6, or about 1:4.

[0076] In an embodiment of the invention, a first source of reducing sugars has a dextrose equivalent value between 20 and 40, and a second source of reducing sugars has a dextrose equivalent value between 0 and 15, wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:1 and 1:10 by weight.

[0077] In another embodiment of the invention, a first source of reducing sugars has a dextrose equivalent value between 20 and 40, and a second source of reducing sugars has a dextrose equivalent value between 0 and 15, wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:1 and 1:10 by weight.

[0078] In a further embodiment of the invention, a first source of reducing sugars has a dextrose equivalent value between 25 and 40, and a second source of reducing sugars has a dextrose equivalent value between 0 and 15, wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:1 and 1:6 by weight.

[0079] In another embodiment of the invention, a first source of reducing sugars has a dextrose equivalent value between 20 and 40, and a second source of reducing sugars has a dextrose equivalent value between 5 and 15, wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:1 and 1:6 by weight.

[0080] In still a further embodiment of the invention, a first source of reducing sugars has a dextrose equivalent value between 25 and 35, and a second source of reducing sugars has a dextrose equivalent value between 5 and 15, wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:2 and 1:6 by weight.

[0081] In another embodiment of the invention, a first source of reducing sugars has a dextrose equivalent value of about 30, and a second source of reducing sugars has a dextrose equivalent value of about 10, wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:2 and 1:6, or about 1:4.

[0082] Sources of reducing sugars are well known to those skilled in the art and include monosaccharides and disaccharides, for example glucose, fructose, maltose, galactose, glyceraldehyde and lactose. Suitable sources of reducing sugars also include oligosaccharides, for example glucose polymers, such as dextrin and maltodextrin and glucose syrup solids. The reducing sugars may also be derived from glucose syrup which typically contains not less than 20% by weight of reducing sugars.

[0083] The source(s) of reducing sugars may be present in an amount between about 10% and 80% of the total weight of the composition, or in an amount between about 10% and 75%, or in an amount between about 10% and 70%, or in an amount between about 15% and 70%, or in an amount between about 20% and 70%, or in an amount between about 25% and 65%, or in an amount between about 25% and 60%, or in an amount between about 30% and 65%, or in an amount between about 35% and 65%, or in an amount between about 40% and 65%, or in an amount between about 45% and 65%, or in an amount between about 50% and 65%, or in an amount between about 50% and 60%, of the total weight of the composition.

[0084] The source(s) of reducing sugars and the octenylsuccinic anhydride-modified starch may be present in the compositions in a ratio between about 3:1 and 15:1, or between about 4:1 and 14:1, or between about 4:1 and 13:1, or between about 5:1 and 15:1, or between about 7:1 and 15:1, or between about 8:1 and 14:1, or between about 8:1 and 12:1, or between about 8:1 and 11:1, or between about 10:1 and 11:1, by weight.

[0085] In an embodiment of the invention the compositions further comprise one or more antioxidants. Suitable antioxidants are well known to those skilled in the art and include, but are not limited to: green tea extract,

tocopherols, tocotrienols and ascorbic acid, including salts and derivatives thereof. The compositions may comprise a water-soluble antioxidant and/or a lipid-soluble antioxidant. In one embodiment the compositions comprise an ascorbate salt such as sodium ascorbate, and a lipid-soluble ascorbate derivative, for example a fatty acid ester of ascorbic acid such as ascorbyl palmitate.

[0086] The compositions may further comprise one or more anti-caking agents. Anti-caking agents that are compatible with the compositions of the invention will be well known amongst those skilled in the art and include calcium phosphates, such as tricalcium phosphate and carbonates, such as calcium and magnesium carbonate and silicon dioxide

[0087] The compositions of the invention may further comprise one or more low molecular weight emulsifiers. Suitable low molecular weight emulsifiers include, for example, mono- and di- glycerides, lecithin and sorbitan esters. Other suitable low molecular weight emulsifiers will be well known to those skilled in the art. The low molecular weight emulsifier may be present in an amount between about 0.1% and 3% of the total weight of the composition, or in an amount between about 0.1% and about 2%, or in an amount between about 0.1% and 0.5%, or in an amount between about 0.1% and 0.3%, of the total weight of the composition.

[0088] The compositions of the invention may further comprise additional components, for example flavouring agents, preservatives, colouring agents, chelating agents and the like. Such additional components are well known amongst those skilled in the art.

[0089] The compositions of the invention may be free of mannitol.

[0090] In one embodiment, the compositions of the invention comprise:

- an oil comprising DHA and AA, the oil being present in an amount between about 10% and 50% by weight of the total weight of the composition;
- a first source of reducing sugars having a dextrose equivalent value in the range of 20 and 40 in an amount between about 5% and 25% by weight of the total weight of the composition;
- a second source of reducing sugars having a dextrose equivalent value in the range of 0 and 15 in an amount between about 25% and 70% by weight of the total weight of the composition;
- an octenylsuccinic anhydride-modified starch in an amount between about 1% and 10% by weight of the total weight of the composition.

[0091] The composition may be in the form of a powder, and the first source of reducing sugars and the second source of reducing sugars may be present in a ratio between about 1:1 and 1:10, or between about 1:1 and 1:6, or between about 1:3 and 1:6, by weight. The DHA and AA may comprise between about 10% and 70% of the oil by weight. The composition may further comprise one or more antioxidants.

[0092] In another embodiment, the compositions of the invention comprise:

- an oil comprising DHA and AA, the oil being present in an amount between about 1% and 35% by weight of the total weight of the composition;
- a first source of reducing sugars having a dextrose equivalent value in the range of 20 and 40 in an amount between about 1% and 15% by weight of the total weight of the composition;
- a second source of reducing sugars having a dextrose equivalent value in the range of 0 and 15 in an amount between about 5% and 25% by weight of the total weight of the composition;
- an octenylsuccinic anhydride-modified starch in an amount between about 1% and 10% by weight of the total weight of the composition.

[0093] The composition may be in the form of an emulsion, and the first source of reducing sugars and the second source of reducing sugars may be present in a ratio between about 1:1 and 1:10 by weight. The DHA and AA may

comprise between about 10% and 70% of the oil by weight. The composition may further comprise one or more antioxidants.

[0094] In another embodiment, the compositions of the invention comprise:

- an oil comprising DHA and AA, the oil being present in an amount between about 1% and 35% by weight of the total weight of the composition;
- a first source of reducing sugars having a dextrose equivalent value in the range of 20 and 40 in an amount between about 1% and 15% by weight of the total weight of the composition;
- a second source of reducing sugars having a dextrose equivalent value in the range of 0 and 15 in an amount between about 30% and 45% by weight of the total weight of the composition;
- an octenylsuccinic anhydride-modified starch in an amount between about 1% and 5% by weight of the total weight of the composition.

[0095] The composition may be in the form of an emulsion, and the first source of reducing sugars and the second source of reducing sugars may be present in a ratio between about 1:1 and 1:10 by weight. The DHA and AA may comprise between about 10% and 70% of the oil by weight. The composition may further comprise one or more antioxidants.

[0096] In a further embodiment, the compositions of the invention comprise:

- an oil comprising DHA and AA, the oil being present in an amount between about 20% and 35% by weight of the total weight of the composition;
- a first source of reducing sugars having a dextrose equivalent value in the range of 25 and 35 in an amount between about 10% and 15% by weight of the total weight of the composition;
- a second source of reducing sugars having a dextrose equivalent value in the range of 5 and 15 in an amount between about 45% and 55% by weight of the total weight of the composition;
- an octenylsuccinic anhydride-modified starch in an amount between about 3% and 8% by weight of the total weight of the composition,

wherein the composition is in the form of a powder, the DHA and AA comprise between about 10% and 70% by weight of the oil, and wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:3 and 1:6 by weight. The composition may further comprise one or more antioxidants.

[0097] In a further embodiment, the compositions of the invention comprise:

- an oil comprising DHA and AA, the oil being present in an amount between about 1% and 25% by weight of the total weight of the composition;
- a first source of reducing sugars having a dextrose equivalent value in the range of 25 and 35 in an amount between about 5% and 15% by weight of the total weight of the composition;
- a second source of reducing sugars having a dextrose equivalent value in the range of 5 and 10 in an amount between about 30% and 40% by weight of the total weight of the composition;
- an octenylsuccinic anhydride-modified starch in an amount between about 2% and 8% by weight of the total weight of the composition,

wherein the composition is in the form of an emulsion, the DHA and AA comprise between about 10% and 70% by weight of the oil, and wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:3 and 1:6 by weight. The composition may further comprise one or more antioxidants.

[0098] In a further embodiment, the compositions of the invention comprise:

- an oil comprising DHA and AA, the oil being present in an amount between about 28% and 30% by weight of the total weight of the composition;

- a first source of reducing sugars having a dextrose equivalent value of about 30 in an amount between about 10% and 15% by weight of the total weight of the composition;
- a second source of reducing sugars having a dextrose equivalent value of about 10 in an amount between about 45% and 50% by weight of the total weight of the composition;
- an octenylsuccinic anhydride-modified starch in an amount between about 3% and 6% by weight of the total weight of the composition,

wherein the composition is in the form of a powder, the DHA and AA comprise between about 10% and 70% by weight of the oil and wherein the first source of reducing sugars and the second source of reducing sugars are present in a ratio between about 1:3 and 1:6 by weight. The composition may further comprise one or more antioxidants.

[0099] The compositions of the invention may be prepared by forming an aqueous mixture comprising the unstable material (which is typically in the form of an oil), the source(s) of reducing sugars and octenylsuccinic anhydride-modified starch, and drying the mixture, preferably by spray drying. More specifically, the compositions of the invention may be prepared by solubilising the source(s) of reducing sugars and the octenylsuccinic anhydride-modified starch in an aqueous phase using a high shear mixer. The mixture is then heated to a temperature of about 65 °C to 70 °C after which time one or more antioxidants may be added if desired. The unstable material, such as an edible oil for example, is dosed in-line to the aqueous mixture which is passed through a high shear mixer to form a coarse emulsion. The coarse emulsion is then passed through homogenisation at 240/40 bar. If it is desired to prepare a powdered product the coarse emulsion is pressurised and spray-dried at an inlet temperature of about 180 °C and an outlet temperature of 80 °C. Anti-caking agents may be dosed into the resulting powder which is then packaged into barrier packaging under a modified atmosphere of 100% nitrogen.

[0100] In another aspect, the present invention relates to a method for preparing an emulsion composition comprising the following steps: preparing an aqueous mixture comprising octenylsuccinic anhydride-modified starch in an amount as defined above with respect to the total weight of the composition, at least two sources of reducing sugars having a dextrose equivalent value as defined above in an amount between about 10% and 50% with respect to the total weight of the composition, and an oil phase in an amount between about 1% and 30% with respect to the total weight of the composition, the oil phase comprising one or more long-chain polyunsaturated fatty acids, and homogenising the mixture so as to provide an emulsion composition.

[0101] In this aspect of the invention the source(s) and amounts of reducing sugars may be as defined herein in connection with the compositions of the first aspect. The amount of octenylsuccinic anhydride-modified starch in the emulsion may be as defined herein in connection with the compositions of the first aspect. The composition may be free of mannitol.

[0102] The long-chain polyunsaturated fatty acids may be DHA and/or AA. In one embodiment, the composition may comprise between about 20% and 55% water.

[0103] Whilst the compositions of the invention may themselves be consumed, typically the compositions are incorporated into food products. Accordingly, the present invention further relates to the use of the compositions of the first aspect in the preparation of a food product, and further to food products comprising the compositions of the first aspect.

[0104] Suitable food products include, but are not limited to, bakery products, spreads, salad dressings, beverages, snack bars and the like. In one embodiment, the compositions of the invention are incorporated into infant formula during and/or after the manufacture thereof.

[0105] When compositions of the invention comprising DHA and AA are incorporated into infant formula the resulting formula is able to provide beneficial levels of DHA and AA whilst meeting all current CODEX standards governing maximum amounts of octenylsuccinic anhydride-modified starch. A suitable infant formula may be prepared as follows. Dose 1.33% of a powdered composition of the invention (for example composition 1 in the Examples below) into an infant formula base. Blend to achieve homogeneity. Reconstitute at a rate of 14g/100mL. The resulting formulation allows delivery of up to 7 mg DHA and up to 14 mg AA per 100 mL, with the OSA starch level being less

than 100 ppm which complies with the relevant CODEX standards.

[0106] Without wishing to be bound by theory the inventors believe that the ability of the compositions of the invention to provide the above noted amounts of DHA and AA in the presence of low levels of octenylsuccinic anhydride-modified starch may be facilitated by inclusion of at least one source of reducing sugars having a low DE value.

[0107] Accordingly, in another aspect the present invention also relates to the use of at least two sources of reducing sugars having a dextrose equivalent value as defined above in the preparation of a composition comprising one or more long-chain polyunsaturated fatty acids and octenylsuccinic anhydride-modified starch, wherein the amount of octenylsuccinic anhydride-modified starch as a percentage of the total weight of the composition is as defined above. In this aspect of the invention the source(s) and amounts of reducing sugars may be as defined herein in connection with the compositions of the first aspect.

[0108] The octenylsuccinic anhydride-modified starch may be present in an amount of less than about 10%, 9%, 8%, 7%, 6.5%, 6%, 5.5%, 5%, 4.5%, 4%, 3.5%, 3%, 2.5%, or less than 2% of the total weight of the composition. The octenylsuccinic anhydride-modified starch may be present in an amount between about 1% and 10%, or in an amount between about 1% and 9%, or in an amount between about 1% and 8%, or in an amount between about 1% and 7%, or in an amount between about 1% and 6%, or in an amount between about 1% and 5% of the total weight of the composition. In alternative embodiments, the amount of octenylsuccinic anhydride-modified starch as a percentage of the total weight of the composition may be between between about 1% and about 5%, or between about 1.5% and about 5%, or between about 2% and about 5%.

Examples

Example 1 - Compositions

[0109] Compositions in accordance with the invention include the following:
Composition 1 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as RD18-V7-131210)

Component	% by weight
Oil phase comprising DHA and AA*	29.4
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.03
Monomuls 90-35 (monoglyceride)	0.24
C*Dry MD 01960 (maltodextrin 10)	47.69
Dridex 30 (maltodextrin 30)	11.71
Tricalcium phosphate	0.49
Sodium ascorbate	4.82
CAPSUL® IMF	5.61
* Comprises 14.7% ARASCO and 14.7% DHASCO	

[0110] A further composition hereinafter referred to as Composition 2 (and also RD18-V6-131210) was also prepared having the same components as Composition 1, except the oil phase comprising DHA and AA comprised 19.6% ARASCO and 9.8% DHASCO.
Composition 3 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as RD18-V1-271010)

Component	% by weight
HiDHA® tuna oil	23.2
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.03
Monomuls 90-35 (monoglyceride)	0.24
C*Dry MD 01960 (maltodextrin 10)	9.22
Dridex 30 (maltodextrin 30)	47.1
Sodium ascorbate	4.73
HI CAP® IMF	15.51
Citric acid	0.005

Composition 4 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as RD18-V2-271010)

Component	% by weight
HiDHA® tuna oil	23.05
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.03
Monomuls 90-35 (monoglyceride)	0.24
C*Dry MD 01960 (maltodextrin 10)	47.5
Dridex 30 (maltodextrin 30)	9.05
Sodium ascorbate	4.71
HI CAP® IMF	15.43
Citric acid	0.005

Composition 5 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as RD18-V3-291010)

Component	% by weight
HiDHA® tuna oil	23.08
Ronoxan® A (ascorbyl palmitate, lecithin and	0.03
dl α-Tocopherol)	
Monomuls 90-35 (monoglyceride)	0.24
C*Dry MD 01960 (maltodextrin 10)	57.57
Dridex 30 (maltodextrin 30)	9.06
Sodium ascorbate	4.71
CAPSUL® IMF	2.94
HI CAP® IMF	12.36
Citric acid	0.005

Composition 6 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as RD18-V4-291010)

Component	% by weight
HiDHA® tuna oil	20.71
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.02
Monomuls 90-35 (monoglyceride)	0.62
Tricalcium phosphate	0.46

Component	% by weight
Sodium ascorbate	2.92
HI CAP® IMF	13
Citric acid	0.005
Potassium dihydrogen phosphate	1.35
Glucose syrup	60.91

Composition 7 - Hypoallergenic LCPUFA emulsion composition (also referred to hereinafter as RD18-V1-011210)

Component	Weight (g)
HiDHA® tuna oil	296.12
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.291
Monomuls 90-35 (monoglyceride)	2.43
C*Dry MD 01960 (maltodextrin 10)	480.28
Dridex 30 (maltodextrin 30)	117.93
Sodium ascorbate	48.54
Sodium ascorbate water	200
Tricalcium phosphate	4.98
HI CAP® IMF	56.45
Citric acid	0.05
Water	2577.7

Composition 8 - Hypoallergenic LCPUFA emulsion composition (also referred to hereinafter as RD18-V2-011210)

Component	Weight (g)
HiDHA® tuna oil	296.12
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.291
Monomuls 90-35 (monoglyceride)	2.43
C*Dry MD 01960 (maltodextrin 10)	480.28
Dridex 30 (maltodextrin 30)	117.93
CAPSUL® IMF	56.45
Sodium ascorbate	48.54
Sodium ascorbate water	200
Tricalcium phosphate	4.98
Citric acid	0.05
Water	2577.7

Composition 9 - Hypoallergenic LCPUFA emulsion composition (also referred to hereinafter as RD18-V3-011210)

Component	Weight (g)
HiDHA® tuna oil	296.12
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.291
Monomuls 90-35 (monoglyceride)	2.43
C*Dry MD 01960 (maltodextrin 10)	480.28
Dridex 30 (maltodextrin 30)	117.93
HICAP® IMF	26.7

Component	Weight (g)
CAPSUL® IMF	28.22
Sodium ascorbate	48.54
Sodium ascorbate water	200
Tricalcium phosphate	4.98
Citric acid	0.05
Water	2577.7

Composition 10 - Hypoallergenic LCPUFA emulsion composition (also referred to hereinafter as RD18-V4-011210)

Component	Weight (g)
HiDHA® tuna oil	296.12
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.291
Monomuls 90-35 (monoglyceride)	2.43
C*Dry MD 01960 (maltodextrin 10)	480.28
Dridex 30 (maltodextrin 30)	117.93
HICAP® IMF	48.54
CAPSUL® IMF	11.34
Sodium ascorbate	48.54
Sodium ascorbate water	200
Tricalcium phosphate	4.98
Citric acid	0.05
Water	2577.7

Composition 11 - Hypoallergenic LCPUFA emulsion composition

Component	% by weight
HiDHA® tuna oil	20
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.02
Monomuls 90-35 (monoglyceride)	0.16
C*Dry MD 01960 (maltodextrin 10)	32.44
Dridex 30 (maltodextrin 30)	7.96
CAPSUL® IMF	3.81
Sodium ascorbate	3.28
Tricalcium phosphate	0.34
Water	31.98

Composition 12 - Hypoallergenic LCPUFA emulsion composition

Component	% by weight
HiDHA® tuna oil	1
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.0206
Monomuls 90-35 (monoglyceride)	0.1723
C*Dry MD 01960 (maltodextrin 10)	34.0596
Dridex 30 (maltodextrin 30)	8.3631
CAPSUL® IMF	4.0032
Sodium ascorbate	3.4423
Tricalcium phosphate	0.3532

Component	% by weight
Water	48.58
Citric acid	0.0035

Composition 13 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as RD18-V1-011210)

Component	% by weight
HiDHA® tuna oil	29.4
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.03
Monomuls 90-35 (monoglyceride)	0.24
C*Dry MD 01960 (maltodextrin 10)	47.69
Dridex 30 (maltodextrin 30)	11.71
Tricalcium phosphate	0.49
Sodium ascorbate	4.82
HICAP® IMF	5.61
Citric acid	0.005

Composition 14 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as RD18-V2-011210)

Component	% by weight
HiDHA® tuna oil	29.4
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.03
Monomuls 90-35 (monoglyceride)	0.24
C*Dry MD 01960 (maltodextrin 10)	47.69
Dridex 30 (maltodextrin 30)	11.71
Tricalcium phosphate	0.49
Sodium ascorbate	4.82
CAPSUL® IMF	5.61
Citric acid	0.005

Composition 15 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as RD18-V3-011210)

Component	% by weight
HiDHA® tuna oil	29.45
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.03
Monomuls 90-35 (monoglyceride)	0.24
C*Dry MD 01960 (maltodextrin 10)	47.76
Dridex 30 (maltodextrin 30)	11.73
Tricalcium phosphate	0.50
Sodium ascorbate	4.83
CAPSUL® IMF	2.81
HI CAP® IMF	2.66
Citric acid	0.005

Composition 16 - Spray dried hypoallergenic microencapsulated LCPUFA composition (also referred to hereinafter as

RD18-V4-011210)

Component	% by weight
HiDHA® tuna oil	29.48
Ronoxan® A (ascorbyl palmitate, lecithin and dl α-Tocopherol)	0.03
Monomuls 90-35 (monoglyceride)	0.24
C*Dry MD 01960 (maltodextrin 10)	47.81
Dridex 30 (maltodextrin 30)	11.74
Tricalcium phosphate	0.50
Sodium ascorbate	4.83
CAPSUL® IMF	1.13
HI CAP® IMF	4.24
Citric acid	0.005

Example 2 - Determination of oxidative stability using Induction Period and Slope

[0111] The ML Oxipres is a modification of the Oxygen Bomb method traditionally used for testing efficiency of antioxidants on heterogeneous products containing oils and fats. The ML Oxipres monitors the oxidation of oils and fats in a heterogeneous product and can also be used to monitor oxidative stability of oils and fats. The instrument gives a graph of oxygen absorption over time and the end of the induction period is the point of inflection (Figure 1) which is quite clear and sharp. Induction period is the time (in hours) elapsed between placing the pressure vessel in the block heater and the break point at a given temperature/pressure combination. The longer the period of time until "breakpoint" the more stable the oil or heterogeneous product containing the oil (e.g. microencapsulated sample).

[0112] Hypoallergenic micro-encapsulated powders were analysed by ML Oxipres (Mikrolab Aarhus A/S Denmark) to compare the oxidative stability. A suitable amount of sample containing 4g of oil (e.g. sampling 8g of 50% oil loaded powder) was weighed into reactor pressure vessels and placed into ML Oxipres pressure vessels and sealed. Pressure vessels were filled with oxygen to a defined initial pressure of 5 bar (70 psi). Vessels were then placed in the thermostat block pre-heated and maintained at 80°C. Pressure changes were recorded and the induction period calculated as the time after which the pressure began to decrease rapidly as measured from the cross section point of tangents from the first and second parts of the curve recording pressure changes (see Figure 1). Slope after induction period is a measure of how rapidly the oxygen is penetrating through the encapsulation matrix to the volume of lipid core and is measured as absorbed oxygen after IP (see Figure 1). Oxidative stability for selected compositions of the invention are shown in Figures 2 and 3.

Example 3 - Rapid Exposure Testing - Exposure of raw material and in infant formula application at elevated temperatures in the absence of a modified atmosphere and exposed to UV radiation

[0113] Protein free microcapsules corresponding to compositions 3 to 6 above dosed into infant formula application were assessed. Samples were stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24 °C) and accelerated (40 °C) storage conditions.

[0114] MRP and MRP-RS microcapsules and commercial competitor powders were dosed into Nutricia Karicare Follow-on to achieve an Omega-3/6 DHA/AA concentration of 11mg DHA and/or 11mg AA per 100mL reconstituted beverage.

Table 1: Exposure Plan

Test Temperature	Hypoallergenic microcapsules			In infant formula application		
	Test Duration	Test frequency	Test Method	Test Duration	Test frequency	Test Method
Room temperature (24°C)	4 weeks	Samples at begin, middle and end.	Smell, odour taste	4 weeks	Samples at begin, middle and end. The first two samples are sealed and then stored in freezer. Three samples tasted at same time.	NM standard Protocol
Accelerated (40°C)	4 weeks	Samples at begin, middle and end.	Smell, odour taste	4 weeks	Samples at begin, middle and end. The first two samples are sealed and then stored in Freezer. Three samples tasted at same time.	NM standard Protocol

[0115] To determine if the rapid exposure compromised the quality of the raw material and quality in infant formula application a combination of oxidative stability and subjective sensory analysis were assessed. The tables below outline the finished product stability testing methods conducted in this study. The analytical methods employed were Australian Standard Methods, American Oil Chemists Society (AOCS) or in-house protocols based on the International Union of Pure and Applied Chemistry Standard Methods detailed below.

Table 2: Stability testing protocol

Test parameter for microcapsules*	Test method
Fatty acid determination and quantitation	AOCS Ce 1B-89
Total fat	AS 2300.1.3
Acid value	AOCS Ca 5a-40
Free fatty acids	AOCS Cd 3d-63
Peroxide value	AOCS Cd 8-53c
Anisidine value	AOCS Cd18-90c
*The oil was removed quickly and carefully from the product and stored under nitrogen in amber bottles. During this extraction protocol the oil tested has been exposed to air and the actual oxidative integrity of the oils may have been compromised during this process. Thus, the analytical results represent the oil as removed from the encapsulation matrix and theoretically the oil incorporated into the Driphorm® microcapsules and incorporated into the infant formula will be less oxidised than as shown.	

[0116] In addition, the following sensory attributes were evaluated by an untrained in-house sensory panel minimum of five:

Table 3: Sensory testing protocol

Test parameter for microcapsules	Test measure
Rancid odour	Absent/Detected
Fresh marine odour	Absent/Detected
Rancid Flavour	Absent/Detected
Fresh marine Flavour	Absent/Detected
Overall quality	Acceptable/Unacceptable
*Pertains to raw material testing protocol only	

Stage 1: Rapid Exposure Testing - Exposure of raw material at elevated temperatures in the absence of a

modified atmosphere and exposed to UV radiation

[0117]

Table 4: Rancid odour of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions

Time (weeks)	Rancid Odour											
	RD 18 - V1 – 271010						RD 18 - V2 – 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	5	0	0

Time (weeks)	RD 18 - V3 – 291010						RD 18 - V4 – 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 5: Marine odour of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Marine Odour											
	RD 18 - V1 – 271010						RD 18 - V2 – 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	4	1	0	5	0	0	4	1	0	4	1	0
4	4	1	0	4	1	0	5	0	0	5	0	0

Time (weeks)	RD 18 - V3 – 291010						RD 18 - V4 – 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	4	1	0	-	-	-
2	4	1	0	4	1	0	4	1	0	4	1	0
4	5	0	0	5	0	0	4	1	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 6: Rancid flavour of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Rancid Flavour											
	RD 18 - V1 271010						RD 18 - V2 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	5	0	0

Time (weeks)	RD 18 - V3 – 291010						RD 18 - V4 – 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 7: Marine flavour of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Marine Flavour

Time (weeks)	RD 18 - V1 – 271010						RD 18 - V2 – 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	4	1	0	-	-	-	5	0	0	-	-	-
2	4	1	0	4	1	0	5	0	0	5	0	0
4	4	1	0	4	0	1	5	0	0	5	0	0

Time (weeks)	RD 18 - V3 – 291010						RD 18 - V4 – 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	4	1	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 8: Overall quality of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Overall quality											
	RD 18 - V1 271010						RD 18 - V2 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	4	1	0	5	0	0	4	1	0
4	4	1	0	4	0	1	5	0	0	4	1	0

Time (weeks)	RD 18 - V3 – 291010						RD 18 - V4 – 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	4	1	0	-	-	-
2	5	0	0	4	1	0	4	1	0	4	1	0
4	5	0	0	4	1	0	5	0	0	4	1	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 9: Total fat content (%) of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Fat (%) content								
Time (weeks)	RD 18 - V1 - 271010		RD 18 - V2 - 271010		RD 18 - V3 - 291010		RD 18 - V4 - 291010	
	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure
0	24.6	-	24.2	-	24	-	24	-
4	24.2	24	23.4	23.9	23.3	23.7	24.9	24

Table 10: Concentration of long chain polyunsaturated fatty acids of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Concentration of long chain polyunsaturated fatty acids							
	RD 18 - V1 - 271010		RD 18 - V2 - 271010		RD 18 - V3 - 291010		RD 18 - V4 - 291010	
	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure
	DHA 22:3 ω3 mg/g	DHA 22:3 ω3 mg/g	DHA 22:3 ω3 mg/g	DHA 22:3 ω3 mg/g	DHA 22:3 ω3 mg/g	DHA 22:3 ω3 mg/g	DHA 22:3 ω3 mg/g	DHA 22:3 ω3 mg/g
Specification (mg/g)	58 ± 7	58 ± 7	58 ± 7	58 ± 7	58 ± 7	58 ± 7	58 ± 7	58 ± 7
0	58.32	-	56.93	-	56.71	-	57.37	-
4	57.89	58.38	56.89	58.64	56.66	57.41	59.15	55.41
DHA = Docosahexaenoic acid								

Table 11: FFA, p-Anisidine, Acid value and Peroxide Value of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Oxidative Status							
	RD 18 - V1 – 271010							
	Ambient				Accelerated			
	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acid#	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acid#
Specification	5meq /kg	3 mg KOH/g	20	0.50%	5meq /kg	3 mg KOH/g	20	0.50%
0	1.1	1.1	12.2	0.6	-	-	-	-
4	6.3	8.4	10.7	4.2	5.3	11.5	12.4	5.8

Time (weeks)	RD 18 - V2 – 271010							
	Ambient				Accelerated			
	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acid#	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acid#
Specification	5meq /kg	3 mg KOH/g	20	0.50%	5meq /kg	3 mg KOH/g	20	0.50%
0	1.3	0.4	12.3	0.2	-	-	-	-
4	6.1	5.9	12.5	2.9	7.5	7.2	12.7	3.6

Time (weeks)	RD 18 - V3 – 291010							
	Ambient				Accelerated			
	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acid#	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acid#
Specification	5meq /kg	3 mg KOH/g	20	0.50%	5meq /kg	3 mg KOH/g	20	0.50%
0	1.1	0.5	12.1	0.3	-	-	-	-
4	7.6	10.2	11.4	5.1	7.2	6.8	12.9	3.4

Time (weeks)	RD 18 - V4 291010							
	Ambient				Accelerated			
	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acid#	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acid#
Specification	5meq /kg	3 mg KOH/g	20	0.50%	5meq /kg	3 mg KOH/g	20	0.50%
0	1.7	0.9	10	0.4	-	-	-	-
4	7	20.2	11.5	10.1	6.8	11.7	10.5	5.9

as oleic

Stage 1 Rapid Exposure Testing - Exposure fortified infant formula at elevated temperatures in the absence of a modified atmosphere and exposed to UV radiation

[0118]

Table 12: Rancid odour of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Rancid Odour											
	RD 18 - V1 – 271010						RD 18 - V2 – 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	4	1	0	4	1	0	5	0	0	4	1	0
4	4	1	0	4	1	0	5	0	0	4	1	0

Time (weeks)	RD 18 - V3 291010						RD 18 - V4 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	4	1	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 13: Marine odour of infant formula fortified with hypoallergenic powder samples

stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Marine Odour											
	RD 18 – V1 – 271010						RD 18 - V2 – 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	5	0	0

Time (weeks)	RD 18 – V3 – 291010						RD 18 - V4 – 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 14: Rancid flavour of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Rancid Flavour											
	RD 18 - V1 – 271010						RD 18 - V2 – 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	4	1	0	-	-	-	3	2	0	-	-	-
2	3	2	0	4	1	0	4	1	0	4	1	0
4	4	1	0	4	1	0	5	0	0	5	0	0

Time (weeks)	RD 18 - V3 291010						RD 18 - V4 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	4	1	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject; TBD = To be determined

Table 15: Marine flavour of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Marine Flavour											
	RD 18 - V1 – 271010						RD 18 - V2 – 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	5	0	0

Time (weeks)	Marine Flavour											
	RD 18 - V3 291010						RD 18 - V4 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	5	0	0	5	0	0	5	0	0
4	5	0	0	5	0	0	5	0	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 16: Overall quality of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Overall quality											
	RD 18 - V1 – 271010						RD 18 - V2 – 271010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	5	0	0	4	1	0	5	0	0	4	1	0
4	4	1	0	5	0	0	5	0	0	5	0	0

Time (weeks)	RD 18 - V3 291010						RD 18 - V4 291010					
	Ambient Exposure			Accelerated Exposure			Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	-	-	-	5	0	0	-	-	-
2	4	1	0	5	0	0	5	0	0	5	0	0
4	4	1	0	4	1	0	5	0	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 17: Total fat content (%) of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Fat (%) content								
Time (weeks)	RD 18 - V1 - 271010		RD 18 - V2 - 271010		RD 18 - V3 - 291010		RD 18 - V4 - 291010	
	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure
0	22.16	-	22.3	-	21.63	-	22.02	-
4	21.73	22.35	21.82	22.36	22.34	22.47	21.94	22.47

Table 18: Concentration of long-chain polyunsaturated fatty acids of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Concentration of long-chain polyunsaturated fatty acids							
	RD 18 - V1 - 271010		RD 18 - V2 - 271010		RD 18 - V3 - 291010		RD 18 - V4 - 291010	
	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure	Ambient Exposure	Accelerated Exposure
	DHA	DHA 22:3	DHA	DHA 22:3	DHA	DHA 22:3	DHA	DHA 22:3
	22:3 ω3	ω3	22:3 ω3	ω3	22:3 ω3	ω3	22:3 ω3	ω3
Target (mg/100L prepared feed)	11	11	11	11	11	11	11	11
0	11.17	-	9.18	-	7.91	-	11.48	-
4	10.67	10.83	8.99	9.18	7.44	11.3	11.38	11.95
DHA = Docosahexaenoic acid								

Table 19: p-Anisidine, Acid value and Peroxide Value of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	RD 18 - V1 – 271010							
	Ambient				Accelerated			
	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acids*	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acids*
Specified Maximum	5meq /kg	3 mg KOH/g	20	0.5%	5meq /kg	3 mg KOH/g	20	0.50%
0	7.2	0.5	1.6	0.3	-	-	-	-
4	6.6	1.5	<0.1	0.7	3.9	1.6	<0.1	0.8

Time (weeks)	RD 18 - V2 – 271010							
	Ambient				Accelerated			
	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acids*	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acids*
Specified Maximum	5meq /kg	3 mg KOH/g	20	0.5%	5meq /kg	3 mg KOH/g	20	0.50%
0	6.1	1.6	<0.1	0.8	-	-	-	-
4	6.8	1.6	1	0.8	3	1.5	0.4	0.7

Time (weeks)	RD 18 - V3 – 291010						
	Ambient				Accelerated		
	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acids*	Peroxide Value	Acid Value	p-Anisidine	FFA

Specified Maximum	5meq /kg	3 mg KOH/g	20	0.5%	5meq /kg	3 mg KOH/g	20	0.50%
0	6.4	1.6	0.7	0.8	-	-	-	-
4	6.1	1.6	<0.1	0.8	6.1	1.1	<0.1	0.5

Time (weeks)	RD 18 - V4 – 291010							
	Ambient				Accelerated			
	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acids#	Peroxide Value	Acid Value	p-Anisidine	% Free Fatty Acids#
Specified Maximum	5meq /kg	3 mg KOH/g	20	0.5%	5meq /kg	3 mg KOH/g	20	0.50%
0	6.4	1.1	<0.1	0.5	-	-	-	-
4	5.6	1.7	<0.1	0.9	4.8	1.7	1.9	0.8

#as oleic

Stage 2 Rapid Exposure Testing - Exposure of raw material at elevated temperatures in the absence of a modified atmosphere and exposed to UV radiation

[0119]

Table 20: Rancid odour of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Rancid Odour					
	RD18-V7-131210) (Raw Material)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	NA	NA	NA
2	5	0	0	4	1	0
4	5	0	0	4	1	0
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 21: Marine odour of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Marine Odour					
	RD18-V7-131210) (Raw Material)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	2	3	0	NA	NA	NA
2	2	1	2	3	2	0
4	2	3	0	3	1	1
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 22: Rancid flavour of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Rancid Flavour					
	RD18-V7-131210 (Raw Material)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	4	1	0	NA	NA	NA
2	3	1	1	4	0	1
4	4	0	1	4	0	1
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 23: Marine flavour of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5

layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Marine Flavour					
	RD18-V7-131210 (Raw Material)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	2	2	1	NA	NA	NA
2	2	3	0	2	3	0
4	3	2	0	3	2	0
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 24: Overall quality of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Overall Quality					
	RD18-V7-131210 (Raw Material)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	2	3	0	-	-	-
2	2	2	1	2	2	1
4	4	1	0	4	1	0
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 25: Total fat content (%) of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Fat (%) content		
Time (weeks)	RD18-V7-131210 (Raw Material)	
	Ambient	Accelerated
0	34.3	-
4	34.0	32.4

Table 26: Concentration of long-chain polyunsaturated fatty acids of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Concentration of long-chain polyunsaturated fatty acids			
	RD18-V7-131210 (Raw Material)			
	Ambient		Accelerated	
Specification (mg/g)	AA 20:4ω6 mg/g	DHA 22:6 ω3 mg/g	AA 20:4ω6 mg/g	DHA 22:6 ω3 mg/g
	56.5 ± 9	56.5 ± 9	56.5 ± 9	56.5 ± 9
0	68.04	68.52	-	-
4	66.47	66.97	62.84	64.49
DHA = Docosahexaenoic acid; AA = Arachidonic acid				

Table 27: Acid value and Peroxide Value of hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	RD18-V7-131210 (Raw Material)							
	Ambient				Accelerated			
	Peroxide Value	*p*-Anisidine	% Free Fatty Acids#	Acid Value	Peroxid e Value	*p*-Anisidine	Acid Value	% Free Fatty Acids#
Maximium Specification	5meq/kg	20	0.50%	KOH/g	5meq/kg	20	KOH/g	0.50%
0	2.3	5.9	0.8	1.6	-	-	-	-
4	3.9	6.7	1.5	2.9	5.1	5.9	1.4	0.7
# as oleic								

Stage 1: Rapid Exposure Testing - Exposure of fortified in infant formula at elevated temperatures in the absence of a modified atmosphere and exposed to UV radiation

[0120]

Table 28: Rancid odour of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Rancid Odour					
	RD18-V7-131210 (In infant formula application)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	NA	NA	NA
2	5	0	0	5	0	0
4	5	0	0	5	0	0
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 29: Marine odour of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Marine Odour					
	RD18-V7-131210 (In infant formula application)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	NA	NA	NA
2	5	0	0	5	0	0
4	5	0	0	5	0	0
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 30: Rancid flavour of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Rancid Flavour					
	RD18-V7-131210 (In infant formula application)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	NA	NA	NA
2	5	0	0	5	0	0
4	5	0	0	5	0	0

Acc=Accept; Bor = Borderline acceptable; Rej = Reject

Table 31: Marine flavour of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Marine Flavour					
	RD18-V7-131210 (In infant formula application)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	NA	NA	NA
2	5	0	0	5	0	0
4	5	0	0	5	0	0
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 32: Overall quality of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Overall Quality					
	RD18-V7-131210 (In infant formula application)					
	Ambient Exposure			Accelerated Exposure		
	Acc	Bor	Rej	Acc	Bor	Rej
0	5	0	0	NA	NA	NA
2	5	0	0	5	0	0
4	5	0	0	5	0	0
Acc=Accept; Bor = Borderline acceptable; Rej = Reject						

Table 33: Total fat content (%) of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Fat (%) content		
Time (weeks)	RD18-V7-131210 (In infant formula application)	
	Ambient	Accelerated
0	22.3	-
4	22.8	22.4

Table 34: Concentration of long-chain polyunsaturated fatty acids of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	Concentration of long-chain polyunsaturated fatty acids			
	RD18-V7-131210 (In infant formula application)			
	Ambient		Accelerated	
Specification (mg/ 100g prepared feed)	AA 20:4ω6 mg/ 100g of prepared feed	DHA 22:6 ω3 mg/100g of prepared feed	AA 20:4ω6 mg/100g of prepared feed	DHA 22:6 ω3 mg/100g of prepared feed
	11	11	11	11
0	12.17	11.81	-	-
4	10.51	10.77	10.02	10.21
DHA = Docosahexaenoic acid; AA = Arachidonic acid				

Table 35: Acid value and Peroxide Value of infant formula fortified with hypoallergenic powder samples stored in the absence of an inert atmosphere in open 5 layer foil laminate bags at ambient (24°C) and accelerated (40°C) storage conditions.

Time (weeks)	RD18-V7-131210 (In infant formula application)							
	Ambient				Accelerated			
	Peroxide Value	*p*-Anisidine	% Free Fatty Acids#	Acid Value	Peroxide Value	*p*-Anisidine	Acid Value	% Free Fatty Acids#
Maximium Specification	5meq/kg	20	0.5%	KOH/g	5meq/kg	20	KOH/g	0.5%
0	5.5	0.1	0.8	1.5	-	-	-	-
4	3.4	<0.1	0.9	1.7	2.1	1.1	1.1	0.6
# as oleic								

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO2008155536A [0009]
- EP1371363A [0010]

Non-patent literature cited in the description

- **DRUSCH, S et al.**Food Biophysics, 2009, vol. 4, 14-48 [0007]
- **DRUSCH, S. et al.**European Journal of Lipid Science and Technology, 2006, vol. 108, 6501-512 [0008]

Patentkrav

1. Sammensætning, der omfatter:
(i) et ustabilt materiale, hvori materialet er en spiselig olie;
(ii) en stivelse modificeret med octenylsuccinylanhydrid, som er til stede i en mængde imellem omkring 1 % og 10 % af den totale vægt af sammensætningen; og
(iii) i det mindste to kilder til reducerende sukkerstoffer, hvori den første kilde til reducerende sukkerstoffer har en ækvivalentværdi af dextrose imellem 20 og 40, og den anden kilde til reducerende sukkerstoffer har en ækvivalentværdi af dextrose imellem 0 og 15, og hvori den første og den anden kilde til reducerende sukkerstoffer hver er maltodextriner.

2. Sammensætning ifølge krav 1, der er i form af et pulver eller en emulsion.

3. Sammensætning ifølge krav 2, hvori sammensætningen er et spraytørret pulver.

4. Sammensætning ifølge et hvilket som helst af kravene 1 til 3, hvori det ustabile materiale er til stede i en mængde, der er valgt fra: imellem omkring 0,1 % og 80 % af den totale vægt af sammensætningen; og imellem omkring 0,5 % og 35 % af den totale vægt af sammensætningen.

5. Sammensætning ifølge et hvilket som helst af kravene 1 til 4, hvori den spiselige olie omfatter én eller flere langkædede, flerumættede fedtsyrer, valgfrit omega-3-fedtsyrer og omega-6-fedtsyrer.

6. Sammensætning ifølge et hvilket som helst af kravene 1 til 5, hvori den spiselige olie omfatter docosahexaensyre og arakidonsyre.

7. Sammensætning ifølge krav 6, hvori docosahexaensyren og arakidonsyren omfatter imellem omkring 10 % og 70 % efter vægt af den totale spiselige olie, der er til stede i sammensætningen.

8. Sammensætning ifølge et hvilket som helst af kravene 1 til 7, hvori den første kilde til reducerende sukkerstoffer og den anden kilde til reducerende sukkerstoffer er til stede i et forhold, der er valgt fra: imellem omkring 1:1 og 1:10 efter vægt; og imellem omkring 1:2 og 1:6 efter vægt.

9. Sammensætning ifølge et hvilket som helst af kravene 1 til 7, hvori kilderne til reducerende sukkerstoffer er til stede i en mængde, der er valgt fra: imellem omkring 10 % og 80 % af den totale vægt af sammensætningen; og imellem omkring 35 % og 65 % af den totale vægt af sammensætningen.

10. Sammensætning ifølge et hvilket som helst af kravene 1 til 9, der yderligere omfatter en emulgator af lav molekylvægt og/eller én eller flere antioxidanter.

11. Anvendelse af en sammensætning ifølge et hvilket som helst af kravene 1 til 10 til fremstilling af et fødevareprodukt.

12. Anvendelse ifølge krav 11, hvorved fødevareproduktet en modermælkserstatning eller en modermælkserstatning til for tidligt fødte.

13. Fremgangsmåde til at fremstille en emulsionssammensætning ifølge krav 1, idet fremgangsmåden omfatter de følgende trin:
- at forberede en vandig blanding, der omfatter stivelsen modificeret med octenylsuccinylanhydrid, de i det mindste to kilder til reducerende sukkerstoffer, hvorved den første kilde til reducerende sukkerstof er til stede i en mængde imellem omkring 10 % og 50 % i forhold til den totale vægt af sammensætningen, og en oliefase i en mængde imellem omkring 1 % og 30 % i forhold til den totale vægt af sammensætningen, idet oliefasen omfatter én eller flere langkædede, flerumættede fedtsyrer, og
- at homogenisere blandingen for således at tilvejebringe en emulsionssammensætning som afgrænset i krav 1.

DRAWINGS

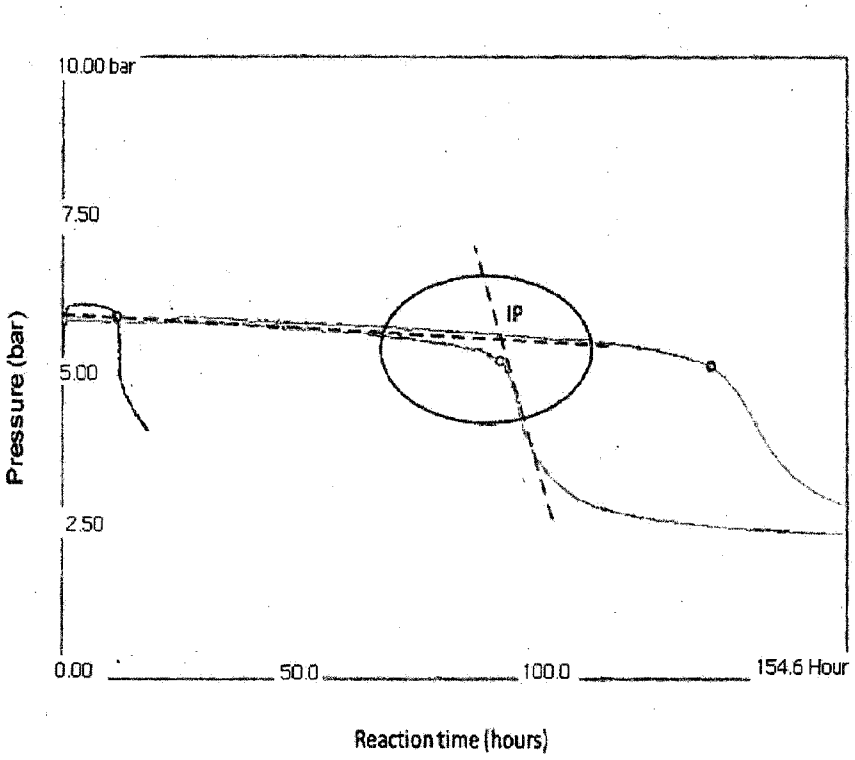

Figure 1

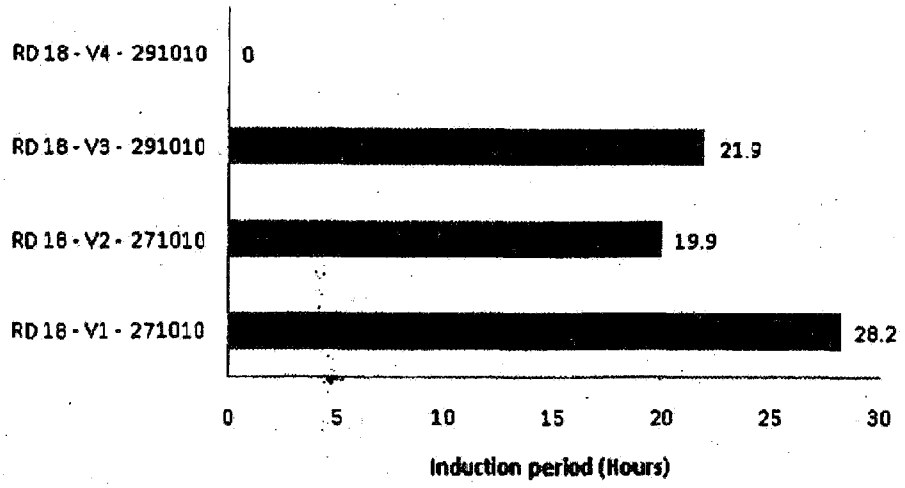
RD 18 - V4 - 291010
0
RD 18 - V3 - 291010
21.9
RD 18 - V2 - 271010
19.9
RD 18 - V1 - 271010
28.2
0
5
10
15
20
25
30
Induction period (Hours)

Figure 2

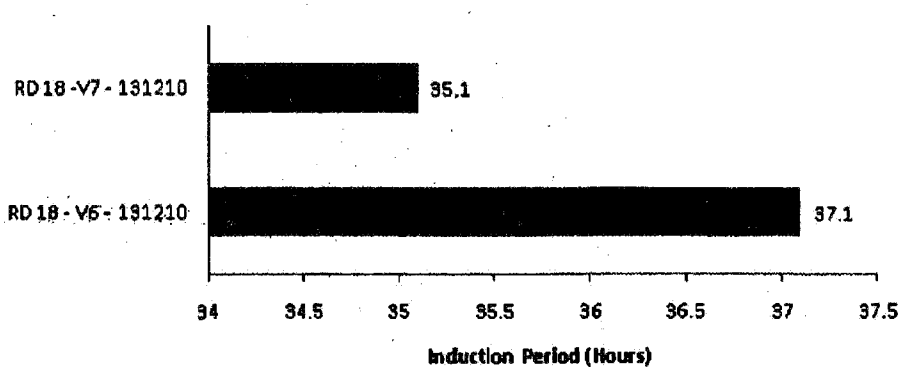
RD18-V7-131210
35.1
RD18-V5-131210
37.1
34
34.5
35
35.5
36
36.5
37
37.5
Induction Period (Hours)

Figure 3