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(54) Title: NEW GREEN COLOR FOR BEVERAGE

(57) Abstract: The present invention is directed to a green colorant comprising Gardenia Blue pigment and beta-carotene. The present invention is further directed to a green sugar syrup or a green sugar-free syrup, and the beverage comprising the green colorant, as well as to the use of the green colorant.



NEW GREEN COLOR FOR BEVERAGE

The present invention is directed to a green colorant for beverage. The present
5 invention is further directed to a green sugar syrup or a green sugar-free syrup,
and the beverage comprising the green colorant, as well as to the use of the
green colorant.

There is increasing interest in the beverage industry to replace synthetic
10 materials for coloring beverage with natural or nature identical colorants.
Especially wanted are colors that are also animal-free and kosher/halal.

A challenge in replacing synthetic colorants with natural colorants in beverage
has been in obtaining the stability of color characteristics provided by synthetic
15 colorants and to match the color of the product the consumer is already used
to. Thus, it is important that a consistent visual quality of the product is
guaranteed.

Surprisingly it has been found that a mixture of Gardenia Blue pigment and
20 beta-carotene can be used to impart a green color to beverage. In a preferred
embodiment of the present invention the Gardenia Blue pigment and the beta-
carotene are the only colorants used in the beverage.

Thus, the present invention is directed to a green colorant comprising a
25 mixture of Gardenia Blue pigment and beta-carotene. This colorant can be
applied to any desired beverage.

The Green Colorant

The green colorant of the present invention comprises a mixture of Gardenia
30 Blue pigment and beta-carotene.

Preferably, the green colorant of the present invention comprises Gardenia Blue pigment and beta-carotene in a weight ratio of from 0.5-50:1, more preferably 2.5-15:1, and the most preferably 4-12.5:1.

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More preferably, the green colorant of the present invention comprises 30-98wt%, preferably 70-90wt% of Gardenia Blue pigment, and 2-70wt%, preferably 10-30wt% of beta-carotene.

10 Gardenia Blue Pigment

The “Gardenia Blue pigment” according to the present invention is defined in more detail below.

The Gardenia Blue pigment comprised in the green colorant of the present invention is preferably obtained by a process comprising the following steps:

15

a) Treating geniposide with a glycosidase to obtain a hydrolysate; and

b) Extracting the hydrolysate obtained in step a) with a solvent and removing the solvent after the extraction to obtain a product comprising genipin; and

20

c) Reacting the product comprising genipin obtained in step b) with an amino acid and/or a salt thereof under an atmosphere of inert gas, and

d) Introducing oxygen after genipin is consumed to produce the gardenia blue pigment; and

25

e) Optionally, purifying the gardenia blue pigment produced in step d).

In the process, the geniposide used as raw material may be from various sources. It may be obtained by extracting the fruit *Gardenia Jasminoides Ellis* by any known process, for example, that as disclosed in Chinese patent

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publication CN102732050A. In addition, geniposide powders, which contain about 20wt% to about 70wt% of geniposide and are commercially available, and the waste stream from the gardenia yellow production, which contains about 40wt% of geniposide and is also commercially available, may be used into the process directly or after simple refining. (see: CN103509368A, CN103525883A etc.)

The glycosidase is an enzyme under EC 3.2.1 according to the Recommendations of the Nomenclature Committee of the International Union of Biochemistry and Molecular Biology on the Nomenclature and Classification of Enzymes by the Reactions they Catalyse. Preferably, the glycosidase is cellulase (EC 3.2.1.4) and β -glucosidase (EC 3.2.1.21). The examples of the glycosidase include but are not limited to cellobiase commercially available from Sunson Biotechnology Co. Ltd. (Guangzhou, China), Cellulase 4000 commercially available from DSM (China) Ltd. (Shanghai, China), and Rapidase[○],^R commercially available from DSM (China) Ltd. (Shanghai, China). The glycosidase may be added into the reaction of the step a) in an amount in the range of from 0.01 g to 1.0 g, preferably in an amount in the range of from 0.1 g to 0.9 g, more preferably in an amount in the range of from 0.3 g to 0.8 g, per 1 g of geniposide.

The treatment of the step a) may be carried out at a pH in the range of from 3.0 to 6.5, preferably at a pH in the range of from 3.6 to 6.0, and more preferably at a pH in the range of from 4.0 to 4.6. Preferably, the treatment of the step a) is carried out in a buffer solution which can provide the above pH ranges. Such buffer solution is known in the art, and the examples include but are not limited to an aqueous HCOOH/NaOAc solution or an aqueous citric acid/ Na_2HPO_4 solution. The buffer solution may be added in an amount in the range of from 8 mL to 80 mL, preferably in an amount in the range of from 10 mL to 70 mL, more preferably in an amount in the range of from 15 mL to 50 mL, per 1 g of geniposide.

The treatment of the step a) may be carried out at a temperature in the range of from about 20°C to about 60°C, preferably at a temperature of about 50°C.

The reaction of the step a) may last about 2 hours to about 30 hours,

5 preferably 4 hours to 10 hours, and more preferably less than 8 hours. The

obtained hydrolysate contains genipin as main component and other components. The hydrolysate can be used for the extraction in step b) directly.

In the prior process, the hydrolysate obtained from the step a) is normally reacted with an amino acid directly to produce gardenia blue pigment.

10 However, the gardenia blue pigment obtained from the prior process is dark and not good for some industrial applications such as beverages. The inventors of the present invention surprisingly discovered that an additional extraction of the step b) results in sky blue color, a bright blue pigment which is more applicable for industrial applications like beverages.

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Any person skilled in the art could understand that, the solvent used for extraction in the step b) is important and may be any one suitable for the purpose of the invention, and examples include but are not limited to diethyl ether, ethyl acetate, butanol, a mixture of butanol with petroleum and/or

20 hexane, or mixtures thereof. In the embodiment that the solvent is a mixture of butanol with petroleum and/or hexane, the volume ratio of butanol with petroleum and/or hexane is in the range of from 1:5 to 5:1, preferably in the range of from 1:3 to 3:1, and more preferably in the range of from 1:2 to 2:1. Preferably, the solvent used in the step b) is ethyl acetate.

25

The amount of the solvent used in the step b) may be from 0.5 mL to 5 mL, preferably from 1.0 mL to 3 mL, per 1 mL of the hydrolysate. The extraction of the step b) may be carried out at a temperature in the range of from 10°C to 60°C, preferably at room temperature. According to the present invention, the

30 extraction of the step b) may be repeated two to four times.

The product comprising genipin is obtained after the organic phases are collected and the solvent is removed in the step b). The solvent may also be recycled. The extraction procedures and the procedures for collecting solvents and removing/recycling solvents during the extraction are known to the person skilled in the art. Therefore, they are not discussed in more detail here.

As known in the art, genipin reacts with an amino acid or a salt thereof in one step to provide gardenia blue pigment. Different from the known process, the present invention provides an improved process with a two-steps color reaction to produce the gardenia blue pigment. As steps c) and d) of the process of the present invention, the product comprising genipin obtained in the step b) is reacted with an amino acid or a salt thereof under an atmosphere of inert gas at first, and then oxygen is introduced after the genipin is consumed to produce the gardenia blue pigment. By the two-steps color reaction, the inventors of the present invention surprisingly discovered that the process of the present invention provides more consistent and stable gardenia blue pigment with higher color value, and the color reaction time is reduced significantly from more than 30 hours to less than 10 hours.

In the step c) of the present invention, the amino acid may be selected from the group consisting of glutamate, phenylalanine, histidine, leucine, isoleucine, arginine and mixture thereof. The salt may be any alkali metal salt such as sodium salt. Preferably the salt is sodium glutamate. The inventors of the present invention discovered that the amino acid and the salt used in the step c) are also important because they can provide sky blue color as disclosed in the present invention. Preferably, the amino acid used in the step c) is sodium glutamate.

In the step c) of the present invention, the amino acid may be added in an amount of 0.5-10 moles, preferably 0.8-6 moles, and more preferably 1-3 moles,

per 1 mole of genipin in the reaction. Preferably, the amino acid is added in an aqueous solution.

In one embodiment, the product comprising genipin obtained from the step b)
5 is dissolved in a water-soluble solvent to react with the amino acid in the step c). The water-soluble solvent may be any one known in the art that can dissolve the product comprising genipin and examples include but are not limited to C₁-C₁₀ alkanols such as methanol and ethanol, and C₃-C₁₀ ketones such as acetone. Preferably, the water-soluble solvent is methanol, ethanol or
10 acetone or any mixture thereof. In one preferable embodiment of the process, the product comprising genipin obtained from the step b) is reacted with an aqueous solution of the amino acid in the absence of any organic solvent in the step c). No organic solvent process would be preferred in the industry because of safety advantage and others like easy-to-workup, reduced organic solvent
15 residue and low cost.

The inert gas used in step c) may be any gas that cannot react with any material in the reaction liquid. The example of the inert gas includes but is not limited to nitrogen gas, argon gas and helium gas.

20

The reaction of the step c) may be carried out at about 30°C to about 100°C, preferably about 60°C to 80°C, such as 60°C, 65°C, 70°C and 75°C. The progress of the reaction can be monitored by any known method, such as HPLC and TLC. Preferably, the step c) is carried out at a pH value in the range of from 7.0 to
25 11. In some embodiments, a base selected from but not limited to NaOH, KOH, NaCO₃ and NaHCO₃ is added to adjust the reaction mixture of the step c) to an appropriate pH value.

After the genipin in the reaction liquid is consumed, preferably after all the
30 genipin is consumed, oxygen is introduced into the reaction liquid to produce the gardenia blue pigment as step d) of the present invention. The oxygen may

be introduced as pure oxygen, air and/or diluted oxygen or air. Preferably, the oxygen is introduced as air.

5 The reaction of the step d) of the present invention may continue till the desired gardenia blue is obtained. Preferably, the reaction lasts from 4 hours to 20 hours, more preferable from 6 hours to 15 hours, under the same range of temperature as the step c). The reaction may be terminated or quenched by any know method in the art, for example, by introducing vacuum or inert gas when the desired gardenia blue is obtained.

10

After the reaction is complete, the gardenia blue pigment can be obtained as a solid by removing the organic solvent and water in the reaction mixture. Accordingly, the process of the present invention optionally further comprises the step of removing the solvent and water to provide a solid of the gardenia
15 blue pigment by, for example, lyophilization or spray drying.

20

Optionally, the obtained gardenia blue pigment can be purified further by any procedures known in the art such as ultrafiltration to obtain an even purer gardenia blue pigment. The process of the present invention produces the
20 gardenia blue pigment which is sky blue, brighter than the blue color such as ultramarine blue produced by the known processes and thus more popular for some industrial applications such as beverages.

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In addition, the obtained gardenia blue pigment of the present invention has a
25 color value of >100 , that means low dosage is needed in applications and more stable in beverage. Further, by an additional extraction step, the obtained gardenia blue pigments can be easily separated and purified from the reaction mixture without complicated operations. Furthermore, by the two-steps color reaction, the process of the present invention becomes easy-to-workup and has
30 reduced reaction time, and the obtained gardenia blue pigment is more consistent.

Since the Gardenia Blue pigment is water-soluble, it is used as such or as aqueous solution.

5 **Beta-Carotene**

Beta-carotene comprised in the green colorant of the present invention may be synthetically manufactured or isolated from natural sources.

The beta-carotene may be added in a water-soluble or water-dispersible form.

10 Such a form or also called “formulation” contains the beta-carotene embedded or encapsulated in a matrix of a protective colloid. Such a formulation will be explained in more detail below.

Beta-carotene formulation

15 In the formulation the beta-carotene is embedded in a matrix of a protective hydrocolloid. The amount of beta-carotene in the formulation is usually in the range of from 1wt% to 15wt%, preferably in the range of from 2wt% to 10wt%, based on the total weight of the formulation.

20 The protective hydrocolloid may preferably be selected from the group consisting of modified food starch (esp. OSA starch) and proteins (of animal or plant origin) such as gelatin. Additionally water- and/or fat-soluble antioxidants may be present, preferably in an amount of from 0.5wt% to 5wt% in total, based on the total amount of the formulation.

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A preferred example of such water-soluble antioxidants is sodium ascorbate.

A preferred example of such fat-soluble antioxidants is dl-alpha-tocopherol.

30 In an embodiment of the present invention a clear liquid formulation of beta-carotene is used which comprises:

- a) 0.1wt% to 10wt% (preferably 0.5wt% to 5wt%, more preferably 0.5wt% to 3.0wt%, most preferably 1.0wt% to 3.0wt%) of beta-carotene, and
- b) 20wt% to 60wt% (preferably 30wt% to 50wt%) of at least one modified food starch as defined below, and
- 5 c) 0.5wt% to 60wt% (preferably 0.5wt% to 30wt%, more preferably 0.5wt% to 20wt%, even more preferably 0.5wt% to 10wt%, most preferably 1.0wt% to 10wt%) of at least one saccharide, and
- d) 35wt% to 75wt% (preferably 45wt% to 65wt%) of water,
- all amounts based on the total weight of the liquid formulation,
- 10 whereby all amounts add up to 100wt%.

Hereby the beta-carotene is embedded in a matrix of the modified food starch/es and the saccharide/s.

15 “Modified food starch”

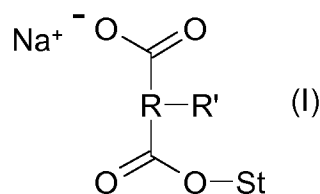
A modified food starch is a food starch that has been chemically modified by known methods to have a chemical structure which provides it with a hydrophilic and a lipophilic portion. Preferably the modified food starch has a long hydrocarbon chain as part of its structure (preferably C₅-C₁₈).

20

At least one modified food starch is preferably used as protective hydrocolloid, but it is possible to use a mixture of two or more different modified food starches in one formulation.

- 25 Starches are hydrophilic and therefore do not have emulsifying capacities. However, modified food starches are made from starches substituted by known chemical methods with hydrophobic moieties. For example starch may be treated with cyclic dicarboxylic acid anhydrides such as succinic anhydrides, substituted with a hydrocarbon chain (see O. B. Wurzburg (editor), “Modified
- 30 Starches: Properties and Uses, CRC Press, Inc. Boca Raton, Florida, 1986, and

subsequent editions). A particularly preferred modified food starch of this invention has the following formula (I)



wherein St is a starch, R is an alkylene radical and R' is a hydrophobic group.

- 5 Preferably R is a lower alkylene radical such as dimethylene or trimethylene. R' may be an alkyl or alkenyl group, preferably having 5 to 18 carbon atoms. A preferred compound of formula (I) is an "OSA-starch" (starch sodium octenyl succinate). The degree/extent of substitution, i.e. the number of esterified hydroxyl groups to the number of free non-esterified hydroxyl groups usually
- 10 varies in a range of from 0.1% to 10%, preferably in a range of from 0.5% to 4%, more preferably in a range of from 3% to 4%.

- The term "OSA-starch" denotes any starch (from any natural source such as corn, waxy maize, waxy corn, wheat, tapioca and potato or synthesized) that
- 15 was treated with octenyl succinic anhydride (OSA). The degree/extent of substitution, i.e. the number of hydroxyl groups esterified with OSA to the number of free non-esterified hydroxyl groups usually varies in a range of from 0.1% to 10%, preferably in a range of from 0.5% to 4%, more preferably in a range of from 3% to 4%. OSA-starches are also known under the expression
- 20 "modified food starch".

- The term "OSA-starches" encompasses also such starches that are commercially available e.g. from National Starch/Ingredion under the tradenames HiCap 100, Capsul, Capsul HS, Purity Gum 2000, Clear Gum Co03, UNI-PURE, HYLON VII;
- 25 from National Starch/Ingredion and Roquette Frères, respectively; from CereStar under the tradename C*EmCap or from Tate & Lyle.

Saccharide

The term “saccharide” of the clear liquid formulation of beta-carotene encompasses mono-, di-, oligo- and polysaccharides, as well as any mixtures thereof.

5

Examples of monosaccharides are fructose, glucose (= dextrose), mannose, galactose, sorbose, as well as any mixtures thereof.

Preferred monosaccharides are glucose and fructose, as well as any mixture thereof.

10

The term “glucose” in the context of the present invention does not only mean the pure substance, but also a glucose syrup with a $DE \geq 90$. This also applies for the other monosaccharides.

15

The term “dextrose equivalent” (DE) denotes the degree of hydrolysis and is a measure of the amount of reducing sugar calculated as D-glucose based on dry weight; the scale is based on native starch having a DE close to 0 and glucose having a DE of 100.

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Examples of disaccharides are saccharose, isomaltose, lactose, maltose and nigerose, as well as any mixture thereof.

An example of an oligosaccharide is maltodextrin.

25

An example of a polysaccharide is dextrin.

An example of a mixture of mono- and disaccharides is invert sugar (glucose + fructose + saccharose).

30

Mixtures of mono- and polysaccharides are e.g. commercially available under the tradenames Glucidex IT 47 (from Roquette Frères), Dextrose Monohydrate ST (from Roquette Frères), Sirodex 331 (from Tate & Lyle) and Glucamyl F 452 (from Tate & Lyle).

5

An example of such a clear liquid formulation of beta-carotene is “β-carotene 2.5% emulsion CC” as commercially available by DSM Nutritional Products AG, Kaiseraugst, Switzerland and described in detail in WO 2013/144221.

10 Green Sugar Syrup and Gree Sugar-free Syrup

The green colorant of the present invention may also comprise sugar to form a green sugar syrup. The green sugar syrup is also part of the present invention.

Preferably the sugar in the green colorant is selected from the group consisting of monosaccharides and disaccharides and mixtures thereof.

15

Preferred examples of mono- and disaccharides are saccharose, glucose, fructose, maltose and mixtures thereof.

The sugar syrup has preferably a Brix value in the range of from 65 to 75, more preferably it has a Brix value in the range of from 70 to 75.

20

Alternatively, polyols such as maltitol, xylitol, mannitol, sorbitol, isomalt, palatinose and mixtures thereof may be used to replace the sugar in the green sugar syrup to form a green sugar-free syrup. The green sugar-free syrup is also part of the present invention.

25

Any person skilled in the art can understand that the amount of the sugars and the polyols may be adjusted easily depending on the taste of the beverage that the syrup will be used into.

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Beverage

The invention is also directed to a beverage comprising the green colorant, the green sugar syrup or the green sugar-free syrup of the present invention as described above.

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In the present invention, the term “beverage” refers to a drinkable liquid for human consumption, including but not limited to non-alcoholic beverage such as water, sparkling water, soda pop, lemonade, milk, milkshakes, iced tea, root beer, juice, fruit punch, hot chocolate, tea, coffee and energy drinks; and
10 alcoholic beverage such as beer, cider, spirits and wine.

In the beverage of the present invention, the amount of the Gardenia Blue pigment may be in the range of from 0.5 ppm to 50 ppm, more preferably it is in the range of from 2.5 ppm to 15 ppm, most preferably it is in the range of
15 from 4 ppm to 12 ppm, based on the total weight of the beverage; and the amount of the beta-carotene may be in the range of from 0.1 ppm to 100 ppm, more preferably it is in the range of from 0.15 ppm to 6 ppm, most preferably it is in the range of from 0.3 ppm to 3 ppm, based on the total weight of the beverage.

20

Besides the green colorant, optionally the sugar or polyols as mentioned above, the beverage of the present invention may also comprise the following ingredients:

- a) One or more vitamins such as vitamin C;
- 25 b) a pH adjustor such as citric acid and or salts thereof such as sodium citrate;
- c) a stabilizer such as pectin; and
- d) a flavor such as lemon flavor supplied by Firmenich SA, Switzerland.

As understood by any person skilled in the art, the above ingredients may be easily added into drinkable water such as carbonated water sequentially or simultaneously to mix and form the beverage of the present invention.

5 **Use according to the present invention**

The present invention is also directed to the use of the green colorant of the present invention comprising a mixture of Gardenia Blue pigment and beta-carotene for coloring beverage.

10 **Color measurement**

Color (lightness, Chroma, and hue) of the green colorant and the beverage of the present invention was determined with a HunterLab Ultra Scan Pro spectrophotometer (Hunter Associates Laboratory, Reston, VA, USA) and expressed on basis of the CIELAB color scale. The mode used was RSIN which stands for Reflectance - Specular Included. The small area view (SAV) with a diameter of 4.826 mm (0.190 inch) was chosen. Color measurements are carried out after CIE guidelines (Commission International d'Eclairage). Values can be expressed as planar coordinates as L*, a*, b* with L* being the measuring values for lightness, with a* being the value on the red-green axes and b* being the value on the yellow-blue axes.

The Chroma (C*) sometimes called saturation describes the vividness or dullness of a color which can be calculated as followed:

$$C^* = \sqrt{a^{*2} + b^{*2}}$$

The angle called hue (h) describes how we perceive an object's color and can be calculated as followed:

$$h = \tan(b/a)^{(-1)}$$

Instruments settings:

- Color scale is the CIE L*a*b*/L*C*h
 - Light source definition: D65 daylight equivalent
 - Geometry: Diffuse/8°
 - Wavelength: scan 350-1050 nm
- 5 • Sample measurement area diameter: 4.826 mm
- Calibration mode: Reflection/ Specular-included

In addition, the maximum absorption wavelength $\lambda_{\max}$ and the color value are measured according to the national standard GB 28311-2012 of China.

10

The invention is now further illustrated in the following non-limiting examples.

Example 1: Preparation of the Gardenia Blue pigment

420 g liquid geniposide (40wt%) purchased from He'nan ZhongDa Hengyuan
15 Biotechnology Co., Ltd. (He'nan, China) was added into 2.9 L of an aqueous
citric acid/ Na_2HPO_4 buffer solution (pH 4.0), the resulting mixture was heated
to 50°C. 50.4 g of cellobiase purchased from Sunson Biotechnology Co. Ltd.
(NingXia, China) was further added to the preheated solution for reaction for
10 hours under 50°C. After filtration to remove insolubles, the reaction mixture
20 was extracted with 2.9 L ethyl acetate twice. The organic phase was
concentrated under vacuum to remove part of ethyl acetate. About 560 g of
ethyl acetate solution was left for further precipitation at about 50°C, 200
mbar to offer 58.9 g crude genipin powder with 98.0% HPLC purity.

25 In a reaction flask with 4.5 g of the above genipin powder, 67 ml of ethanol
was used to dissolve the powder. 4.42 g sodium glutamate was dissolved in 67
ml of deionized water and charged to the flask with genipin solution. The
resulting mixture was stirred under nitrogen at 75°C for about 4.5 hours when
genipin totally disappeared by NMR monitoring. Then nitrogen in the system
30 was blown away by air and the resulting mixture was stirred in the presence of
air for another 6 hours at 75°C. After removing ethanol under vacuum, freeze

drying was performed to offer about 7.8 g of gardenia blue pigment as solid powder.

The obtained gardenia blue was dissolved in deionized water to provide a test solution with the maximum absorbance of 0.337 for color test, and the test results of $\lambda_{\max}$, color value and L*, a*, b* and h values are summarized in table 1.

Table 1

Color value (E)	$\lambda_{\max}$	L*	a*	b*	c*	h
135.79	598	84.88	-9.22	-10.85	14.24	229.66

Example 2: Preparation of the green colorant

The green colorants of the present invention were prepared by mixing the following ingredients as listed in Table 2 together by using a conventional mixing apparatus at room temperature. The gardenia blue was obtained as example 1. Beta-carotene was obtained from DSM Nutritional Products AG, Kaiseraugst, Switzerland. Color was tested with the maximum absorbance of 0.337, and the test results of L*, a*, b*, c* and h values are summarized in table 2.

Table 2

Ingredients	Colorant 1	Colorant 2	Colorant 3	Colorant 4	Colorant 5	Colorant 6	Colorant 7
Gardenia blue (mg)	3.68	4.79	5.52	6.26	7.36	8.83	11.05
beta-carotene 2.5% EM/CC (mg)	40	40	40	40	40	40	40
Carbonated water	1 L	1 L	1 L	1 L	1 L	1 L	1 L
L*	95.83	95.46	95.01	94.82	93.70	92.76	91.41
a*	-2.58	-2.83	-3.09	-3.19	-3.85	-4.38	-5.13
b*	10.78	10.42	10.06	9.87	8.97	8.24	6.89
c*	11.09	10.80	10.52	10.38	9.76	9.33	8.59
h	103.48	105.21	107.08	107.93	113.26	118.01	126.64

Example 3: Preparation of the beverage comprising the green colorant of the present invention

The beverage of the present invention was prepared by mixing the following ingredients as listed in the Table 3 together using a conventional mixing apparatus at room temperature. The gardenia blue was obtained as example 1.

Beta-carotene was obtained from DSM Nutritional Products AG, Kaiseraugst, Switzerland.

Table 3

Ingredients	Amount (g/kg)
Sugar	118
Citric acid	2.50
Sodium citrate	0.50
Ascorbic acid	0.40
Pectin	0.50
Lemon flavor (from Firmenich SA, Switzerland)	0.40
Gardenia blue	0.0063
beta-carotene 2.5% EM/CC	0.056
Carbonated water	To 1000 g

Claims

1. A green colorant comprising a mixture of Gardenia Blue pigment and beta-carotene.

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2. The green colorant according to claim 1, wherein the beta-carotene is in a water-dispersible or water-soluble form.

3. The green colorant according to any one or more of the preceding claims wherein the Gardenia Blue pigment has been obtained by a process comprising the following steps:

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- a). Treating geniposide with a glycosidase to obtain a hydrolysate; and
- b). Extracting the hydrolysate obtained in step a) with a solvent and removing the solvent after the extraction to obtain a product comprising genipin; and
- 15 c). Reacting the product comprising genipin obtained in step b) with an amino acid and/or a salt thereof under an atmosphere of inert gas, and
- d). Introducing oxygen after genipin is consumed to produce the gardenia blue pigment; and
- e). Optionally, purifying the gardenia blue pigment produced in step d).

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4. A sugar syrup comprising a mixture of Gardenia Blue pigment and beta-carotene.

5. The sugar syrup according to claim 6, wherein the sugar is selected from the group consisting of saccharose, glucose, fructose, maltose and mixtures thereof.

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6. The sugar syrup according to claim 6 or 7, wherein the Gardenia Blue pigment has been obtained by a process comprising the following steps:

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- a). Treating geniposide with a glycosidase to obtain a hydrolysate; and
- b). Extracting the hydrolysate obtained in step a) with a solvent and removing the solvent after the extraction to obtain a product comprising genipin; and

- c). Reacting the product comprising genipin obtained in step b) with an amino acid and/or a salt thereof under an atmosphere of inert gas, and
- d). Introducing oxygen after genipin is consumed to produce the gardenia blue pigment; and

5 e). Optionally, purifying the gardenia blue pigment produced in step d).

7. A sugar-free syrup comprising a mixture of Gardenia Blue pigment and beta-carotene and a polyol.

10 8. The sugar-free syrup according to claim 9, wherein the polyol is selected from the group consisting of maltitol, xylitol, mannitol, sorbitol, isomalt, palatinose and mixtures thereof.

9. The sugar-free syrup according to claim 9 or 10, wherein the Gardenia Blue pigment has been obtained by a process comprising the following steps:

- 15 a). Treating geniposide with a glycosidase to obtain a hydrolysate; and
- b). Extracting the hydrolysate obtained in step a) with a solvent and removing the solvent after the extraction to obtain a product comprising genipin; and
- c). Reacting the product comprising genipin obtained in step b) with an amino
- 20 acid and/or a salt thereof under an atmosphere of inert gas, and
- d). Introducing oxygen after genipin is consumed to produce the gardenia blue pigment; and
- e). Optionally, purifying the gardenia blue pigment produced in step d).

25 10. A beverage comprising a green colorant according to any one or more of claims 1 to 5 or a sugar syrup according to any one or more of claims 6 to 8 or a sugar-free syrup according to one or more claim 9 to 11.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/070420

A. CLASSIFICATION OF SUBJECT MATTER
INV. A23L5/40 A23L5/43 A23L27/30
ADD.

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

B. FIELDS SEARCHED

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

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

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

EPO-Internal, WPI Data, FSTA, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	----- CN 103 614 431 B (UNIV NANJING) 17 June 2015 (2015-06-17) abstract	1-10
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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

"&" document member of the same patent family

Date of the actual completion of the international search

1 November 2017

Date of mailing of the international search report

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
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