International Application Published Under the Patent Cooperation Treaty (PCT)

International Publication Number
WO 2014/053288 A1

International Publication Date
10 April 2014 (10.04.2014)

International Patent Classification:
A23L 7/0522 (2006.01) A23L 7/0532 (2006.01)

International Application Number:
PCT/EP2013/068776

Filing Language: English

Publication Language: English

Priority Data:
12187359.0 5 October 2012 (05.10.2012) EP

Applicant: NESTEC S.A. [CH/CH]; Av. Nestlé 55, CH-1800 Vevey (CH).

Inventors: LAGARRIGUE, Sophie; Gottlieber Str 25, 78462 Konstanz (DE); DURBEN, Konca Yasmin; Leinerstrasse 20, 78462 Konstanz (DE); SCHWÄGERL, Martina; Untere Söökicherstrasse 1d, 78315 Radolfzell (DE); HANLÉ, Christoph; Obere Beugen 26, 78224 Singen (DE); TSIOULPAS, Alexandros; Weierstrasse 22b, CH-8280 Kreuzlingen (CH).

Agent: MOLLET, Beat; Avenue Nestlé 55, CH-1800 Vevey (CH).

Designated States (unless otherwise indicated, for every kind of regional protection available):

Declarations under Rule 4.17:
— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
— as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))
— of inventorship (Rule 4.17(iv))

Published:
— with international search report (Art. 21(3))

Title: GEL FOR PREPARING A FOOD PRODUCT

Abstract: The invention relates to a composition in gel form for preparing a food product, to a process for preparing a food product, and to the use of the composition for preparing a food product. In particular, the invention relates to a gel composition comprising carrageenan and un-gelatinised starch for preparing savoury food products such as sauces, gravies, and soups.
Gel for preparing a food product

The invention relates to a composition in gel form for preparing a food product, to a process for preparing a food product, and to the use of the composition for preparing a food product. In particular, the invention relates to a gel composition comprising carrageenan and un-gelatinised starch for preparing savoury food products such as sauces, gravies, and soups.

Concentrated food products, such as dehydrated gravies and sauces, and bouillon or stock cubes, have been known for many years. Savoury dehydrated products are becoming increasingly unattractive to consumers due to a perception that they are not natural, they have an old fashioned image, and they have an artificial appearance. Some products have a pasty texture, but these are typically fat-based and therefore have a high fat content and consequently a poor health or nutritional profile. In the search for alternative product types having different characteristics and advantages over traditional food concentrates, food compositions concentrated in gel form have been developed. A number of such products are now known. They are typically based on the presence of a gelling agent or a combination of two or more gelling agents.

Those products give usually after dilution and product preparation only limited viscosity in the final product, typically they are used to prepare bouillons. Examples of such products are described in WO2007/068484, WO 2008/151850, WO 2008/151851, WO 2008/151852 and WO 2012/062919.
Those products present the disadvantage that the hydrocolloids used are fully solubilised in the food concentrate to develop the gel texture and cannot therefore give additional thickening after dilution in order to give the consistency typical for a soup or sauce. In a dehydrated soup typically 20 to 50 g/l of starch or flour is used to thicken the dish. Incorporation of such high amounts of starch in those products is a problem as starch might get gelatinised during processing, therefore not providing binding in the final application, and it might negatively affect the formation of the gel texture by dramatically increasing the viscosity.

WO 2012/097930 describes a food concentrate in a gel format comprising 10 to 50% un-gelatinised starch that will develop the viscosity during product preparation. This composition presents the disadvantage that a high amount of polyols (5 to 60%) is used in the composition to get the right gel texture that is otherwise affected by the incorporation of the un-gelatinised starch. Polyols might not be perceived as very natural and attractive by consumers. Furthermore, certain polyols in too high amounts may have not desired side effects with some consumers, such as e.g. a non-desired laxative effect.

Another commercial product is based on the use of three hydrocolloids and un-gelatinised starch. This product typically suffer from problems that, when used to make a soup or sauce, the gelling agents are still able to form a gel very quickly during cooling. This re-forming of a gel can lead to an undesirable texture for consumption of the product when the dish is cooling. There is therefore a need for a gelling agent composition which does not gel during normal food consumption times.
Those products might also be difficult to dissolve in cold or hot water without lumps. To improve dissolution, some of those products need a pre-dissolution/heating step at a specific temperature before being added to the final application, thus making the product complicated to use for consumers.

There is a persisting need for a composition for preparing soups, sauces and gravies, which composition has the texture of a gel and develops texture upon dilution and product preparation. The gel-forming composition should be able to set after production and melt during product preparation. The melting temperature should be in a range allowing the composition to melt easily during a standard heating step or to allow dilution of the gel composition in hot water. There is further a need for a gel composition for preparing a food product that is stable during transportation and storage, and shows a low syneresis during storage typically for a few weeks or even up to several months.

The object of the present invention is to improve the state of the art and to provide a gel composition that at least goes part way to overcoming one or more of the above mentioned disadvantages of existing gel compositions or at least provides a useful alternative. Particularly, the objective is to provide a gel composition which: i) further thickens upon use of said gel product during the preparation of a food product for example by heating or dissolution of the gel product in hot water, e.g. at a consumer’s home; ii) dissolves easily in hot or cold water; iii) does not readily and quickly reform a gel upon cooling of a prepared sauce or food-dish; and iv) does not make use of chemical substances such as polyols, which may not be favourably perceived by consumers.
The object of the present invention is achieved by the subject matter of the independent claims. The dependent claims further develop the idea of the present invention.

Accordingly, the present invention provides in a first aspect a composition in the form of a gel for preparing a food product, the composition comprising:

i) water in the amount of 20 to 50 % (by weight of the total composition),

ii) flavourings in the amount of 10 to 40 % (by weight of the total composition),

iii) salt in the amount of 3 to 15 % (by weight of the total composition),

iv) carrageenan as a gelling agent in the amount of 0.1 to 1.5 % (by weight of the total composition), and

v) un-gelatinised starch in the amount of 10 to 40 % (by weight of the total composition).

In a second aspect, the invention pertains to a process for preparing a composition in the form of a gel for preparing a food product comprising the steps:

a) mixing carrageenan as a gelling agent in the amount of 0.1 to 1.5 % (by weight of the total composition) in water;

b) heating the mixture to a temperature of at least 70°C, preferably to at least 80°C;

c) adding salt in the amount of 3 to 15 % (by weight of the total composition) and flavourings in the amount of 10 to 40 % (by weight of the total composition) and mixing further;

d) pasteurize the mixture of step c) at a temperature of at least 75°C, preferably of at least 80°C;
e) cooling the mixture after pasteurization to a temperature within the range 20°C to 60°C, preferably 25°C to 50°C, more preferably 30°C to 45°C; and

f) adding un-gelatinised starch in the amount of 10 to 40 % (by weight of the total composition) to the mixture of step e) after the cooling, mixing further to form the composition and letting the composition sit and form a gel.

A third as aspect of the invention is a use of the composition according to the claim 1 for the preparation of a food product.

A still further aspect of the invention is a food product comprising the composition according to claim 1.

It has now been found by the inventors that a simple combination of carrageenan, preferably of iota-carrageenan, with un-gelatinised starch in a composition with water, flavourings and salt has certain desirable and surprising characteristics. It forms a gel, is easily dosed into packaging containers, is easily diluted in water, can be used to prepare a thick sauce, soup or gravy that does not readily re-form a gel on cooling, and delivers a smooth mouth-feel which is ideal for a thick sauce or gravy.

Furthermore, it has been found that even further improved gels can be obtained by combining carrageenan, preferably of iota-carrageenan, with xanthan in a combination with un-gelatinised starch. The gels dissolve even more readily in hot or cold water, and they do not form any lumps during the dissolution process. Furthermore, syneresis of such gels during handling or transportation is even further reduced.
The present invention further pertains to a composition in the form of a gel for preparing a food product, the composition comprising:

i) water in the amount of 20 to 50 % (by weight of the total composition),

ii) flavourings in the amount of 10 to 40 % (by weight of the total composition),

iii) salt in the amount of 3 to 15% (by weight of the total composition),

iv) carrageenan as a gelling agent in the amount of 0.1 to 1.5 % (by weight of the total composition), and

v) un-gelatinised starch in the amount of 10 to 40 % (by weight of the total composition),

wherein the carrageenan is iota-carrageenan.

The term “gel”, in the context of this invention, means a solid or semi-solid matrix formed by interaction with one or more polysaccharides and water, which is free standing over a time scale of at least a few minutes and which deforms partially in an elastic way when submitted to a deformation force.

The term “flavourings” in the context of this invention means flavouring agents, taste enhancing ingredients, herbs, spices, vegetables, meat and fish components (in liquid or powder form), lipids, carbohydrates or mixtures thereof, which are suitable for being used in a food product or food concentrate product.

“Salt” refers to any suitable alkali metal salt or mixture thereof. The salt used in the composition of this invention is typically, but not limited to, sodium chloride. For example,
potassium chloride may be used or any low-sodium product having a taste impression of sodium chloride may be used, as long as the taste in the end formulation is acceptable.

The term “un-gelatinised starch” refers to starch that is in an un-swollen, semi-crystalline state. Due to birefringence, it presents maltese crosses when examined under the microscope with polarized light. During cooking the starch loses the birefringence, starts to absorb water which results in swelling of the starch granules and product thickening. The starch or mixtures of starches are selected among starches that have a rather high gelatinization temperature such as corn starch, chemically modified starches, physically modified starches such as annealed or heat-moisture treated starch, preferably heat-moisture treated potato starch. Flours can also be used as a source of starch.

The term “carrageenan” refers to a family of linear sulfated polysaccharides which are usually extracted from red seaweeds. All carrageenans are high molecular weight polysaccharides made up of repeating galactose units and 3,6 anhydrogalactose, both sulfated and non-sulfated. The units are joined by alternating alpha 1-3 and beta 1-4 glycosidic linkages. Various types of carrageenans exist. Their structures differ in 3,6 anhydrogalactose and ester sulphate content. The main types are kappa, lambda and iota. Iota-carrageenan forms gels in the presence of cations, and therefore its behaviour is strongly dependent on salt content. Gelling temperature increases when salt concentration increases. Carrageenan gels are usually heat reversible, showing a small hysteresis between the gelling and melting temperature. When salt content increases, gelling and melting temperatures can be as high as 90-95 °C making it difficult to dissolve easily in hot water.
Iota-carrageenan also shows syneresis in the presence of a high salt content.

As used in the context of this invention, “iota-carrageenan” means any carrageenan or mix of carrageenans having a predominance of iota-carrageenan structural units.

The composition may comprise further ingredients selected from carbohydrates, lipids, or mixtures thereof. The lipids may be provided by oils, creamer, vegetable or animal fats, cream and any traditional ingredients used in the manufacture of savoury food compositions. Carbohydrates may be provided by sugars, starches, flours, maltodextrins, and glucose syrups.

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”.

In a preferred embodiment, the composition of the invention comprises carrageenan in an amount of 0.2 to 1% by weight of the total composition, and more preferably from 0.25 to 0.75% by weight of the total composition.

In a further embodiment, the composition of the invention comprises the un-gelatinised starch in the range 20 to 35% by weight of the total composition.

The starch must be un-gelatinised starch and must remain in this state during preparation of the composition. This is so that the thickening function of the starch is preserved until such time as a user or a consumer at home adds hot water to the composition or adds the gel composition to hot water and
cooks it for a few minutes. The starch then gelatinises to provide the desired thickening to the sauce or gravy. The un-gelatinised starch used for the preparation of the gel composition can be selected according to a specific gelatinisation/pasting profile so that it can be incorporated into the composition at a temperature below the gelatinising (or swelling) temperature, but above the critical temperature at which the gelling agent carrageenan may form a gel. The preferred un-gelatinised starch of the invention is corn starch or physically modified starch, for example heat-moisture treated potato starch.

The amount of water in the composition is in the range 20 to 50 wt% of the total composition. A more preferred range includes 25 to 40% by weight of the total composition.

In a further preferred embodiment, the composition of the invention further comprises xanthan. Preferably, xanthan is present in the composition of the invention in the amount of 0.05 to 1.5 %, more preferably from 0.1 to 0.4 % (by weight of the total composition).

Surprisingly, the inventors have found that the presence of xanthan improves the quality of the gel composition. Particularly, the presence of xanthan helps to strengthen the gel structure of the composition and reduces even further syneresis which may happen during storage or transportation of the gel composition. Furthermore, gels comprising xanthan dissolve even more readily in hot or cold water, and they do not form any lumps during the dissolution process.

"Xanthan" is a hetero-polysaccharide of high molecular weight commonly used as a food thickening agent (for example, in
salad dressings) and as a stabiliser (for example, in cosmetic products). Its main chain is constituted of glucose units and its side chain is a trisaccharide consisting of alpha-D-mannose which contains an acetyl group, beta-D-glucuronic acid, and a terminal beta-D-mannose unit linked with a pyruvate group. Xanthan shows very high compatibility with salts, for example up to 25 %, and provides high elasticity. Optionally, the composition of the invention may further comprise fat or oil. Fat and oil are standard ingredients in food concentrate compositions and contribute generally to the taste and texture of the gel composition, but also to final food products for which the consumer has made use of the gel composition in its preparation. Preferably, the fat or oil are present in the composition of the invention in the range of 3 to 13 % (by weight of the total composition).

In a still further embodiment, the flavourings are present in the composition of the invention in the range of 15 to 30 % (by weight of the total composition).

In a second aspect, the invention pertains to a process for preparing a composition in the form of a gel for preparing a food product comprising the steps:

a) mixing carrageenan as a gelling agent in the amount of 0.1 to 1.5 % (by weight of the total composition) in water;

b) heating the mixture to a temperature of at least 70°C, preferably to at least 80°C;

c) adding salt in the amount of 3 to 15 % (by weight of the total composition) and flavourings in the amount of 10 to 40 % (by weight of the total composition) and mixing further;

d) pasteurize the mixture of step c) at a temperature of at least 75°C, preferably of at least 80°C;
e) cooling the mixture after pasteurization to a temperature within the range 20°C to 60°C, preferably 25°C to 50°C, more preferably 30°C to 45°C; even more preferably 35°C to 40°C, and

f) adding un-gelatinised starch in the amount of 10 to 40 % (by weight of the total composition) to the mixture of step e) after the cooling, mixing further to form the composition and letting the composition sit and form a gel.

In a preferred embodiment of the process of the invention, carrageenens is selected iota-carrageenan.

In a further preferred embodiment of the process of the invention, the un-gelatinised starch is added in the form of a solid powder or in the form as a slurry of starch in oil. This has the advantage that they are industrially feasible and convenient forms of adding un-gelatinised starch to a composition.

In a still further aspect, the invention relates to a food product comprising the composition of the invention, and wherein the food product is a condiment, seasoning, sauce, soup or gravy.

Those skilled in the art will understand that they can freely combine all features of the present invention disclosed herein. In particular, features described for the composition of the present invention may be combined with the process for the preparation of the composition, and vice versa. Further, features described for different embodiments of the present invention may be combined. Further advantages and features of the present invention are apparent from the examples.
EXAMPLES

The invention is further described with reference to the following examples. It will be appreciated that the invention as claimed is not intended to be limited in any way by these examples.

Example 1

10 The general procedure for preparing gel compositions of the invention is as follows:
- prepare a pre-mix of the gelling agents (including carrageenens). Preferably, maltodextrin or glucose syrup can be added to the pre-mix;
- add the pre-mix to water with mixing;
- heat the mix to a temperature of 85 °C for a few minutes;
- add all other ingredients (including the salts and flavourings);
- heat the mix at a temperature of 80°C for at least 6 minutes in order to pasteurize the mix;
- cool the mix to between ca. 45-50°C;
- add un-gelatinised starch to the mixture, either in solid form or as a slurry in oil;
- fill the composition into containers and allow the gel to form and set at room-temperature.

Example 2

A composition according to the invention was prepared according to the general method as described in Example 1 using the amounts of ingredients in the following table:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>33</td>
</tr>
</tbody>
</table>
Salt & 9 
un-gelatinised Starch & 23 
Oil & 11 
Iota-carrageenan & 0.33 
Xanthan & 0.20 
Other ingredients & up to 100 

The xanthan was added to the pre-mix together with the Iota-carrageenan; the oil was added to the composition together with the un-gelatinised starch.

Example 3

A composition according to the invention was prepared according to the general method of Example 1 using the amounts of ingredients as in the following table:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>29</td>
</tr>
<tr>
<td>Salt</td>
<td>8</td>
</tr>
<tr>
<td>Slurry of starch and oil</td>
<td>Starch 21</td>
</tr>
<tr>
<td></td>
<td>Oil 10</td>
</tr>
<tr>
<td>Iota-carrageenan</td>
<td>0.41</td>
</tr>
<tr>
<td>Xanthan</td>
<td>0.20</td>
</tr>
<tr>
<td>Other ingredients</td>
<td>up to 100</td>
</tr>
</tbody>
</table>

Starch and oil were premixed to form a slurry before being added to the composition.

Example 4

A composition according to the invention was prepared according to the general method of Example 1 using the amounts of ingredients in the following table:
<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>35</td>
</tr>
<tr>
<td>Salt</td>
<td>10</td>
</tr>
<tr>
<td>Starch</td>
<td>20</td>
</tr>
<tr>
<td>Oil</td>
<td>2</td>
</tr>
<tr>
<td>Iota-carrageenan</td>
<td>0.40</td>
</tr>
<tr>
<td>Xanthan</td>
<td>0.20</td>
</tr>
<tr>
<td>Other ingredients</td>
<td>up to 100</td>
</tr>
</tbody>
</table>

**Example 5**

Rupture strength of the resulting gels from the Examples 2 to 4 were determined.

The term “rupture strength” is used in reference to gel strength and relates to the deformation force needed to break a gel. The rupture strength of a gel should be at least 20 g, but preferably greater than 35 g, as measured using a Texture Analyser.

Rupture strength was measured using a Texture Analyser TAXT2 (Microstable systems) according to the following conditions:

- load cell: 5 kg.
- Penetration test using a cylindrical probe of 1.27 cm diameter.
- The sample was loaded just after heating into a container of 50 mm diameter, until reaching a height of 55 mm. The sample was allowed to cool and gel at ambient temperature. Before measurement, the sample is placed in a water-bath at 20 °C for temperature equilibration.
- Test conditions: pre-test speed: 1 mm/s, test speed: 0.5 mm/s, post speed: 10 mm/s. Measurement was stopped at 25 mm penetration depth.
- The rupture strength is recorded at the peak of the curve force versus penetration depth.

The resulting products from the Examples 2 to 4 were a gel composition which had a rupture strength of above 40 g which when dissolved in water and heated for 1 min delivered the texture of a sauce. It is also to be mentioned that the prepared sauce maintained its thickened texture during cooling as well without re-jellifying.

As a comparison, comparable products available on the market place manufactured with making use of xanthan, locust bean gum as gelling agent and gellan and starch, but without the use of a carrageenan in combination with an un-gelatinised starch, were tested in parallel to the Examples 2 to 4. It was observed that those comparative products which gave a texture during the cooking process showed already reformation of a gel only minutes after the cooking process. The test samples from the Examples 2 to 4 did not re-jellify during this same period after the cooking process.
**Claims**

1. A composition in the form of a gel for preparing a food product, the composition comprising:
   i) water in the amount of 20 to 50 % (by weight of the total composition),
   ii) flavourings in the amount of 10 to 40 % (by weight of the total composition),
   iii) salt in the amount of 3 to 15% (by weight of the total composition),
   iv) carrageenan as a gelling agent in the amount of 0.1 to 1.5 % (by weight of the total composition),
   and
   v) un-gelatinised starch in the amount of 10 to 40 % (by weight of the total composition).

2. The composition according to claim 1, wherein the carrageenan is iota-carrageenan.

3. The composition according to claim 1 or 2, wherein the amount of carrageenan in the composition is in the range 0.2 to 1 %.

4. The composition according to one of the claims 1 to 3, wherein the amount of the un-gelatinised starch in the composition is in the range 20 to 35 %.

5. The composition according to one of the claims 1 to 4, wherein the un-gelatinised starch is corn starch or physically modified potato starch.
6. The composition according to one of the claims 1 to 5, wherein the composition further comprises xanthan.

7. The composition according to claim 6, wherein the xanthan is present in the composition in the amount of 0.05 to 1.5 % (by weight of the total composition).

8. The composition according to one of the claims 1 to 7, wherein the composition further comprises fat or oil.

9. The composition according to claim 8, wherein the amount of fat or oil is in the range 3 to 13 % (by weight of the total composition).

10. The composition according to one of the claims 1 to 9, wherein the amount of flavourings is in the range of 15 to 30 %.

11. A process for preparing a composition in the form of a gel for preparing a food product comprising the steps:

a) mixing carrageenan as a gelling agent in the amount of 0.1 to 1.5 % (by weight of the total composition) in water;

b) heating the mixture to a temperature of at least 70°C, preferably to at least 80°C;

c) adding salt in the amount of 3 to 15 % (by weight of the total composition) and flavourings in the amount of 10 to 40 % (by weight of the total composition) and mixing further;

d) pasteurize the mixture of step c) at a temperature of at least 75°C, preferably of at least 80°C;
e) cooling the mixture after pasteurization to a temperature within the range 20°C to 60°C, preferably 25°C to 50°C, more preferably 30°C to 45°C; and

f) adding un-gelatinised starch in the amount of 10 to 40 % (by weight of the total composition) to the mixture of step e) after the cooling, mixing further to form the composition and letting the composition sit and form a gel.

12. The process according to claim 11, wherein the un-gelatinised starch is added in the form of a solid powder or as a slurry of starch in oil.

13. A use of the composition according to one of the claims 1 to 10 for the preparation of a food product.

14. A food product comprising the composition according to one of the claims 1 to 10.

15. The food product according to claim 14, wherein the food product is a condiment, seasoning, sauce, soup or gravy.
## A. CLASSIFICATION OF SUBJECT MATTER

<table>
<thead>
<tr>
<th>INV.</th>
<th>A23L1/0522</th>
<th>A23L1/0532</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)

A23L

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 database and, where practicable, search terms used)

EPO-Internal, WPI Data, COMPENDEX, FSTA

## 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>
<tbody>
<tr>
<td>Y</td>
<td>WO 2004/049822 A1 (NESTEC SA [CH]; MOOSER OSWALDO [CH]) 17 June 2004 (2004-06-17) page 5, lines 7-26 page 6, lines 7-13 example 4</td>
<td>1-15</td>
</tr>
<tr>
<td>Y</td>
<td>CA 2 161 713 A1 (GEN FOODS INC [US]) 16 May 1996 (1996-05-16) Examples 1 - 4 in Table I; example 5 in Table II.</td>
<td>1-15</td>
</tr>
<tr>
<td>Y</td>
<td>WO 2012/097930 A1 (UNILEVER NV [NL]; UNILEVER PLC [GB]; UNILEVER HINDUSTAN [IN]; PERRINE) 26 July 2012 (2012-07-26) cited in the application page 3, line 15 - page 4, line 17 page 10, lines 9-15 Page 26, Comparative example 1b</td>
<td>1-15</td>
</tr>
</tbody>
</table>

* 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 application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) 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 date 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

Further documents are listed in the continuation of Box C. See patent family annex.

### Date of the actual completion of the international search

8 October 2013

### Date of mailing of the international search report

25/10/2013

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax (+31-70) 340-3016

Authorized officer

Götz, Michael
<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>BR 0316849 A</td>
<td>18-10-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1719980 A</td>
<td>11-01-2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1569526 A1</td>
<td>07-09-2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FR 2847770 A3</td>
<td>04-06-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 2006507830 A</td>
<td>09-03-2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NL 1024901 C1</td>
<td>11-06-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NZ 540376 A</td>
<td>31-05-2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PL 212602 B1</td>
<td>31-10-2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 3779795 A</td>
<td>23-05-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2161713 A1</td>
<td>16-05-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1130023 A</td>
<td>04-09-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NZ 280444 A</td>
<td>24-04-1997</td>
</tr>
<tr>
<td>WO 2012097390 A1</td>
<td>26-07-2012</td>
<td>AU 2011356253 A1</td>
<td>01-08-2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 103298357 A</td>
<td>11-09-2013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2012097390 A1</td>
<td>26-07-2012</td>
</tr>
</tbody>
</table>