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(54) **Title:** PLANT BASED EMULSIFIER FOR FROZEN CONFECTION PRODUCTS

(57) **Abstract:** The present invention relates to a frozen confection product comprising β -pectin as an emulsifier. The invention is also concerning the method of producing such a frozen confection.



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TITLE

“PLANT BASED EMULSIFIER FOR FROZEN CONFECTION PRODUCTS”

TECHNICAL FIELD

[0001] The present invention relates to frozen confection products. More particularly the present invention relates to frozen confection products comprising β -pectin as an emulsifier.

[0002] Furthermore, the invention relates to a method of preparing the frozen confection product.

BACKGROUND

[0003] Using 100% natural emulsifiers in ice cream products leads to generating natural, clean label, consumer friendly and preferred products. Many different kinds of emulsifiers are used in the frozen confection industry. They can be divided into two groups: natural emulsifiers such as eggs, soy lecithin, acacia gum and artificial emulsifiers. The currently used natural emulsifiers (such as egg yolks) contribute to allergens and others like soy lecithin contribute to off-flavors to the product.

[0004] Consumers demand products which are free of artificial emulsifiers and stabilizers. However, most frozen confection products currently on the market contain artificial emulsifiers and/or stabilizers.

[0005] Furthermore, there is a growing demand from consumers of frozen confections to buy frozen confections prepared from low fat or non-fat formulations, while maintaining their good sensorial properties or even improve the sensory attributes.

[0006] The prior art discloses ways of improving the texture of low fat or non-fat frozen confection products prepared by conventional freezing through the use of specific

emulsifiers. However, these emulsifiers are often perceived negatively by the consumer and products that are free from such “chemical sounding” ingredients are highly sought after.

[0007] The use of egg yolk as an emulsifier in frozen desserts is also described. However, eggs add allergens into the products and into the manufacturing system which requires additional wash-out steps. Allergens in food products are therefore to be excluded.

[0008] Hence, there is an unmet need for frozen confection products, which contain natural emulsifiers and if needed natural stabilizers, and which are free from artificial stabilizers, emulsifiers, and possibly allergens, and which can provide improved sensorial properties to the end product.

SUMMARY

[0009] An object of the present invention relates to providing frozen confection products which contain a natural emulsifier or a combination of natural emulsifiers.

[0010] The first aspect of the invention relates to a frozen confection product comprising β -pectin.

[0011] In a preferred embodiment of the invention, the frozen confection product is preferably devoid of any artificial emulsifiers.

[0012] In another preferred embodiment of the invention, the frozen confection product is preferably devoid of any artificial stabilizers.

[0013] In a more preferred embodiment of the invention, the frozen confection product is preferably devoid of any stabilizers.

[0014] In the most preferred embodiment of the invention, the frozen confection product is devoid of any artificial emulsifiers and other ingredients such as eggs, soy lecithin or acacia gum, and stabilizers.

[0015] In particular, it is an object of the present invention to provide frozen confection products which contain a natural emulsifier or a combination of natural

emulsifiers. It is another object of the present invention to provide frozen confection products which are preferably devoid of artificial emulsifiers and allergens, preferably using minimal number of base ingredients and at the same time have a very light, creamy, and smooth textural attributes. It is another object of the present invention to provide frozen confection products which are preferably also devoid of artificial stabilizers. It is another object of the present invention to provide frozen confection products comprising β -pectin, preferably with an overrun between 20-150%. Furthermore, it is an object of the present invention to obtain a frozen dessert with a good body and texture and with a stable foam structure without the stability of the frozen confection being compromised.

[0016] In addition, it is an object of the present invention to obtain a frozen confection products with improved heat shock resistance, when comparing it to products comprising artificial emulsifiers.

[0017] The inventors of the present invention have surprisingly found that β -pectin, which is a natural plant extract, functions as a very effective natural emulsifier for frozen confection products. Beta-pectin is an abundant by-product in the sugar beet process. Beta-pectin is a high ester pectin extracted from sugar beet pulp which helps to provide stable oil-in-water emulsions and also helps to keep other particles in suspension. Also, the use of β -pectin can deliver the desired body and texture properties in frozen confection products.

[0018] Over the recent years, consumers of frozen confections are becoming more and more demanding and conscious about what they eat and tend to prefer products with fewer additives or totally avoid additives. Thus, consumers tend to seek products that contain a minimum of ingredients on their label, i.e. have a clean label.

[0019] Therefore, the consumers' demand of products preferably with a clean label, i.e. free of additives such as artificial emulsifiers, artificial stabilizers and preferably devoid of allergens, is met.

[0020] Another aspect of the present invention is the use of a pH adjusting agent, such as molasses, an edible organic acid such as citric acid, acetic acid, lactic acid, malic acid, ascorbic acid, benzoic acid, fumaric acid, fruit derived acids and fermentation derived acids preferably lactones such as glucono-delta-lactone, for manufacturing a frozen confection product.

[0021] Another aspect of the present invention relates to a method of producing a frozen confection product comprising β -pectin, comprising the steps of:

[0022] a) providing an ingredient mix comprising at least dairy components, sweetening agent, β -pectin or the combination of β -pectin and another natural emulsifier or emulsifiers, and if needed natural stabilizer or a combination of natural stabilizers;

[0023] b) homogenizing the mix;

[0024] c) pasteurizing the mix

[0025] d) freezing the pasteurized mix to form the frozen confection product after the addition of flavorings; and

[0026] e) optionally hardening the frozen confection product.

[0027] In general, the various aspects of the invention may be combined and coupled in any way possible within the scope of the invention. These and other aspects, features and/or advantages of the invention that will be apparent from and elucidated with reference to the embodiments described hereinafter.

[0028] The present invention will now be described in more detail in the following.

[0029] Additional features and advantages are described herein, and will be apparent from the following Detailed Description.

DETAILED DESCRIPTION

[0030] Definitions

[0031] Prior to discussing the present invention in further details, the following terms and conventions will first be defined:

[0032] In the context of the present invention, mentioned percentages are weight/weight percentages unless otherwise stated.

[0033] The term “and/or” used in the context of the “X and/or Y” should be interpreted as “X”, or “Y”, or “X and Y”.

[0034] Numerical ranges as used herein are intended to include every number and subset of numbers contained within that range, whether specifically disclosed or not. Further, these numerical ranges should be construed as providing support for a claim directed to any number or subset of numbers in that range. For example, a disclosure of from 1 to 10 should be construed as supporting a range of from 1 to 8, from 3 to 7, from 4 to 9, from 3.6 to 4.6, from 3.5 to 9.9, and so forth. All references to singular characteristics or limitations of the present invention shall include the corresponding plural characteristic or limitation, and vice versa, unless otherwise specified or clearly implied to the contrary by the context in which the reference is made.

[0035] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art (e.g. in frozen confection manufacture). Definitions and descriptions of various terms and techniques used in frozen confection manufacture are found in ice Cream, 6th Edition, Robert T Marshall, H. Douglas Goff and Richard W Hartel (2003), Kluwer Academic/Plenum Publishers.

[0036] As used in this specification, the words “comprises”, “comprising”, and similar words, are not to be interpreted in an exclusive or exhaustive sense. In other words, they are intended to mean “including, but not limited to.”

[0037] In the context of the present invention, the term “free” means that these material are not intentionally added for their conventional property imparting abilities, although there could be unintended minor amounts present without detracting from the performance of the products. Generally and preferably, the products of the invention will

not contain any non-natural materials. By the term “free” is therefore meant that the product comprise 2% by weight or less of a given compound, such as 1% by weight or less of a given compound.

[0038] The embodiments of the present invention described below are not intended to be exhaustive or to limit the invention to the precise forms disclosed in the following detailed description. Rather the embodiments are chosen and described so that others skilled in the art may appreciate and understand the principles and practices of the present invention.

[0039] The first aspect of the invention relates to a frozen confection product comprising β -pectin.

[0040] Frozen confection product

[0041] In the context of the present invention the term “frozen confection product” means a confection product comprising ice crystals distributed homogeneously throughout a sweetened and/or flavored aqueous product and typically having a refreshing and cooling effect with a nice appearance.

[0042] Frozen confections include water in the form of ice crystals and are for consumption in a frozen or semi-frozen state, i.e. under conditions wherein the temperature of the product is less than 0°C, and preferably under conditions wherein the product comprises a significant amount of ice crystals.

[0043] Frozen confections may also be called “frozen confections”, “frozen confection products”, “ice desserts” or “frozen desserts” and these terms may be used interchangeably.

[0044] In an embodiment of the invention the frozen confection product is an aerated frozen confection product, in particular a frozen dairy dessert.

[0045] By the term “frozen aerated confection product” is meant any aerated frozen dessert.

[0046] In the context of the present invention, the term “aerated” refers to a product which has air cells distributed evenly throughout the product. The air cells or air bubbles can be distributed throughout the product for example by extrusion or whipping air into the product, e.g. whipping of air into an ice cream mix. For example one volume part of air whipped into one volume part of ice cream mix is equal to 100% overrun, as described by Marshall, Goff and Hartel.

[0047] In an embodiment of the present invention, the product has an overrun of at least 20%, such as in the range of 20-150%, preferably in the range of 80-130%, even more preferably in the range of 100-130%.

[0048] Overrun relates to the amount of air whipped in to an ingredient mix for preparing aerated products. Overrun is a term generally recognized for the skilled person within the field of ice cream production. In the present invention overrun is defined as the increase in volume, in percentage, of ice cream greater than the volume of the mix used to produce that ice cream due to incorporation of air. In other words, if you start off with 1 litre of mix and you make 2.0 litres of ice cream from that, you have increased the volume by 100% (i.e., the overrun is 100%).

[0049] In an embodiment of the invention, the frozen confection may be selected from the group of frozen dairy dessert, cultured frozen dairy dessert, ice cream, non-fat ice cream, low-fat ice cream, frozen yoghurt, milk shake, milk ice, and sherbet.

[0050] In a preferred embodiment, the frozen confection product is an ice cream, which may be a full fat ice cream, low fat ice cream and fat free ice cream.

[0051] In an embodiment of the invention, the frozen confection product comprises from 0.5% to 16% fat by weight.

[0052] In another embodiment of the present invention, the confection product is a low fat product and comprises at most 6% fat.

[0053] In the context of the present invention, the term “fat” should be interpreted broadly and generally relates to one or more triglycerides independent of their melting temperature. The term “fat” comprises both triglycerides that are in liquid form at 25°C, as well as triglycerides that are in solid or semi-solid form at 25°C. Fatty acid triesters of the trihydroxy alcohol glycerol which are present in plant and animal tissues that can occur both as liquid or semi-liquid or solid fat forms. The physical and chemical properties of fats and oils depend on the nature of the fatty acids present. Saturated fatty acids give higher-melting fats and represent solid fats, for example, lard and butter. Unsaturation lowers the melting point of fatty acids and fats, e.g. plant oils, contain large amounts of unsaturated fatty acids.

[0054] According to a preferred embodiment of the invention, the product essentially consists of natural ingredients.

[0055] The term “essentially consist” means that at least 95% of the ingredients have to be natural, such as at least 97%, preferably at least 98%, even more preferably at least 99%.

[0056] The term “natural ingredients” refers in the context of the present invention to ingredients of natural origin. These are ingredients which come directly from the field, animals, etc. or which are the result of a physical or microbiological / enzymatic transformation process. These therefore do not include ingredients which are the result of a chemical modification process. The term “artificial ingredients” refers in the context of the present invention to ingredients of non-natural origin.

[0057] β -pectin

[0058] The inventors of the present invention have surprisingly found that β -pectin (GENU® BETA pectin), which is a natural plant extract, functions as a very effective natural emulsifier for frozen confection products. Beta-pectin is an abundant by-product in the sugar beet process. Beta-pectin is high ester pectin extracted from sugar beet pulp which

helps to provide stable oil-in-water emulsions and also helps to keep other particles in suspension. Also, the use of β -pectin can deliver the desired body and texture properties in frozen confection products.

[0059] In an embodiment of the invention, the frozen confection product preferably comprises β -pectin in the range of 0.05-3.0% by weight, more preferably 0.05-2.0 wt% and most preferably 0.05-1.0 wt%.

[0060] The inventors of the present invention have surprisingly discovered that by using β -pectin to emulsify frozen confections, it is possible to avoid the use of any other emulsifiers or stabilizers. Furthermore, a product is obtained which has improved sensorial properties. For example the obtained product has an increased creaminess and rich, full body, reduced ice crystal size and an improved heat shock resistance as observed in stability tests.

[0061] Other natural emulsifier or natural emulsifiers could also be used in combination with β -pectin such as whey protein phospholipid concentrate, acacia gum, xanthan gum, egg yolk and soy lecithin or any other emulsifiers known in the art or mixtures thereof.

[0062] In a preferred embodiment of the invention, the frozen confection product comprises the mixture of β -pectin and another natural emulsifier or natural emulsifiers.

[0063] In a more preferred embodiment of the invention, the frozen confection product comprises only β -pectin as an emulsifier.

[0064] Protein

[0065] The confection product according to the present invention comprises one or more proteins. Typical sources of proteins are skim milk, whey protein concentrate; acid casein; sodium caseinate, acid whey, whey protein isolate, sweet whey, demineralized sweet whey, demineralized whey, milk protein concentrate or mixtures thereof.

[0066] The protein(s) may be selected from any dairy protein and plant protein.

[0067] In a preferred embodiment of the present invention, the protein is a dairy protein. The protein may also be a plant protein such as soya protein, pea protein, wheat protein, corn protein, and rice protein, proteins from legumes, cereals and grains in general. The protein may also be protein isolates from nuts or seeds.

[0068] In another embodiment of the present invention, the protein includes a partially coagulated protein system including kappa-casein and beta-lactoglobulin.

[0069] The term “partially coagulated protein system” is to be understood to mean a complex or an aggregate resulting from at least a partial coagulation of proteins present in the ingredient mix, for instance induced by the presence of an acidifying agent combined with a heat treatment.

[0070] Most milk proteins (mainly caseins) in their native state remain in colloidal suspension form leading to minimal changes in mix viscosity (~200-400 cp). However, when proteins are subjected to controlled exposure to known amounts of heat and acid (e.g., pH of 6.1 or less and pasteurization) they undergo denaturation. Protein denaturation is a state of unfolding, where the proteins are hydrated resulting in a three dimensional network (soft gel) causing increased mix viscosity (~199-2400 cp). If the exposure of proteins to heat and acid is not controlled, this phenomenon could lead to precipitation (e.g. syneresis in yoghurt).

[0071] The inventors of the present invention have surprisingly found that when adding β -pectin to an ice cream mix including a partially coagulated protein system, for example addition of an acidifying agent to an ice cream mix comprising dairy proteins, a product with improved sensorial properties is obtained as compared to products only comprising an acidifying agent and no β -pectin and as compared to products with β -pectin but no acidifying agent added. Without being bound by any theory, it is believed that this is due to the fact that the protein aggregation is synergistically increased in products

comprising a β -pectin and an acidifying agent as compared to products only comprising either a β -pectin or an acidifying agent.

[0072] Without being bound by any theory, it is believed that partial denaturation of proteins within the ice cream mix is providing freshly aggregated proteins that act as a natural stabilizer for the air cells and enable creation of a very fine and stable microstructure resulting in a smooth, rich and creamy product without the use of artificial emulsifiers or stabilizers or similar additives. This makes the products more natural and desirable for consumers who wish to minimize their intake of such artificial additives.

[0073] In particular, the synergistic effect of the freshly aggregated proteins obtained by addition of B-pectin, and preferably in combination with a pH adjusting agent (acidifying agent), obtained in combination with low temperature freezing technology is therefore leading to superior products in terms of texture and stability.

[0074] Preferably, the proteins are dairy proteins which are usually present in an ice cream mix and which comprises casein, whey proteins, whey protein concentrate, whey protein isolate or sweet whey or the combination thereof. Such proteins may undergo partial aggregation.

[0075] pH adjusting agent

[0076] According to a particular embodiment of the invention, the pH is controlled by the presence of a pH adjusting agent. The pH adjusting agent may for example be molasses, an edible organic acid such as citric acid, acetic acid, lactic acid, malic acid, ascorbic acid, benzoic acid, fumaric acid, lactones such as glucono-delta-lactone, fruit derived acids and fermentation derived acids.

[0077] In a preferred embodiment of the invention, the product comprises a pH adjusting agent. The pH adjusting agent is in the context of the present invention an acidifying agent.

[0078] The pH adjusting agent will as described earlier result in coagulation or aggregation of the proteins present in the ingredient mix for preparing the frozen confection product.

[0079] The pH adjusting agent is added in an amount such as to obtain a pH in the products in the range of 5.0 to 6.5, preferably in the range of 5.1 to 6.3, such as in the range of 5.3 to 6.0, even more preferably in the range of 5.4 to 5.9, such as in the range of 5.5 to 5.8.

[0080] When the protein system is partially denatured prior to addition to the other components, the pH can be as high as 6.4 without detracting from the organoleptic properties of the product.

[0081] When using β -pectin in combination with a pH adjusting agent such as organic acids, preferably glucono-delta-lactone, an increased aggregation of protein will be obtained as compared to products only comprising either β -pectin or a pH adjusting agent. By protein aggregation the large milk proteins structure in an ice cream mix is broken into smaller proteins, i.e. the proteins are un-folded. These unfolded proteins have the ability to increase the water holding capacity and form a unique 3-D network, i.e. trap water and small fat particles inside them. This results in increasing mix viscosity and making an ice cream mix which is thick and viscous when extruded through the Low Temperature Freezer (LTF), and which helps the ice cream product to attain a unique smooth and creamy texture that mimics the presence of higher fat levels.

[0082] In another embodiment of the invention, the frozen confection product comprises a pH adjusting agent in an amount of 0.05 to 2.0% by weight, preferably in an amount of 0.06 to 1.0%, such as 0.07 to 0.8%, even more preferably in an amount of 0.1 to 0.3% by weight.

[0083] In a preferred embodiment of the present invention, the pH adjusting agent is a mild organic acid to get the desired protein aggregation.

[0084] In the context of the present invention, the term “mild acid” refers to acids which have slow and mild acidification capabilities. A “mild acid” is a weak acid and hereby is to be understood an acid which partially dissociate ions as compared to strong acids, e.g. hydrochloric acid, which has a complete dissociation of ions. For example acetic acid has a pKa of 4.74 and gluconic acid has a pKa of 3.70.

[0085] *Sweetening agents*

[0086] The product of the invention may comprise one or more sweetening agents. Sweetening agent refers to an ingredient or mixture of ingredients which imparts sweetness to the final product. These include preferably natural sugars such as cane sugar, beet sugar, molasses, other plant-derived nutritive sweeteners, and non-nutritive high intensity sweeteners.

[0087] In addition to sweetness, the types of sweeteners used in ice cream also affect the freezing point, viscosity, smoothness, body, and melting qualities.

[0088] In another embodiment of the invention, the frozen confection product comprises sweetening agent in an amount of from 15 to 25 % by weight.

[0089] In the most preferred embodiment of the invention, the product is preferably free of polysaccharides. Polysaccharides are mainly hydrocolloids, and they are disliked by many consumers. In ice cream polysaccharides, mainly hydrocolloids, are used to modulate the texture. The consumers prefer textural attributes in ice creams, such as ice cream having a smooth, creamy texture will be perceived as the right mouthfeel. When polysaccharides are overused in ice cream production, they can contribute to a gummy, sticky or chewy texture that consumers dislike.

[0090] *Additional ingredients*

[0091] According to a particular embodiment of the present invention, the product comprises of fat in an amount of 0-20% by weight, preferably 0-13%, milk-solid non-fat in an amount of 5-15% by weight, preferably 10-13%, a sweetening agent in an amount of

5-30%. Preferably, the product comprises 0.5 to 5.5% fat which is representative of a low-fat or non-fat product.

[0092] Milk-solid-non-fat (MSNF) includes protein, carbohydrates and ash (minerals) in a dairy product. The protein content in MSNF is normally about 45-55%.

[0093] The product may comprise natural stabilizers such as plant exudates like gum Arabic; plant extracts like agar-agar, alginates, carrageenan, konjac and pectin; seed gums like guar gum, locust bean gum; and microbial exudates like xanthan gum, or mixtures thereof.

[0094] The product may additionally comprise flavorings, colorings, inclusions, sauces, water or any mixtures thereof. Such flavorings or colorings, when used, are preferably selected from natural ingredients. These are used in conventional amounts which can be optimized by routine testing for any particular product formulation.

[0095] Method

[0096] An aspect of the present invention related to the method of producing a frozen confection product comprising β -pectin, comprising the steps of:

[0097] a) providing an ingredient mix comprising at least dairy components, sweetening agent, β -pectin or the combination of β -pectin and another natural emulsifier or natural emulsifiers, and if needed a natural stabilizer or a combination of natural stabilizers;

[0098] b) homogenizing the mix;

[0099] c) pasteurizing the mix;

[00100] d) freezing the pasteurized mix to form the frozen confection product after the addition of flavorings, and

[00101] e) optionally hardening the frozen confection product.

[00102] The inventors of the present invention has surprisingly found out the method will give the consumers the desired ice cream body and textural experience of frozen dairy systems even at full fat, low fat or non-fat contents.

[00103] In a preferred embodiment of the invention the method relates to producing a frozen aerated confection product.

[00104] Continuous pasteurization is performed under standard conditions and may be carried out prior to or after homogenization. Preferred pasteurization conditions include heating to a temperature between 75°C to 90°C, such as between 80°C to 90°C, even more preferably between 83°C to 87°C for a period of 30 to 120 seconds, preferably from 30 to 60 seconds.

[00105] Batch pasteurization is preferably performed by heating to a temperature between 69°C to 85°C, such as between 70°C to 80°C for a period of 30 to 120 minutes.

[00106] Homogenization can be done either prior or after pasteurization. It is preferably carried out under standard conditions, namely at a pressure of between 40 and 200 bars, preferably between 100 and 150 bars, more preferably between 120 and 140 bars.

[00107] The homogenized mix may then be cooled to around 2 to 8°C by known means. The mix may further be aged for 4 to 72 hours at around 2 to 6°C with or without stirring. Optionally, the addition of flavorings, colorings, sauces, inclusions etc. may be carried out prior to the ageing step. If flavorings, colorings, sauces, inclusions etc. are added, these are preferably selected from natural ingredients only.

[00108] In the next step, the mix is frozen. In an embodiment of the invention the freezing is made while aerating the pasteurized mix. In a preferred embodiment, the mix may be cooled to a temperature below -3°C, preferably between -3 and -10°C, even more preferably between at about -4.5 to -8°C with stirring and injection of a gas to create a desired overrun.

[00109] The aerating may be performed to an overrun from 20 to 150%, preferably from 50 to 140%, such as from 80-130%, and even more preferably from 100 to 130%.

[00110] In a preferred embodiment of the invention, the method comprises a step of adjusting the pH of the mix before pasteurization, in particular adjusting the pH of the mix with an acidifying agent to a pH in the range of 5.0 to 6.5.

[00111] In another preferred embodiment of the invention, the method comprises a step of adjusting the pH of the mix after pasteurization, in particular adjusting the pH of the mix with an acidifying agent to a pH in the range of 5.0 to 6.5, preferably 5.0 to 5.6.

[00112] The mix is then subjected to freezing either by using standard continuous freezing equipment or by using a low temperature extrusion system. In this equipment, the mix is cooled by extrusion at a temperature of below -11°C, preferably between -12°C and -18°C in a screw extruder. The screw extruder may be as described in WO 2005/070225. The extrusion may be performed in a single or multi screw extruder.

[00113] The freezing in step d) is made by using a standard continuous industry freezer, such as a Taylor freezer.

[00114] In a preferred embodiment of the invention, the primary freezing step in step d) is followed by a step of Low Temperature Freezing (LTF). The Low Temperature Freezing, may also be termed Low Temperature Extrusion, is reducing the product temperature from -10°C to -18°C.

[00115] A further object is to provide a low temperature extruded frozen confection product comprising β -pectin and a pH adjusting agent.

[00116] Low-Temperature Extrusion (LTE) is a known process which imparts to the final product a specific and advantageous microstructure. For instance, ice crystal size and air bubble size tend to be smaller than in traditional manufacturing

processes. On the other hand, the size of fat globules does not change significantly when LTE process is used.

[00117] With β -pectin as the only natural emulsifier or in combination with other natural emulsifier(s) and /or in combination with natural stabilizer(s), it is possible to produce a frozen confection being stable and having a high overrun even when extruded through a Low Temperature Freezer or a conventional freezer.

[00118] Foam stability is usually difficult to achieve at LTF with high overruns up to 150%, especially with a natural emulsification system like egg and acacia gum. Surprisingly, β -pectin was preferably adsorbed at the oil-water interface to form a mechanical steric barrier protecting the emulsion droplets from coalescence. The inventors of the present invention surprisingly found out that the method of the invention solved the problem of using a natural emulsifiers and achieving high overrun up to 150% through a Low Temperature Freezer.

[00119] In a preferred embodiment of the invention, the freezing is made first through a primary conventional freezer and then through a secondary low temperature freezer to achieve a creamy frozen dessert.

[00120] Products known which are made by low temperature freezing are described in US 2007/0196553, the content of which is here-included by reference. For instance, ice crystal size and air bubble size tend to be smaller than in traditional manufacturing processes. Ice crystals, air cells, fat globules and agglomerates thereof shall be in a specific diameter range in order to enhance positive sensory and stability characteristics.

[00121] The low-temperature extruded frozen confection products of the present invention have a smoother mouth feel and have particularly appealing textural and organoleptic properties, compared to low temperature extruded products. Besides the frozen confection product of the present invention in the most preferred embodiment is

preferably free of stabilizers, artificial emulsifiers, and other ingredients such as eggs, soy lecithin and acacia gum.

[00122] The frozen mix is then packaged and stored at temperatures colder than -20°C, where it will undergo hardening step during storage. Alternatively, it can be hardened by accelerated hardening step, for example via a hardening tunnel, carried out at a temperature between -20°C to -40°C for a sufficient time to harden the product.

[00123] The method of the invention lends itself to the manufacture of frozen confections which are shelf-life stable at the necessary storage temperatures and have superior organoleptic and textural properties.

[00124] It has surprisingly been found out by the inventors of the present invention that a low temperature extruded product comprising β -pectin and a pH adjusting agent, has a substantially improved sensory profile. In particular the product has an improved smooth and creamy texture.

[00125] The combination of the β -pectin and low pH mix environment makes it possible to increase the efficacy of the ingredients and also optimize its' emulsification properties to produce a full fat, low fat or non-fat product that can hold overrun up to 150% after LTF extrusion. The end product has no aftertaste; in fact, the β -pectin helps to improve the flavor release as the ice cream product is clean and uses only a few ingredients.

[00126] It should be noted that embodiments and features described in the context of one of the aspects of the present invention also apply to the other aspects of the invention.

[00127] All patent and non-patent references cited in the present application, are hereby incorporated by reference in their entirety.

[00128] The invention will now be described in further details in the following non-limiting examples.

[00129] Examples

[00130] Example 1: Clean Label All Natural Ice Cream comprising β -Pectin

[00131] An all natural frozen confection was prepared by using WCB only (non-LTF) as well as WCB and LTF freezer. The all natural frozen confection contained only 5 ingredients and an overrun of 100 – 125%. (LTF=low temperature freezing)

[00132] Table 1 – Recipe used

Ingredients	Wt% in final product
Fat	5 -6 %
Sugar	14-18%
MSNF	10-12
β -Pectin	0.05-1%
Total solids	36-41%

[00133] The five all natural ingredients used were milk, cream, sweetening agent, β -Pectin (GENU[®] BETA pectin, supplier CP Kelco) and vanilla.

[00134] Glucono delta lactone (GDL) was used as a processing aid to reduce the pH of the base mix before pasteurization. This lower pH combined with heat treatment resulted in controlled coagulation in the mix, which delivered superior textural attributes to the final product.

[00135] The pH of the mix was reduced to 5.8-6.0 before pasteurization by addition of GDL. It was standardized to 5-6 % fat and 10 - 12 % MSNF, and then processed at below given parameters.

[00136] All Natural 5 ingredients system

[00137] Pasteurized at 180°F for 90 sec.

[00138] Homogenization at 1500 psi (Stage I), 500 psi (Stage II)

[00139] LTF inlet and outlet pressure were very stable.

[00140] LTF and Non- LTF samples were collected.

[00141] Overrun for LTF sample was 125% and Non- LTF (primary freezer) was 100%.

[00142] The end product had a very smooth and creamy texture coming out of the LTF freezer at 125% overrun.

[00143] **Example 2: Clean Label All Natural Ice Cream comprising β -Pectin and whey protein phospholipid concentrate (WPPC)**

[00144] An all natural frozen confection was prepared by using WCB only (non-LTF) as well as WCB and LTF freezer. The all natural frozen confection contained only 5 ingredients and an overrun of 100 – 130%. (LTF=low temperature freezing)

[00145] Table 2: Recipe used

Ingredients	Wt% in final product
Fat	5 -6 %
Sugar	14-18%
MSNF	10-12
β -Pectin	0.05-1%
WPPC	0.2-2
Total solids	36-41%

[00146] The five all natural ingredients used were: milk, cream, sweetening agent, β -Pectin, WPPC (all natural ingredients) and vanilla.

[00147] Glucono delta lactone (GDL) was used as a processing aid to reduce the pH of the base mix before pasteurization. This lower pH combined with heat treatment resulted in controlled coagulation in the mix, which delivered superior textural attributes to the final product.

[00148] The pH of the mix was reduced to 5.8-6.0 before pasteurization by addition of GDL. It was standardized to 5-6 % fat and 10 - 12 % MSNF, and then processed at below given parameters.

[00149] All Natural 5 ingredients system

[00150] Pasteurized at 180°F for 90 sec.

[00151] Homogenization at 1500 psi (Stage I), 500 psi (Stage II)

[00152] LTF inlet and outlet pressure were very stable.

[00153] LTF and Non- LTF samples were collected.

[00154] Overrun for LTF sample was 125% and Non- LTF (primary freezer) was 100%.

[00155] The end product had a very smooth and creamy texture coming out of the LTF freezer at 125% overrun.

[00156] It should be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present subject matter and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

CLAIMS

The invention is claimed as follows:

1. A frozen confection product comprising β -pectin as an emulsifier.
2. The product according to claim 1, wherein the amount of β -pectin is in the range of 0.05-3.0% by weight, more preferably 0.05-2.0 wt% and most preferably 0.05-1.0 wt%.
3. The product according to claim 1 or 2, wherein the product further comprises dairy components, sweetening agent and flavor.
4. The product according to any of the preceding claims, wherein the dairy component is selected from the group consisting of milk, cream, casein, whey proteins and mixtures thereof.
5. The product according to any of the preceding claims, wherein the product further comprises a pH adjusting agent to obtain a pH in the range of 5.0 to 6.5.
6. The product according to any of the preceding claims, wherein the pH adjusting agent is an edible organic acid, more preferably is a lactone and most preferably is glucono-delta-lactone.
7. The product according to any of the preceding claims, wherein the product further comprises at least one natural emulsifier.
8. The product according to any of the preceding claims, wherein the product further comprises at least one natural stabilizer.
9. The product according to any of the preceding claims, wherein the product is free of artificial emulsifiers.
10. The product according to any of the preceding claims, wherein the product is free of eggs, soy lecithin and acacia gum.

11. The product according to any of the preceding claims, wherein the product is free of artificial stabilizers, and preferably free of stabilizers.

12. The product according to any of the preceding claims, wherein the product is all natural.

13. The product according to any of the preceding claims, wherein the product is obtainable by conventional freezing, by low-temperature extrusion and/or low temperature freezing.

14. The product according to any of the preceding claims, wherein the product has an overrun between 20 to 150% by volume, preferably 80-130%, more preferably 100-130%.

15. A method of producing a frozen confection product comprising β -pectin, comprising the steps of:

a) providing an ingredient mix comprising at least dairy components, sweetening agent, β -pectin or the combination of β -pectin and another natural emulsifier or natural emulsifiers, and if needed a natural stabilizer or a combination of natural stabilizers;

b) homogenizing the mix;

c) pasteurizing the mix;

d) freezing the pasteurized mix to form the frozen confection product after the addition of flavor, and

e) optionally hardening the frozen confection product.

16. The method according to claim 15, wherein the freezing is followed by a low temperature freezing step.

17. The method according to claim 15 or 16, wherein the method further comprises a step of adjusting the pH of the mix before pasteurization with the pH adjusting agent to the pH range of 5.0 to 6.5.

18. The method according to any of claims 15 to 17, wherein the method further comprises a step of adjusting the pH of the mix after pasteurization, in particular adjusting the pH to the range of 5.0 to 6.5.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055372

A. CLASSIFICATION OF SUBJECT MATTER
INV. A23G9/42 A23L1/0524
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A23G A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00/40098 A1 (DANISCO [DK]; SOENDERGAARD KAREN MARIE [DK]; JUUL ANNE GRETE [DK]; NOE) 13 July 2000 (2000-07-13) the whole document	1-18
X	WO 2004/017746 A1 (UNILEVER NV [NL]; UNILEVER PLC [GB]; LEVER HINDUSTAN LTD [IN]) 4 March 2004 (2004-03-04) examples	1-18
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Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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International application No

PCT/EP2014/055372

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