Title: LIQUID ACIDIC FOOD PRODUCTS

Abstract: The present invention provides a liquid, pourable or spoonable food product having a pH in the range of 3 to 5 and comprising at least one non-animal protein having a water solubility which is less at pH 3 than at pH 5, an edible acid, a salt of an edible organic acid, and wherein 25% wt or more of the protein and at least a part of the salt is dissolved in the food product. The products have a good combination of acidic taste and physical stability. A method of making the food product is also provided.
LIQUID ACIDIC FOOD PRODUCTS

FIELD OF THE INVENTION
The present invention relates to liquid, pourable or spoonable food products which comprise protein and have an acidic taste but which do not suffer from unacceptable levels of sedimentation and/or precipitation of the protein.

BACKGROUND OF THE INVENTION
There is an increasing demand for food products which are perceived by the consumer as healthy, or, as giving health benefits. Furthermore, such products should have acceptable taste, acceptable stability and ideally be available in convenient forms such as drinks (liquid), other pourable products and spoonable products. In particular, and at least in part due to increasing concerns regarding the safety of protein from animal sources, there is a need for such products which contain protein(s) from sources other than bovine sources (and to a somewhat lesser extent from other non-animal sources). Non-animal source proteins are becoming increasingly renowned for their health or physiological benefits, for example cardiovascular benefits. An example of such a protein is soya protein.

Drinks, other pourable products and spoonable products comprising protein(s) from non-animal sources are already commercially available and are becoming increasingly accepted by consumers as more is known about the potential health benefits of such food ingredients. Examples include soya-protein based drinks and puddings etc.
It is known in the art that products based upon non-animal protein sources, such as soya protein, often have a tendency to suffer from physical instability at certain pHs. In particular the proteins may exhibit a degree of sedimentation and/or precipitation of the protein at pHs at which it is desired to formulate food products, for example pH 3 to 6.

US 4 389 425 discloses soya-based milk and a method for making it. Soaked soy beans are blanched and ground in the presence of an acidified water solution having a pH of 1.4 to prevent coagulation of the extracted soy beans and produce a stable milk. Citric acid, hydrochloric acid or phosphoric acid may be used. The pH of the product is raised and the final pH is about 7.

However, a problem which can be encountered in food products comprising non-animal protein and which are not substantially solid (that is which are liquid, pourable or spoonable) is that often the consumer desires an acidic taste (found in products having a pH of 6 or less) but the stability of the product can be adversely affected at such pHs. In particular the food product can suffer from problems of sedimentation and/or precipitation of the protein at the pH ranges which are acceptable to the consumer in terms of acidic taste. The solubility of many non-animal proteins is reduced in acidic pHs with the result that unwanted sedimentation or dispersion of the protein forms in an acidic food product.

It is often desired to provide such types of products (e.g. those containing soya) with an acidic taste, for example, when the product comprises fruit or is to have a fruity taste. The consumer typically associates an acidic taste with fruits or
with a fresh-tasting product. It is therefore difficult to find an acceptable balance between providing an acidic taste to the consumer and maintaining the physical stability of the product. If a product is formulated at a pH which provides an acceptable taste for the consumer, the non-animal protein has a tendency to sediment and/or to precipitate. Conversely, if the pH is chosen so that the product is physically stable, the taste will not generally be sufficiently acidic for the consumer.

A further problem with acidic food products which comprise non-animal protein is that the products have a tendency to suffer from poor mouthfeel and/or develop an off-flavour.

There is therefore a need in the art for liquid, pourable or spoonable food products comprising non-animal protein and which have an acceptable acidic taste and acceptable physical stability.

Furthermore, there is also a need for liquid, pourable or spoonable food products comprising soya protein and which have an acceptable acidic taste and acceptable physical stability.

There is also a need for liquid, pourable or spoonable food products comprising non-animal protein which have a good mouthfeel and do not suffer from an unacceptable off-flavour.

Furthermore, there is also a need for liquid, pourable or spoonable food products comprising soya protein and which have good mouthfeel and do not develop unacceptable off-flavours.

The present invention seeks to address one or more of the above problems.
SUMMARY OF THE INVENTION

We have surprisingly found that by formulating liquid, pourable or spoonable food products comprising certain non-animal protein(s), at least one edible acid and at least one salt of an edible organic acid and with a pH within a given pH range, one or more of the above problems can be addressed.

The present invention therefore provides, according to a first aspect, a liquid, pourable or spoonable food product comprising:

a) at least one non-animal protein of which the solubility thereof in water at 20°C is less at pH 3 than at pH 5, and
b) an edible acid, and
c) a salt of an edible organic acid,

and wherein 25 %wt or more of the protein is dissolved in the food product, the salt is at least partly dissolved in the food product and the food product has a pH in the range of from pH 3 to 5.

The products of the first aspect have several advantages including that they have a taste which is acceptable and sufficiently acidic for consumers and also acceptable physical stability. Also they are easily digestible and so are suitable for all consumers. The products also have a good mouthfeel and do not suffer from an off-flavour. Furthermore, they are simple to manufacture and can be produced according to several different methods. A further advantage is that the acidic products are particularly suitable for the incorporation of fruit flavours and give a good fruity taste. They also show good microbiological stability.
According to a second aspect, the present invention provides a process to produce the food product according to the invention, wherein the process comprises forming a mixture comprising the non-animal protein, water, the salt of the organic acid, and the edible acid and wherein the pH of the mixture is within the range pH 3 to 5.

The process of the second aspect has several advantages including that it is simple, reliable and produces products which have good physical and microbiological stability.

It is to be understood that the terms “soy protein” and “soya protein” are used interchangeably in the art to the protein(s) derived from soya (soy) beans. The terms “soya protein” and “soya” are used herein.

The term “pourable” as used herein refers to a food product which can be poured from a vessel at room temperature and which flows from the vessel to beneath.

The term “spoonable” as used herein refers to a food product which does not easily from a vessel as described above but which can be removed therefrom with a spoon. These products have a deformable texture.

Both the pourable and spoonable terms do not refer to products which are discrete particles of solid or semi solid material.

Except in the operating and comparative examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts of material or conditions of reaction, physical properties of materials and/or use are to be understood as modified by the word “about.” All amounts in the
food product are by weight, based on the weight of the food product unless otherwise specified.

**DETAILED DESCRIPTION OF THE INVENTION**
The invention will now be discussed in greater detail.

(i) types of food product
The food product is a liquid, pourable or spoonable product. Foods that are substantially solid do not really suffer from the same problems of sedimentation because of their physical form. Preferably the food product is a drink, dessert, spread, paste or gel. Such products comprising soya protein are especially preferred.

(ii) non-animal protein
The non-animal protein has a solubility in water at 20°C which is less at pH 3 than at pH 5. Any non-animal protein which meets the required solubility requirements may be used. In the products (which have a pH in the range of from pH 3 to pH 5) 25 %wt or more of the protein is dissolved in the food product, preferably 50 %wt or more, most preferably 60 %wt or more, especially 70 %wt or more.

Preferred are plant derived proteins such as those derived from beans, peas, pulses, cereals, fungi and legumes. Suitable proteins include soya, rice, oats, wheat, maize, corn, lentils, chick pea, lupine, pea, chick pea, kidney bean, butter bean, haricot bean and potato. It is especially preferred that the protein comprises soya, more preferred that it comprises at least 50 %wt based on the weight of the protein of soya, most preferably at least 70 %wt, especially at least 80 %wt.
According to one aspect of the invention, the non-animal protein consists substantially of soya.

The protein may be used in any suitable form, for example, combined with an amount of one or more oils to help the preparation of the food product, or as a powder or solution. It may be used as an extraction from the protein source, protein concentrate or protein isolate. Protein isolates, especially soy protein isolates, are especially preferred.

The food product may comprise an amount of from 0.05 %wt to 10%wt of the non-animal protein, preferably from 1 to 8 %wt, more preferably 1.5 to 7 %wt, most preferably 2 to 6 %wt. of the protein. The exact level of protein used will in part depend upon the type of protein used and the type of food product. It has been found that using soya proteins in an amount of from 1 to 8 %wt, especially 1.5 to 7 %wt is especially effective.

The food product may further comprise one or more other proteins in addition to the specified non-animal protein, for example whey protein. Amounts of up to 10 %wt may be incorporated depending upon the type of food product, preferably from 1 to 5 %wt. However it is preferred that the total protein content of the product comprises a greater weight percentage of the specified non-animal protein than of any other type of protein. Preferably at least 60 %wt of the total amount of protein in the product is the specified non-animal protein, more preferably at least 70 %wt.
(iii) edible acid
The food products comprise an edible acid, preferably in an amount of from 0.01 to 5% wt, more preferably 0.2 to 3 wt%, most preferably 0.5 to 2 %wt. Amounts in the range of from 0.6 to 1.5 %wt are suitable in most products, depending upon the pH of the food product without the acid present. Sufficient acid is added to the food product to arrive at a pH which is in the range pH 3 to 5.

Any edible acid may be used. Preferred acids are organic acids. Carboxylic acids are especially preferred, especially acetic acid, citric acid, lactic acid, malic acid, maleic acid, aspartic and formic acid. Edible inorganic acids such as hydrochloric acid, nitric acid, sulphuric acid and phosphoric acids may also be used.

The acid may be added as the isolated acid, for example as a powder, or, it may be added through the addition of a food ingredient comprising such acid, for example a fruit juice.

The acid chosen will affect the taste profile of the product. For example, if a fresh, citrus type taste is required then citric acid or another acid found in citrus fruits may be added and if an apple taste is desired malic acid or another acid found in apples may be added.

It has been found that the use of organic acids has particular advantages, including, that good microbiological results are obtained and this allows good flexibility in which packaging technology to use for the food products.
(iv) salt of an edible organic acid

The food products comprise a salt of an edible organic acid, preferably in an amount of from 0.01 to 5% wt, more preferably of from 0.05 to 2% wt, most preferably of from 0.1 to 1% wt. Amounts in the range of from 0.1 to 0.5% wt are suitable in most products, again, depending upon the pH of the food product without the acid present.

The edible salt in combination with the edible acid provides an increased acid taste in the product at a given pH compared to the use of acid alone at that pH. This allows the product to provide the sufficiently acidic taste which consumers desire, but, without having to formulate the product at pHs which generally result in protein sedimentation and/or precipitation.

The salt of an edible organic acid may be any such salt which when used in combination with the edible acid produces a stronger acid taste perception in the product than does the use of the edible acid alone at the same pH.

Preferred salts are those of edible carboxylic acids, especially the alkaline metal or alkaline earth metal salts thereof. It is preferred that the salt is selected from the sodium, calcium, magnesium or barium salts of acetic acid, citric acid, lactic acid, malic acid, maleic acid, aspartic and formic acid. Sodium and calcium salts are especially preferred. One advantage of such salts is that it helps to increase the nutritional value of the food product.

Iron, zinc and other transition metal salts may be used but their presence is less desired because such salts have been found to increase sedimentation.
The considerations regarding the taste profile of the product as discussed above with reference to the edible acids apply equally to the salt of an edible organic acid. Therefore, it is preferred to use a combination of complimentary edible acids and salts of edible organic acids, for example a citrate salt with citric acid etc, or a mixture of acids with can be obtained from citrus fruit and their corresponding salts.

However, the edible acid and the salt of an edible acid may be from different acids. For example, an inorganic acid such as phosphoric acid may be used with a carboxylic acid salt such as sodium citrate.

The salt of an edible organic acid is at least sparingly water soluble in water at 20°C at the pH of the food product; therefore at least a part of this salt is dissolved in the food product. Preferably the salt has a solubility in water at 20°C of at least 1 g per 100 g of water, more preferably of at least 2 g per 100 g, such as of at least 5 g per 100 g.

The salts can be used in any suitable form, for example as a solid, powder or a solution of the salt.

The weight ratio of the edible acid to the salt of an edible acid is preferably in the range of from 10:1 to 1:5, more preferably 7:1 to 1:2, most preferably 5:1 to 1:1.
(v) pH of the food product

The food product has a pH in the range of 3 to 5 at 20°C. It is preferred that the pH is in the range of from 3.3 to 4.8, most preferably 3.5 to 4.5, especially 3.8 to 4.3.

(vi) Stabiliser

In the most preferred embodiment of the invention, the food product comprises one or more stabilisers which have a thickening effect on the food product at the pH of the food product. Thus, if the pH of the food product is 3.8, the stabiliser has a thickening effect at this pH. Any edible material which has a thickening effect at the pH of the food product may be used, for example suitable pectins, gums, alginates and other hydrocolloids.

It is especially preferred that the stabiliser comprises a pectin, most preferably a pectin having a high ester content. D-galacturonic acid is the principal constituent of the pectin molecule. The polygalacturonic acid is partly esterified with methyl groups and the free acid groups may be partially or fully neutralised with sodium. Potassium or ammonium ions. The ratio of esterified galacturonic acid groups to total galacuronic acid groups, termed the degree of esterification (DE) has a great influence on the properties of pectin, especially on the solubility and the gel forming characteristics. The highest DE that can be achieved by the natural extraction of the natural raw material is about 75%. Pectins with a DE from 20 to 70% are produced by controlled de-esterification in the manufacturing process. The DE of 50% is used in the art to commercially available pectins into high ester pectins (greater than 50% esterification of the pectin) and into low ester pectins (less than 50% esterification). In
the art, pectins which have more than 50% of the carboxyl units esterified to the methyl ester are known as "high-methoxy pectins" and those have less than 50% esterified to the methyl ester are known as "low-methoxy pectins". High ester pectins are known in the art, for example from WO 97/03574.

It is especially preferred that the stabiliser comprises a pectin having a degree of esterification of 50 % or more, more preferably 60 % or more, such as 65 to 75%. It is especially preferred that the pectin has a degree of esterification to the methyl or ethyl ester, most preferably to the methyl ester of 50 % or more, more preferably 60 % or more, such as 65 to 75%.

Other stabilisers which may be used provided that they exhibit thickening at the pH of the food product are Carbomymethylcellulose and propylene glycol alginates.

It is preferred that the above stabiliser is present in amounts in the range of from 0.01 %wt to 5 %wt, more preferably 0.05 %wt to 3 %wt, most preferably 0.1 to 2 %wt. For liquid products the preferred amounts are in the range of from 0.01 to 1.5 %wt, more preferably 0.05 to 1 %wt, most preferably 0.1 to 0.7 %wt. For pourable products the preferred amounts are from 0.2 to 3 %wt, more preferably from 0.4 to 2.5 %wt and for spoonable products the preferred amounts are from 0.5 to 5 %wt, more preferably from 0.6 to 3.5 %wt.

The food products may comprise a mixture of suitable stabilisers. Ratios of the stabilisers in the mixture are fully within the skill of the person skilled in the art. A preferred mixture is one of pectin with a gum, more preferably a mixture of a pectin having a degree of esterification of 50 % or more
with a gum such as carageenan or guar. A particularly preferred mixture is pectin that has a degree of esterification to the methyl or ethyl ester of 50 % or more, more preferably 60 % or more, such as 65 to 75% and guar gum. Weight ratios within the range of pectin to gum of 5:1 to 1:5, preferably 3:1 to 1:2, more preferably 2:1 to 1:1 have been found to be especially suitable.

(vii) water content
The food product comprises a sufficient amount of water so that it is in the form of a liquid, pourable or spoonable product. The food products preferably comprise an amount of water of from 40 to 98% wt, more preferably of from 45 to 95 %wt. The exact amount of water used will depend upon the physical form of the product.

Liquid products preferably comprise an amount of from 65 to 95 %wt water, more preferably 70 to 90 %wt water. Pourable products preferably comprise an amount of from 50 to 85 %wt water, more preferably 55 to 75 %wt water. Spoonable products preferably comprise an amount of from 45 to 70 %wt water, more preferably 50 to 65 %wt water.

(xiii) calcium enrichment
In another very preferred embodiment of the invention, the food products further comprise calcium. It is most preferred that the calcium is present in the food product at least in part from a calcium salt. Preferred inorganic salts are calcium phosphates, calcium chloride, calcium carbonate and calcium sulphate. Some calcium may also be added as a calcium salt of the edible organic acid as described hereinabove. In this case the total amount of the calcium salt is preferably in the ranges stated below.
The calcium salt is preferably present in an amount of from 0.01 to 5 %wt, more preferably of from 0.01 to 2 %wt, most preferably of from 0.02 to 1 %wt, especially 0.05 to 0.5 %wt.

It is especially preferred that the calcium salt is mixed with the protein prior to the preparation of the food product and that this mixture is used in the preparation of the food product. It is especially preferred that soya protein is mixed with a calcium salt such as a calcium phosphate (for example tricalcium phosphate), calcium chloride, calcium carbonate or calcium sulphate or any of the calcium slats of organic acids mentioned above.

(xiv) optional ingredients
The food products may contain any of the usual minor food ingredients in conventional amounts, for example: added vitamins or minerals, flavourings including herbs and spices, colourings, preservatives, flavour improvers, artificial sweeteners, aromas etc.

According to one aspect of the invention it is especially preferred that the food product comprises a fruit juice. The addition of the juice has flavour benefits and is also frequently desired by the consumer because of its perceived health benefits. Any desired fruit juice can be added. It is especially preferred that acidic fruit juices such as citrus fruit juices (such as orange, kiwi, lemon, pineapple, clementines, mandarin, lime etc) are used. Also preferred are grape juice, mango juice, juice from berries such as strawberry, raspberry, cranberry, blackberry, blueberry, elderberry etc may be used. Alkaline or neutral fruit juices
may be used provided that the pH of the product is within the range pH 3 to 5. The fruit juice may be added as a concentrate or extract from the fruit. The fruit juice may be used to provide a part, or all, of the edible acid. Preferably the edible acid is provided in part by the straight addition of an acid and in part from the addition of one or more fruit juices. The fruit juice is preferably present in an amount of from 0.5 to 50 %wt, more preferably 1 to 30 %wt, most preferably 2 to 10 %wt.

The food products may also optionally comprise one or more natural sweeteners. Suitable natural sweeteners include sucrose, fructose, glucose and maltose. The amount of the natural sweetener added is a matter of taste but will usually be in the range of from 1 to 25 %wt, preferably of from 1 to 20 %wt, most preferably 2 to 15%. If any fruit juice is present in the formulation, this may add a part, or all, of the total amount of these natural sweeteners. Preferably the natural sweetener is provided in part by the straight addition of such a ingredient (e.g. sucrose) and in part from the addition of one or more fruit juices.

The food products may comprise edible inorganic acid salts in addition to the organic salts mentioned hereinabove. Suitable salts include those having alkaline metal or alkaline earth metal cations. It is preferred that such salts are selected from the sodium, calcium, magnesium or barium salts of nitric acid, sulphuric acid, hydrochloric acid or a phosphoric acid. Sodium chloride, potassium chloride and magnesium chloride are especially preferred. These salts may, for example, be added to improve the flavour and/or keeping qualities of the product. Amounts in the range of from 0.1 to 5 %wt of the edible
inorganic salts are typically used, more preferably of from 0.5 to 3 %wt.

Fruits and fruit pieces, vegetables and vegetable pieces, honey, cereals such as oats and rice, nuts etc may also be added to the food product to give flavour and/or texture.

Other food ingredients may also be included in suitable amounts. Suitable examples include fats/lipids, preferably, in an amount of from 0.5 to 10 %wt, more preferably 1 to 5%wt.

(x) sedimentation
The food products of the invention exhibit good resistance to sedimentation and/or precipitation of the protein or protein-calcium system or complex where used.

It is preferred that on standing at ambient temperature and/or 5 °C for 1 week, the food products have a sediment of less than 20% by volume, more preferably less than 10% by volume, most preferably less than 5% by volume. Generally, upon shaking the product, at least 50% by volume of any sediment is re-dissolved in the product, preferably at least 60% by volume, most preferably at least 70% by volume.

(xi) production of the food product
The food product may be produced by any suitable method. A preferred method is that of the second aspect of the invention.

A preferred method is to mix the non-animal protein, e.g. soya milk powder, in hot demineralised water (temperature in the range 50 to 95°C, preferably 55 to 80 °C, such as 60 to 70 °C) to form a first phase (A). The salt of the organic acid, e.g. sodium citrate and any natural sweetener, e.g. sucrose, and any
stabiliser, e.g. the high methoxy pectin are mixed together and dissolved in hot demineralised water (temperatures as above) to form a second phase (B). Any flavours, fruit juice or concentrates, and colours are mixed with (B) to form phase (C). Phases (A) and (C) are mixed, preferably at a temperature in the range 35 to 60°C, more preferably at a temperature in the range 40 to 50°C, and the vitamins are added and the pH is adjusted to the desired pH using the edible acid e.g. citric acid.

This process can be used to make all products of the invention. The water content can be varied to produce the desired physical form of the product.

It is preferred that the product is UHT treated (e.g. 118 °C, 7 seconds) and homogenized (e.g. 175/35 bar) before cooling to room temperature or below (e.g. in the range 2 to 15°C, preferably 5 to 10 °C) and being then filled into the product packaging e.g. bottles in an aseptic manner. Alternatively the product can be filled into the packaging at a temperature at or above room temperature, e.g. in the range 30 to 60 °C.

The present invention will be further explained with reference to the following non-limiting examples. Further examples within the scope of the present invention will be apparent to the person skilled in the art.

EXAMPLES

Example 1
A food product according to the present invention was made with the formulation as given in table 1. The method used was the method described in Example 2.
Table 1

<table>
<thead>
<tr>
<th>Raw material</th>
<th>A (%wt)</th>
<th>B (%wt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sucrose</td>
<td>12.5</td>
<td>10.0</td>
</tr>
<tr>
<td>Soya protein isolate (90%wt protein)</td>
<td>3.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Pectin, 70-72 % methoxy content *1</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Citric acid</td>
<td>0.88</td>
<td>0.9</td>
</tr>
<tr>
<td>Sodium citrate</td>
<td>0.27</td>
<td>0.3</td>
</tr>
<tr>
<td>White grape juice concentrate *2</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Vitamin pre-mix, flavour, colouring agent</td>
<td>0.35</td>
<td>0.3</td>
</tr>
<tr>
<td>Water</td>
<td>To 100% wt</td>
<td>To 100% wt</td>
</tr>
</tbody>
</table>

*1 - GENU pectin type JMJ, ex CP Kelco, Denmark. A high ester pectin with a degree of hydrolysis in the range 68-73%.

*2 - brix 68, obtained from Greenwood Associates

Samples A and B are liquid products (drinks) and have a pH in the range of 3.5 to 4.5. The pH may drift slightly upwards on storage (less than 0.3 parts). More than 25 %wt of the protein in the drinks is dissolved. When stored for 1 week at ambient and in the refrigerator the products show good resistance to sedimentation and to precipitation.

The addition of 0.01 to 5 %wt tricalcium phosphate to either composition produces a calcium enriched product which has the same resistance to sedimentation and to precipitation.

Example 2
A drink comprising soya protein according to the invention was prepared according to the following process.

Step 1 - Soymilk powder is dispersed in hot demineralized water (ca. 60 °C) to form (A).
Step 2 - Sucrose, the pectin stabiliser and sodium citrate are mixed together and dissolved in hot deminereralised water to form (B).

Step 3 - the flavors, fruit concentrate and colours are mixed with (B) to form (C).

Step 4 - (A) and (C) are mixed together 45 °C, the vitamins are added and the pH is adjusted to 3.85 using citric acid.

The product is UHT treated (118 °C, 7 seconds) and homogenized (175/35 bar) before cooling to 8 °C and is subsequent aseptic filled into bottles.
CLAIMS

1. A liquid, pourable or spoonable food product comprising:
   a) at least one non-animal protein of which the
      solubility thereof in water at 20°C is less at pH 3
      than at pH 5, and
   b) an edible acid, and
   c) a salt of an edible organic acid,
   and wherein 25 %wt or more of the protein is dissolved in
   the food product, the salt is at least partly dissolved in
   the food product and the food product has a pH in the
   range of from pH 3 to 5.

2. A food product according to claim 1, wherein the product
   further comprises at least one stabiliser which has a
   thickening effect on the food product at the pH of the
   food product.

3. A food product according to claim 2, wherein the
   stabiliser comprises a pectin having a degree of
   esterification of 50 % or more.

4. A food product according to either one of claims 2 or 3,
   wherein the stabiliser is present in an amount of from
   0.05 %wt to 5 %wt based on the weight of the food product.

5. A food product according to any one of the preceding
   claims, wherein the protein comprises soya protein.

6. A food product according to any one of the preceding
   claims, wherein the product comprises an amount of from 1
to 8 %wt of the protein based on the weight of the food product.

7. A food product according to any one of the preceding claims, wherein the product has a pH in the range of from 3.5 to 4.5.

8. A food product according to any one of the preceding claims, wherein the food product comprises an amount of from 0.5 to 2 %wt of the edible acid based on the weight of the food product.

9. A food product according to any one of the preceding claims, wherein the food product comprises an amount of from 0.1 to 2 %wt of the salt of an edible organic acid based on the weight of the food product.

10. A food product according to any one of the preceding claims, wherein the product comprises a calcium salt in an amount of from 0.01 to 2 %wt based on the weight of the food product.

11. A food product according to any one of the preceding claims, wherein the food product comprises water in an amount of from 45 to 95 %wt based on the weight of the food product.

12. A process to produce the food product according to any one of claims 1 to 11, wherein the process comprises forming a mixture comprising the non-animal protein, water, the salt of the organic acid, and the edible acid and wherein the pH of the mixture is within the range pH 3 to 5.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

<table>
<thead>
<tr>
<th>IPC</th>
<th>A23L1/305</th>
<th>A23L2/66</th>
<th>A23L2/68</th>
<th>A23L2/02</th>
</tr>
</thead>
</table>

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)

<table>
<thead>
<tr>
<th>IPC</th>
<th>A23L</th>
</tr>
</thead>
</table>

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

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

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>
| X        | WO 99 56563 A (ABBOY LAB)  
11 November 1999 (1999-11-11)  
page 1, column 4 -column 14  
page 9, line 1 - line 29  
page 16, line 14 -page 19, line 11  
page 20, line 13 - line 33  
page 24, line 6 -page 27, line 5  
page 29 -page 30; examples 1,2  
page 34; table 6 | 1-12 |

☐ Further documents are listed in the continuation of box C.  

☐ Patent family members are listed in annex.

* Special categories of cited documents:
  *A* document defining the general state of the art which is not considered to be of particular relevance  
  *E* earlier document but published on or after the international filing date  
  *L* document which may throw doubts on priority claims or which is cited to establish the publication date of another citation or other special reason (as specified)  
  *O* document referring to an oral disclosure, use, exhibition or other means  
  *P* document published prior to the international filing date but later than the priority date claimed  
  *T* later document published after the international filing date or priority data and not in conflict with the application but cited to understand the principle or theory underlying the invention  
  *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone  
  *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art  
  *A* document member of the same patent family

Date of the actual completion of the international search  
8 January 2004

Date of mailing of the international search report  
27/01/2004

Name and mailing address of the ISA  
European Patent Office, P.B. 5818 Patentlaan 2  
NL-2280 MV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31651 epc nl  
Fax: (+31-70) 340-3016

Authorized officer  
Inceisa, L

Form PCT/ISA/210 (second sheet) (July 1994)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AU 3780599 A</td>
<td>23-11-1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BR 9910279 A</td>
<td>02-10-2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2330061 A1</td>
<td>11-11-1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1102549 A2</td>
<td>30-05-2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 9956563 A2</td>
<td>11-11-1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6475539 B1</td>
<td>05-11-2002</td>
</tr>
</tbody>
</table>