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(54) PRODUCTION OF POTASSIUM MAGNESIUM CITRATE AND ITS USE

HERSTELLUNG VON KALIUMMAGNESIUMCITRAT UND SEINE VERWENDUNG

PRODUCTION DE POTASSIUM-MAGNÉSIUM CITRATE ET SON UTILISATION

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Description

FIELD OF THE INVENTION

[0001] This invention relates to a process for the production of potassium magnesium citrate and its uses.

BACKGROUND OF THE INVENTION

[0002] The following prior art is considered to be relevant for an understanding of the invention.

Prior art

[0003]

1. US 4985593, Walsdorf et al, "Magnesium Potassium Citrate",
2. US 5219889, Walsdorf et al, "Dietary supplementation with potassium Magnesium Citrate",
3. US 7091246, Rushforth, "Dietary supplementation with stoichiometrically specific potassium magnesium citrate".
4. US 6287607, Pak et al, "Potassium calcium citrate compositions and methods therefore."
5. US 4551342, Nakel et al, "Beverages containing specific cation-edible acid mixtures for improved flavor impression"
6. US 5432200, Walsdorf et al., "Method for increasing urinary excretion of electrolytes"
7. US 4867989, Silva et al., "Chewing gum mineral supplement"
8. US 4738856 from 19/04/1988, Clark "Beverages and method for making a beverage for the nutritional supplementation of calcium in humans"
9. US 4582709, Peters et al., "Chewable mineral supplement"
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11. "Reduction of renal stone risk by potassium-magnesium citrate during 5 weeks of bed rest" Zerwekh, Odvina, Wuermser, Pak, Journal of Urology (2007), 177(6) 2179-2184.
12. US 20070003613 A1, Christhy et al, " Preparation to support maintanence of acid-alkaline balance in the human body and methods directed to using same".
13. DE 202006012450 Ul, "Soft drink base concentrate and beverage with base-forming minerals"
14. US 20050197402, Rushforth Dennis, "Dietary supplementation with stoichiometrically specific potassium magnesium citrate".
15. US 4895980, Walsdorf et al, "Method of manufacturing magnesium potassium citrate"
16. US 6616955, Nunes et el, "Beverage compositions comprising palatable calcium and magnesium sources".
17. WO 2007/107999, Paikin et al., "Calcium enrichment compositions method of production thereof and use", is directed to the problem of enriching a product with minerals, in this case calcium.

SUMMARY OF THE INVENTION

[0004] The present invention is directed to compositions comprising edible magnesium that are stable in food and beverages. The composition is comprised of magnesium, potassium and citrate as the active components. It is based on the fact that increasing the magnesium quantity, i.e. molar ratio, relative to that of the potassium in such a three-component system from 1:4 as previously known to 1:1 or 2.5:1 yields a composition that is more efficient for increasing the magnesium intake. The magnesium comprising compositions of the present invention are stable, in various forms of foods, as well as in protein containing beverages, or in their concentrates, and do not separate out of the liquid phase even under long storage periods. The magnesium comprising composition of the present invention is palatable and does not affect the organoleptic properties of the beverage or beverage concentrate to which it is introduced and thus serves as an effective magnesium supplement (fortifier) for beverages and solid food.

[0005] Thus the present invention is directed to a dry magnesium rich composition comprising:

(i) at lease one source of magnesium;
(ii) at least one source of potassium; and
(iii) at least one source of citrate;

wherein the composition has a bulk density of 0.35 to 0.75 g/cm^3 and comprises 8% to 15% (wt/wt) magnesium and 7.5% to 16% (wt/wt) of potassium and 75% to 80% citrate on dry weight basis. More preferably the composition comprises 9% to 13% (wt/wt) magnesium and 8% to 12% potassium (wt/wt) on a dry basis and the bulk density is 0.55 to 0.65 g/cm^3.

[0006] The composition may further comprise artificial or natural coloring agents, emulsifiers, taste modifiers, or other food additives such as food preservatives and stabilizers. In particular, the magnesium rich composition of the invention is used to enrich beverages with magnesium, especially milk, milk-like beverages, soy-milk and naturally or artificially fortified protein containing beverages. It may be either soluble in the beverage or exist as a suspended addition. The magnesium enriched composition introduced into a beverage is stable for a period of at least 90 days wherein less than 5% (wt/wt) of the composition sediments out of the beverage. It should be noted that "stable" relates to the fact that the magnesium enriched composition remains within the liquid phase substantially without sedimenting out. By "substantially without" it is meant that less than 5% of the composition is precipitated. Remaining within the liquid means at least one of remaining suspended, remaining dissolved and remaining bound to a suspended solid or liquid.

[0007] The magnesium source is selected from the group consisting of magnesium hydroxide, magnesium oxide, magnesium carbonate, magnesium citrate, or their mixtures.

[0008] The citrate source is selected from the group consisting of citric acid, citric acid monohydrate, citric acid mono-, di- or tri-sodium salt, citric acid mono-, di- or tri-potassium salt or ammonium citrate.

[0009] The at least one potassium source is selected from the group consisting of potassium hydroxide, potassium citrate, potassium bicarbonate or their mixtures.

[0010] In accordance with the present invention, the magnesium enriched dry composition of the present invention may comprise a molar ratio magnesium:potassium: citrate of 1:1:1 or 5:2:4.

[0011] The invention is further directed to a method for producing a dried magnesium-rich composition comprising:

(i) dissolving at least one source of citrate in water, agitating and cooling;
(ii) adding at least one source of magnesium and at least one source of potassium the agitated cooled aqueous solution; and
(ii) drying the aqueous magnesium solution so as to produce the dried magnesium-rich composition, wherein said composition comprises at least 8% magnesium on a dry weight basis, and at least 7.5% potassium on a dry weight basis.

[0012] The invention is further directed to foods or nutritional product comprising the magnesium enriched composition. The nutritional product may be a beverage or beverage concentrate comprising the magnesium enriched composition. In particular, the beverages are milk and milk-like based beverages that may be fortified with proteins, vitamins, minerals or their mixtures. Non-limiting examples of beverages are selected from soy milk, cow milk, camel milk, goat milk, or their mixtures and fermented milk based products like yoghurts. Such beverages may further comprise additional edible supplements selected from cocoa, vanilla, fruit or vegetable concentrates or flavorings.

DETAILED DESCRIPTION OF EMBODIMENTS

[0013] The present invention is thus directed to compositions comprising magnesium, which are stable in food and beverages and in food and beverage supplements. The compositions comprise a relatively high molar ratio of magnesium to potassium, e.g. 1:1 to 2.5:1. The compositions are suitable for use in milk, soy milk and other "milk-like", "milk-containing", protein containing beverages or their mixtures. Despite the large number of supplements currently available and known in the art, many of these supplements are unstable and precipitate out of solution over time. A rather severe limitation associated with the use of magnesium sources in food and beverages occurs in protein-containing beverages. This is due to the fact that in case the magnesium source is soluble, ions of Mg^{2+} will interact with proteins during heat treatment (UHT or pasteurization); while in case the magnesium source is an insoluble source, the material will gradually precipitate during the shelf life. Slowing down precipitation is not easily achieved and different types of hydrocolloids are usually applied for such a purpose of maintaining the magnesium evenly distributed in solution or in the food to which it was added.

[0014] The products of the present invention may be used to meet the demand in the market for stable sources of magnesium, which are suitable for adding to foods and beverages. The products of the present invention are used as supplements and do not affect the organoleptic properties or the taste of the food or beverage to which they are added. The magnesium products of the present invention are both stable and do not typically precipitate during the storage of the food/beverage even after storage periods of about 90 days. Consequently, usage of hydrocolloids for slowing down precipitation is not required for the products of the present invention.

[0015] The present invention relates in particular to stable dried compositions of organic magnesium, in the form of magnesium potassium citrate, to methods for the preparation of these compositions and their use as magnesium supplements. The products of this invention may be in the form of a solid such as a powder, flakes, granules, a liquid such as a liquid concentrate, suspension, microemulsion. Such products may be consumed either directly for enhancing uptake of magnesium or as an additive in various food and beverages to fortify these food products with magnesium. The compositions in any of the above-mentioned forms are stable in beverages and in food, to which they added.

[0016] The compositions of the present invention exhibit high bioavailability. The compositions of the present invention are stable in sterilization and pasteurization processes known in the art of food and beverage processing. The composition of the present invention does not require the co-addition of other agents in order to retain the magnesium in a stable suspension. Notwithstanding, the composition may further comprise artificial or natural coloring agents, emulsifiers, taste modifiers, or other food additives such as food preservatives.

[0017] A process for producing a dried magnesium-rich composition according to the present invention is herein displayed.

[0018] In a first mixing step citric acid or salts thereof is dissolved in dionized water using agitation to form an aqueous solution having citric acid or its salts typically in a concentration range of 0.25 to 1.2 M. Sources of citrate source is selected from the group consisting of citric acid, citric acid anhydrous, citric acid monohydrate, citric acid mono-, di- or tri-sodium salt, citric acid tripotassium salt or ammonium citrate. The aqueous solution is cooled to a set temperature below 25°C. Cooling jackets known in the art, may be employed on a large scale, or the vessel may be at least partially immersed in a water bath on the small scale, as is known in the art. In the present invention different chillers were used (such as CH10TR nameplate number 30089, Unique, Nehalim, Israel or CC230, Huber High Precision Thermoregulation, Offenburg, Germany)

[0019] To the agitated cooled aqueous solution containing citric acid or salts thereof are added about 2-7 moles of magnesium and about 2.5-3 moles of potassium. Typically this step is performed in a standard mixed vessel well known in the art. This mixing step typically takes up to 30 minutes while the vessel is cooled. The range of final pH prior to drying process is 7.5 -10.5. The reaction can be performed at different concentration of the reagents, but preferable range of TDS prior to drying is 25 - 35 %.

[0020] Examples of magnesium used are selected from the group consisting of magnesium hydroxide, magnesium oxide, magnesium carbonate, magnesium citrate, or their mixtures. Examples of potassium used are selected from the group consisting of potassium hydroxide, potassium citrate, potassium bicarbonate or their mixtures.

[0021] Typically the potassium salt is added in to produce the molar ratio of potassium to citrate in a range of 0.5-1. Typically the magnesium salt is added in suitable concentration to produce the molar ratio of Magnesium and Citrate in range of 1-1.25.

[0022] In the drying step, the aqueous solution is dried and liquid is removed therefrom to form a dry magnesium potassium citrate composition. Typically drying is done using a spray drying or freeze drying process in a dryer APV PSD52 (APV Nordic Anhydro, Silkeborg, Denmark) using the inlet air with temperature from 190 up to 350°C as is known in the art. Excess liquid is removed from the solution until a solid phase forms. The solid phase may be in the form of a powder, flakes, granules or other solid form. The resultant solid composition may then be suitably stored and/or packaged in either a solid form or in a liquid form (dissolved or suspended). The resultant composition typically has a bulk density of about 0.55 to 0.65 g/cm^3, more typically, about 0.6 g/cm^3.

[0023] The obtained dry magnesium-potassium-citrate composition typically has a composition as is shown in the Table below.

Table 1: Typical Composition of a magnesium-potassium-citrate composition on a Dry Weight Basis*

COMPONENT	RELATIVE MOLAR RATIO	PERCENT OF DRY COMPOSITION [WT/WT %]
CITRATE	1-2	75-80
MAGNESIUM	1-2.5	9-13
POTASSIUM	1	8-16
* it should be noted that the "dry weight" was calculated excluding up to 10% adsorbed water in the product		

Examples

Example 1: Method of preparation of Magnesium Potassium Citrate with a molar ratio of Mg, K and Citrate ions 1:1:1.

[0024] 332.5 g of Citric acid anhydrous were dissolved in 1840 g water; while agitated and cooled 82 g magnesium Oxide and 158 g potassium hydroxide were added. The mixture was dried in the spray dryer. Obtained material was analyzed exhibiting the following properties:

Bulk density - 0.6 kg/l; Mg content - 9.5 %; K content — 10 %

Example 2: Method of preparation of Magnesium Potassium Citrate with a molar ratio of Mg, K and Citrate ions 5:2:4.

[0025] 540 g of Citric acid anhydrous were dissolved in 2840 g water; while agitated and cooled 141 g magnesium Oxide and 107 g potassium hydroxide were added. The mixture was dried in the spray dryer. Obtained material was analyzed exhibiting the following properties:

Bulk density - 0.6 kg/l; Mg content — 12.5 %; K content — 8.2 %

Example 3: Use for fortifying beverage

[0026] 3 g of material obtained in Example 1 were added to 1 liter of Soy milk during agitation. Mg content was tested and found 445 mg/l. After retention of two days without agitation the Mg content in upper layer was tested again and found 444 mg/l.

Example 4: Use for fortifying beverage

[0027] 3 g of material obtained in Example 2 were added to 1 liter of Soy milk during agitation. Mg content was tested and found 547 mg/l. After retention of two days without agitation the Mg content in upper layer was tested again and found 545 mg/l.

Example 5: Use for fortifying beverage

[0028] 3 g of material obtained in Example 1 were added to 1 liter of cow milk during agitation. Mg content was tested and found 297 mg/l. After retention of two days without agitation the Mg content in upper layer was tested again and found 289 mg/l.

Example 6: usage of KMgCitrate in molar ratio of 4:1:2

[0029] Potassium magnesium citrate was prepared according to US 4985593. 5.6 g Of the prepared material were added to 1 liter of soy milk and the samples stored refrigerated. After 48 hours of retention, Mg content was tested in the upper level and was found 372 mg/liter while initial concentration of Mg was 373 mg/liter.

Example 7: usage of Tri Magnesium Citrate

[0030] 2.2 g of Tri magnesium citrate nona hydrate were added to 1 liter of soy milk during the agitation. Magnesium content was tested and found 475 mg/l. After retention of two days without agitation the Mg content in upper layer was tested again and found 307 mg/l. 35 percents of Magnesium sediment during two days.

Example 8: usage of Tri Magnesium Citrate +Carragenan

[0031] 2.2 g of Tri magnesium citrate nona hydrate and 0.2 g of Kappa Carragenan were added to 1 liter of soy milk during the agitation. Magnesium content was tested and found 471 mg/l. After retention of two days without agitation the Mg content in upper layer was tested again and found 351 mg/l. 25 percents of Magnesium sediment during two days.

Example 9: usage of mixture Tri Potassium Citrate + Tri Magnesium Citrate.

[0032] 2.2 g of Tri magnesium citrate nona hydrate and 2.2 g of tri potassium citrate were added to 1 liter of soy milk during the agitation. Magnesium content was tested and found 476 mg/l. After retention of two days without agitation the Mg content in upper layer was tested again and found 418 mg/l. 12 percents of Magnesium sediment during two days.

Example 10:

[0033] 120 g of material obtained in Example 1 were added to 40 liters of soy milk, after agitation the mixture passed the well known (in the art) UHT treatment and samples were collected and stored refrigerated. The Magnesium content in the upper level of sample was tested during 13 weeks and the results are as following:

- initial Mg content - 468 mg/l
- after 1 week- 471 mg/l

- after 2 weeks- 470 mg/l
- after 3 weeks- 471 mg/l
- after 4 weeks- 470 mg/l
- after 5 weeks- 462 mg/l
- after 6 weeks- 468 mg/l
- after 7 weeks- 470 mg/l
- after 8 weeks- 468 mg/l
- after 9 weeks- 467 mg/l
- after 10 weeks- 465 mg/l
- after 11 weeks- 471 mg/l
- after 12 weeks- 465 mg/l
- after 13 weeks- 466 mg/l

Claims

1. A magnesium rich composition comprising:

(i) at least one source of magnesium;
(ii) at least one source of potassium; and
(iii) at least one source of citrate;

wherein the composition has a bulk density of 035-0.75 g/cm3 and comprises from 8% to 15% (wt/wt) magnesium and from 7.5% to 16% (wt/wt) potassium and 75% to 80% citrate on dry weight basis.

2. Acomposition accordingto claim 1 comprising 9% to 13% (wt/wt) magnesium and 8% to 12% (wt/wt) potassium on a dry basis, having a bulk density of 0.55 to 0.65 g/cm3.

3. A composition according to claim 1 wherein
the magnesium source is selected from the group consistingof magnesium hydroxide, magnesium oxide, magnesium carbonate, magnesium citrate, or their mixtures;
the citrate source is selected from the group consisting of citric acid, citric acid anhydrous, citric acid monohydrate, citric acid mono-, di- or tri-sodium salt, citric acid tri-potassium salt or ammonium citrate; and
the source of potassium is selected from the group consisting ofpotassium hydroxide, potassium citrate, potassium bicarbonate, or their mixtures.

4. A composition according to any one of claims 1 to 3 wherein the potassium source is selected from potassium hydroxide or potassium oxide; the magnesium is selected from magnesium oxide or magnesium hydroxide; and the citrate is citric acid anhydrous or monohydrate.

5. A composition according to claim 4 comprising a molar ratio magnesium:potassium:citrate of 1:1:1.

6. A composition according to claim 4 comprising a molar ratio magnesium:potassium:cicrate of 5:2:4.

7. A composition according to claim 1 in a dry form selected from powder, granules, flakes.

8. A composition according to any one of claims 1 to 7 being dissolved or suspended in an aqueous based solution.

9. Use of the magnesium rich composition according to claims 1 - 8 in a beverage wherein said beverage is a beverage selected from milk beverages, from milk-like based beverages or from fruit- or vegetable-based beverages.

10. The use according to claim 9 wherein said milk based beverage is selected from goat milk, sheep milk, camel milk, cow milk, human milk or their mixtures; and wherein said milk-like based beverage is selected from soy milk, reconstituted milk formula, substitute milk, oat milk or their mixtures.

11. The use according to any one of claims 9 to 10, wherein said beverage comprises at least 2g/l to 6g/l of the magnesium rich composition.

12. The use according to any one of claims 9 to 11 wherein said beverage is stable for a period of at least 90 days.

13. A method for producing a dried magnesium-rich composition according to claims 1-7 comprising:

(i) dissolving at least one source of citrate in water, agitating and cooling;
(ii) adding at least one source of magnesium and at least one source of potassium the agitated cooled aqueous solution; and
(iii) drying the aqueous magnesium solution so as to produce the dried magnesium-rich composition, wherein said composition comprises at least 8% magnesium on a dry weight basis, and at least 7.5% potassium on a dry weight basis.

Patentansprüche

1. Magnesiumreiche Zusammensetzung, umfassend:

(i) wenigstens eine Magnesiumquelle;
(ii) wenigstens eine Kaliumquelle und
(iii) wenigstens eine Citratquelle;

wobei die Zusammensetzung eine Schüttdichte von 0,35 - 0,75 g/cm^3 hat und von 8% bis 15% (Gew.-%) Magnesium und von 7,5% bis 16% (Gew.-%) Kalium und 75% bis 80% Citrat auf Trockengewichtsbasis umfasst.

2. Zusammensetzung gemäß Anspruch 1, die 9% bis 13% (Gew.-%) Magnesium und 8% bis 12% (Gew.-%) Kalium aufTrockenbasis umfasst und eine Schüttdichte von 0,55 bis 0,65 g/cm^3 hat.

3. Zusammensetzung gemäß Anspruch 1, wobei
die Magnesiumquelle aus der Gruppe ausgewählt ist, die aus Magnesiumhydroxid, Magnesiumoxid, Magnesiumcarbonat, Magnesiumcitrat oder deren Mischungen besteht;
die Citratquelle aus der Gruppe ausgewählt ist, die aus Citronensäure, Citronensäureanhydrid, Citronensäuremonohydrat, Citronensäure-Mono-, Di- oder Trinatriumsalz, Citronensäure-Trikaliumsalz oder Ammoniumcitrat besteht; und
die Kaliumquelle aus der Gruppe ausgewählt ist, die aus Kaliumhydroxid, Kaliumcitrat, Kaliumbicarbonat oder deren Mischungen besteht.

4. Zusammensetzung gemäß einem der Ansprüche 1 bis 3, wobei die Kaliumquelle aus Kaliumhydroxid oder Kaliumoxid ausgewählt ist; das Magnesium aus Magnesiumoxid oder Magnesiumhydroxid ausgewählt ist und das Citrat Citronensäureanhydrid oder- monohydrat ist.

5. Zusammensetzung gemäß Anspruch 4, die ein Molverhältnis Magnesium:Kalium:Citrat von 1:1:1 umfasst.

6. Zusammensetzung gemäß Anspruch 4, die ein Molverhältnis Magnesium:Kalium:Citrat von 5:2:4 umfasst.

7. Zusammensetzung gemäß Anspruch 1 in einer trockenen Form, die aus Pulver, Granulat und Flocken ausgewählt ist.

8. Zusammensetzung gemäß einem der Ansprüche 1 bis 7, die in einer Lösung aufwässriger Basis gelöst oder suspendiert ist.

9. Verwendung der magnesiumreichen Zusammensetzung gemäß Anspruch 1 - 8 in einem Getränk, wobei das Getränk ein Getränk ist, das aus Milchgetränken, aus Getränken auf milchartiger Basis oder aus Getränken auf Fruchtbasis oder pflanzlicher Basis ausgewählt ist.

10. Verwendung gemäß Anspruch 9, wobei das Getränk auf milchartiger Basis aus Ziegenmilch, Schafsmilch, Kamelmilch, Kuhmilch, Humanmilch oder deren Mischungen ausgewählt ist und wobei das Getränk auf milchartiger Basis aus Sojamilch, rekonstituierter Milchnahrung, Milchersatz, Hafermilch oder deren Mischungen ausgewählt ist.

11. Verwendung gemäß einem der Ansprüche 9 bis 10, wobei das Getränk wenigstens 2 g/l bis 6 g/l der magnesiumreichen Zusammensetzung umfasst.

12. Verwendung gemäß einem der Ansprüche 9 bis 11, wobei das Getränk für einen Zeitraum von wenigstens 90 Tagen stabil ist.

13. Verfahren zum Erzeugen einer getrockneten magnesiumreichen Zusammensetzung gemäß Anspruch 1 - 7, umfassend:

(i) Lösen wenigstens einer Citratquelle in Wasser, Rühren und Kühlen;
(ii) Hinzufügen wenigstens einer Magnesiumquelle und wenigstens einer Kaliumquelle zu der gerührten gekühlten wässrigen Lösung; und
(iii) Trocknen der wässrigen Magnesiumlösung, um die getrocknete magnesiumreiche Zusammensetzung zu erzeugen, wobei die Zusammensetzung wenigstens 8% Magnesium auf Trockengewichtsbasis und wenigstens 7,5% Kalium auf Trockengewichtsbasis umfasst.

Revendications

1. Composition riche en magnésium comprenant :

(i) au moins une source de magnésium ;
(ii) au moins une source de potassium ; et
(iii) au moins une source de citrate ;

dans laquelle la composition a une densité apparente de 0,35 à 0,75 g/cm3 et comprend de 8 % à 15 % (pds/pds) de magnésium, de 7,5 % à 16 % (pds/pds) de potassium et 75 % à 80 % de citrate sur la base du poids sec.

2. Composition selon la revendication 1 comprenant 9 % à 13 % (pds/pds) de magnésium et 8 % à 12 % (pds/pds) de potassium sur une base sèche, ayant une densité apparente de 0,55 à 0,65 g/cm^3.

3. Composition selon la revendication 1 dans laquelle
la source de magnésium est sélectionnée parmi le groupe se composant d'hydroxyde de magnésium, d'oxyde de magnésium, de carbonate de magnésium, de citrate de magnésium, ou de leurs mélanges ;
la source de citrate est sélectionnée parmi le groupe se composant d'acide citrique, d'anhydre d'acide citrique, de monohydrate d'acide citrique, de sel mono-, di- ou trisodique d'acide citrique, de sel tri-potassique d'acide citrique ou de citrate d'ammonium ; et
la source de potassium est sélectionnée parmi le groupe se composant d'hydroxyde de potassium, de citrate de potassium, de bicarbonate de potassium, ou de leurs mélanges.

4. Composition selon une quelconque des revendications 1 à 3 dans laquelle la source de potassium est sélectionnée parmi l'hydroxyde de potassium ou l'oxyde de potassium ; le magnésium est sélectionné parmi l'oxyde de magnésium ou l'hydroxyde de magnésium ; et le citrate est de l'anhydre ou du monohydrate d'acide citrique.

5. Composition selon la revendication 4 comprenant un taux molaire magnésium : potassium : citrate de 1:1:1.

6. Composition selon la revendication 4 comprenant un taux molaire magnésium : potassium : citrate de 5:2:4.

7. Composition selon la revendication 1 dans une forme sèche sélectionnée parmi la poudre, les granulés, les flocons.

8. Composition selon une quelconque des revendications 1 à 7 étant dissolue ou suspendue dans une solution à base aqueuse.

9. Application de la composition riche en magnésium selon les revendications 1 à 8 dans une boisson, dans laquelle ladite boisson est une boisson sélectionnée parmi les boissons lactées, les boissons à base similaire au lait ou les boissons à base de fruits ou de légumes.

10. Application selon la revendication 9 dans laquelle ladite boisson à base de lait est sélectionnée parmi le lait de chèvre, le lait de brebis, le lait de chamelle, le lait de vache, le lait humain ou leurs mélanges ; et dans laquelle ladite boisson à base similaire au lait est sélectionnée parmi le lait de soja, une formule de lait reconstituée, le lait de substitution, le lait d'avoine ou leurs mélanges.

11. Application selon une quelconque des revendications 9 à 10, dans laquelle ladite boisson comprend au moins 2 g/l à 6 g/l de la composition sèche riche en magnésium.

12. Application selon une quelconque des revendications 9 à 11 dans laquelle ladite boisson est stable pendant une période d'au moins 90 jours.

13. Méthode de production d'une composition sèche riche en magnésium selon les revendications 1 à 7 comprenant :

(i) la dissolution d'au moins une source de citrate dans de l'eau, l'agitation et le refroidissement;
(ii) l'addition d'au moins une source de magnésium et d'au moins une source de potassium à la solution aqueuse agitée et refroidie ; et
(iii) le séchage de la solution aqueuse de magnésium afin de produire la composition sèche riche en magnésium, dans laquelle ladite composition comprend au moins 8 % de magnésium sur une base du poids sec, et au moins 7,5 % de potassium sur une base du poids sec.

REFERENCES CITED IN THE DESCRIPTION

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