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(57) Abstract: The present application is directed to a method of hard pan coating an edible core, a sucrose-based, hard panned coating, and a hard panned confection comprising an edible core coated with the same. The sucrose-based, hard panned coating comprises sucrose and a pH-adjusted red radish anthocyanin-containing colorant, is substantially crystalline, and has a red or orange hue described by a CIELCH color space h° coordinate of from about 15° to about 70° . In some embodiments, the coating further comprises a yellow colorant. The colorants are desirably naturally sourced to provide alternatives to synthetic colorants for coloring hard panned confectionery coatings in red or orange hues.



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ORANGE AND RED ANTHOCYANIN-CONTAINING COLORANTS

TECHNICAL FIELD

[0001] The present application relates to a hard panned coating, a hard panned confection coated with the same, and a method of hard pan coating an edible core with the same.

BACKGROUND ART

[0002] Confectionery products enjoyed by consumers include products having a confectionery or other edible center that is coated with a sucrose-based coating by the process of hard panning.

[0003] It is known that the color of a food product can convey many different product attributes to the consumer, such as good taste, quality, freshness, and even a sense of fun. Since the coating is the first component of a hard panned confectionery that a consumer sees, it is desirable to use colorants in the coating which convey the desired product attributes.

[0004] However, in using colorants in the coating, it is often technically challenging to provide a desired hue while also delivering other coating attributes such as a target texture, taste, and stability to environmental factors. Therefore, a coating which delivers both a desired hue and other target attributes can expand the variety of hard panned confectioneries that can be made for the consumer's enjoyment.

BRIEF DESCRIPTION

[0005] The present application is directed to a sucrose-based, hard panned coating comprising sucrose and a pH-adjusted red radish anthocyanin-containing colorant, wherein the coating is substantially crystalline and has a red or orange hue described by a CIELCH color space h° coordinate from about 15° to about 70° . In an embodiment, the red radish anthocyanin-containing colorant is pH adjusted in aqueous solution to a pH of from about 4 to about 6 and the water content of the solution is optionally reduced to provide the pH-adjusted red radish anthocyanin-containing colorant. In another embodiment, the coating further comprises a yellow colorant.

[0006] In one embodiment, the sucrose-based, hard panned coating comprises multiple sucrose-based syrup layers, and the pH-adjusted red radish anthocyanin-

containing colorant is present in at least one of the sucrose-based syrup layers. In this embodiment, the coating may further comprise a yellow colorant. In some embodiments of the multilayered coating further comprising a yellow colorant, the yellow colorant is present in one or more of the same sucrose-based syrup layers as the pH-adjusted red radish anthocyanin-containing colorant.

[0007] In some embodiments, the color of the sucrose-based, hard panned coating has a ΔE color difference of 10 or less compared to the color of a sucrose-based, hard panned coating colored with the synthetic red colorant, FD&C Red No. 40.

[0008] The present application is also directed to a hard panned confection comprising an edible core and a sucrose-based, hard panned coating comprising sucrose and a pH-adjusted red radish anthocyanin-containing colorant, wherein the coating is substantially crystalline and has a red or orange hue described by a CIELCH color space h° coordinate from about 15° to about 70° . Any of the embodiments of a sucrose-based, hard panned coating disclosed herein may be used as the coating of the hard panned confection. In embodiments, the coating substantially surrounds the edible core.

[0009] In another aspect, the present application is directed to a method of hard pan coating an edible core. The method comprises: (a) admixing a red radish anthocyanin-containing colorant with water to form an aqueous colorant solution; (b) adjusting the pH of the aqueous colorant solution to from about 4 to about 6, and, optionally, reducing the water content of the solution to form a pH-adjusted colorant; (c) admixing the pH-adjusted colorant with a sucrose-based syrup to form a colored sucrose-based syrup; (d) admixing a yellow colorant with one or more constituents and admixtures of steps (a), (b), and (c) such that the yellow colorant is incorporated into the colored sucrose-based syrup; and (e) applying the colored sucrose-based syrup to an edible core to provide at least one layer of a hard panned coating. In some embodiments, the pH of the aqueous colorant solution is adjusted by admixing a food-grade pH adjusting agent with the solution.

[0010] The method of hard pan coating, in one embodiment, may further comprise crystallizing the colored sucrose-based syrup after it is applied such that the at least one layer of the hard panned coating is substantially crystalline. In another embodiment, the method may further comprise applying the colored sucrose-based syrup to the edible core to provide multiple layers of a hard panned coating.

DETAILED DESCRIPTION

[0011] Definitions

[0012] The present specification provides certain definitions related to the compositions and methods disclosed. Provision, or lack of the provision, of a definition for a particular term or phrase is not meant to imply any particular importance, or lack thereof. Rather, and unless otherwise noted, terms are to be understood according to conventional usage by those of ordinary skill in the relevant art.

[0013] Reference throughout the specification to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with an embodiment is included in at least one embodiment. Thus, the appearance of the phrases, “in one embodiment” or “in an embodiment,” in various places throughout the specification is not necessarily referring to the same embodiment. Further, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

[0014] The present application contemplates the possibility of omitting any components or steps listed herein. The present application further contemplates the omission of any components or steps even though they are not expressly named as included or excluded in the specification.

[0015] As used herein, “comprising” and “comprises” denote the presence of a feature, step, or component without excluding the possibility of additional features, steps, or components being present as well.

[0016] As used herein, a “sucrose-based syrup” means a syrup comprising at least 90 percent by weight of a base composition having about 60 wt% to about 80 wt% sucrose solids and about 40 wt% to about 20 wt%, i.e., the balance, water; and the syrup optionally comprising non-colorant components in a total amount not exceeding 10 percent by weight of the combined base composition and non-colorant components. In some embodiments, sucrose may be the sole carbohydrate in the sucrose-based syrup, or sucrose may be the sole crystallizable carbohydrate in the sucrose-based syrup. Non-colorant components include white or light-colored materials such as titanium dioxide and calcium carbonate when they are used as an opacifier in the coating. One or more colorants may be combined with the sucrose-based syrup to produce a “colored sucrose-based syrup.” Colorants may include

white or light-colored materials such as titanium dioxide and calcium carbonate when they are used to produce a white or light colored coating.

[0017] A “sucrose-based, hard panned coating” is a coating produced by a hard panning process with one or more sucrose-based syrups, with or without colorant(s) added. Conventional hard panning involves mixing edible centers in a rotating pan, rotating drum, moving belt system or similar apparatus while applying multiple applications of one or more sucrose-based syrups to the surfaces of the centers. The process includes introducing a drying gas, such as air, into the pan to dry the coating between applications of sucrose-based syrups. Drying removes water from the sucrose-based syrup and results in crystallization of a substantial portion of the sucrose. Therefore, a sucrose-based, hard panned coating is substantially crystalline. Hard panning produces a panned confectionery with a smooth, hard coating and a crunchy texture when bitten. The hard panned coating is distinguished herein from a soft panned coating, at least in part because it does not have the soft consistency and texture of a soft panned coating. Alternatively, a sucrose-based, hard panned coating may be prepared by a non-conventional process that substantially replicates the properties of a conventionally hard panned coating.

[0018] As used herein, a “colorant” is any substance that imparts color by absorbing or scattering light at different wavelengths. A “food-grade colorant” refers to a colorant suitable for use in a food product intended for human or animal consumption, and is differentiated from a nontoxic material that may provide color, but is generally not included in a food product or is only included in a trace amount. The term, “natural colorant,” includes colorants that exist in or are produced by nature or are sourced therefrom.

[0019] A “red radish anthocyanin-containing colorant” is a colorant comprising anthocyanin(s) sourced from red radish or of the type(s) that may be sourced from red radish.

[0020] “Hue” refers to the color property that gives a color its name, for example, red, orange-red, blue, violet, etc. “Chroma” is a color property indicating the purity of a color, where higher chroma is associated with greater purity of hue and less dilution by white, gray, or black. “Value” is a color property indicating the lightness or darkness of a color, where higher value is associated with greater lightness.

[0021] The terms “color” and “color characteristics” are used interchangeably, and encompass color properties such as hue, chroma, and value, and color model system parameters used to describe these properties, such as Commission Internationale de l’Eclairage CIE 1976 CIELAB color space $L^*a^*b^*$ values and CIELCH color space $L^*C^*h^\circ$ values. The CIELAB and CIELCH color models provide more perceptually uniform color spaces than earlier color models. Colorants are analyzed with a spectrophotometer, and CIELAB $L^*a^*b^*$ and CIELCH $L^*C^*h^\circ$ values are calculated from the spectral data. The $L^*a^*b^*$ and $L^*C^*h^\circ$ values provide a means of representing color characteristics and assessing the magnitude of difference between two colors.

[0022] $L^*a^*b^*$ values consist of a set of coordinate values defined in a three-dimensional Cartesian coordinate system. L^* is the value, or lightness, coordinate. L^* provides a scale of lightness from black (0 L^* units) to white (100 L^* units) on a vertical axis. a^* and b^* are coordinates related to both hue and chroma. a^* provides a scale for greenness (- a^* units) to redness (+ a^* units), with neutral at the center point (0 a^* units), on a horizontal axis. b^* provides a scale for blueness (- b^* units) to yellowness (+ b^* units), with neutral at the center point (0 b^* units), on a second horizontal axis perpendicular to the first horizontal axis. The three axes cross where L^* has a value of 50 and a^* and b^* are both zero.

[0023] $L^*C^*h^\circ$ values consist of a set of coordinate values defined in a three-dimensional cylindrical coordinate system. L^* is the value, or lightness, coordinate. L^* provides a scale of lightness from black (0 L^* units) to white (100 L^* units) on a longitudinal axis. h° is the hue coordinate. h° is specified as an angle from 0° to 360° moving counterclockwise around the L^* axis. Pure red has a hue angle of 0° , pure yellow has a hue angle of 90° , pure green has a hue angle of 180° , and pure blue has a hue angle of 270° . The C^* coordinate represents chroma and is specified as a radial distance from the L^* axis. C^* provides a scale from achromatic, i.e., neutral white, gray, or black, at the L^* axis (0 C^* units) to greater purity of hue as the coordinate moves away from the L^* axis (up to 100 or more C^* units). C^* and h° can be calculated from a^* and b^* using Equations 1 and 2:

$$C^* = (a^{*2} + b^{*2})^{0.5} \quad (1)$$

$$h^\circ = \arctan \left(\frac{b^*}{a^*} \right) \quad (2)$$

[0024] “Delta E,” “ ΔE_{ab}^* ,” or “ ΔE ” is a measure of the magnitude of total color difference between two colors represented in CIELAB $L^*a^*b^*$ color space. It has been reported that an experienced color observer cannot distinguish any difference between two colors when the ΔE is about 2.3 or less. The ΔE of two different colors with $L^*a^*b^*$ values, $L^*_1a^*_1b^*_1$ and $L^*_2a^*_2b^*_2$, is calculated using Equation 3:

$$\Delta E_{ab}^* = \sqrt{(L^*_1 - L^*_2)^2 + (a^*_1 - a^*_2)^2 + (b^*_1 - b^*_2)^2} \quad (3)$$

[0025] The CIELAB $L^*a^*b^*$ and CIELCH $L^*C^*h^\circ$ values of hard panned confections presented herein, in all instances unless stated otherwise, were calculated from spectral data obtained with a Konica Minolta Spectrophotometer CM-3500d operated in reflectance mode, with CIE Standard Illuminant D65 and 10° observer angle.

[0026] Description

[0027] An edible, food-grade colorant is often included in one or more sucrose-based syrup layers of a hard panned confectionery coating. Many edible, food-grade, synthetic colorants are available for effectively coloring hard panned confectionery coatings. However, although synthetic colorants have enjoyed consumer acceptance for a number of years, alternatives are desired that may appeal to consumers as being naturally sourced.

[0028] There are a number of edible, food-grade colorants available that are described as ‘natural.’ Among these are natural anthocyanin-containing colorants, including those provided in the form of anthocyanin-containing vegetable and fruit juices and extracts.

[0029] Color characteristics of anthocyanin-containing vegetable and fruit juices and extracts can change as a result of changing pH. Anthocyanin-containing juices and extracts generally exhibit red hues at low pH, e.g., in the pH range of about 1 to about 3, and the hue shifts to purple as the pH is increased.

[0030] Sucrose-based syrups used for hard panning, however, generally have a pH of about 5 to about 8, with the low end of this range only tolerated at higher syrup temperatures. Operating outside of this pH range can result in inversion of the sucrose, which makes the syrup unsuitable for panning. Coating defects that occur when the pH of the syrup is outside this range can include a bumpy, irregular surface

and blotchy, nonuniform coloration. Therefore, effective colorants added to sucrose-based syrups desirably do not drive the pH of the syrup above or below this range.

[0031] Currently, commercially available anthocyanin-containing colorants have not been found to provide a red hue in a sucrose-based syrup or a hard panned coating produced with the syrup. Instead, the sucrose-based syrup and resulting coating take on a violet hue. Furthermore, combinations of an anthocyanin-containing colorant and a yellow colorant have not been found to provide a red or orange hue in the sucrose syrup or resulting coating, but result in a muddy, brownish hue. It is noted that commercially available colorants used to provide red and orange hues, such as lycopene, β -carotene, carmine, and betalains are not anthocyanin-containing colorants. Accordingly, a natural anthocyanin-containing colorant is needed that can be used to provide red and orange hues in a pH range that is conducive to hard pan coating with sucrose-based syrups.

[0032] It has surprisingly been found that a sucrose-based, hard panned coating with a red or orange hue may be prepared when using a pH-adjusted red radish anthocyanin-containing colorant obtained by pH-adjusting a red radish anthocyanin-containing colorant in aqueous solution to a pH of from about 4 to about 6. That is, incorporating such a pH-adjusted red radish anthocyanin-containing colorant into a sucrose-based syrup does not result in, for example, a violet or muddy brown hue in a hard panned coating prepared with the syrup. The potential for a red radish anthocyanin-containing colorant in this pH range to contribute to providing red and orange hues in a sucrose-based, hard panned coating has not previously been appreciated in the art.

[0033] A publication entitled, "Radish Anthocyanin Extract as a Natural Red Colorant for Maraschino Cherries," Journal of Food Science, 61: 688–694, 1996, Giusti et al., discloses the use of red radish anthocyanin extracts in pH 3.5 high fructose corn syrups for coloring maraschino cherries. This is outside the pH range of colored sucrose-based syrups used for coating edible cores, and the reference does not disclose the use of the syrups for coloring sucrose-based, hard panned coatings. In addition, the disclosed methods do not include a step of preparing a pH-adjusted red radish anthocyanin-containing colorant for admixing with a sucrose-based syrup to form a colored sucrose-based syrup.

[0034] WO 2012/059590 A1, Mason et al., discloses the preparation of sucrose syrups colored with red radish anthocyanin materials and the use of these syrups to produce a hard panned coating on an edible center. The disclosed methods do not include a step of preparing a pH-adjusted red radish anthocyanin-containing colorant for admixing with a sucrose-based syrup to form a colored sucrose-based syrup. The resulting coatings have measured hue angles, h° , of 356 and 13.3, which are outside the range of h° values disclosed herein for producing red or orange hues in a sucrose-based, hard panned coating.

[0035] A method for improving the heat-resistance of anthocyanin pigments is disclosed in US 2005/0181101 A1, Harada et al. In an example, an aqueous solution of a red radish pigment is alkali treated and heated at a temperature of 90°C for one hour. The treated pigment is reportedly suitable for coloring foods which undergo a heating step at a pH of less than 4. This is outside the pH range of colored sucrose-based syrups used for coating edible cores, and the reference does not disclose the use of the treated pigment for coloring sucrose-based, hard panned coatings with red or orange hues.

[0036] In one embodiment of the present application, a sucrose-based, hard panned coating is provided. The coating comprises sucrose and a pH-adjusted red radish anthocyanin-containing colorant. The coating is substantially crystalline and has a red or orange hue described by a CIELCH color space h° coordinate of from about 15° to about 70°.

[0037] As a base material for the pH-adjusted red radish anthocyanin-containing colorant, a red radish anthocyanin-containing colorant is a composition that may comprise only anthocyanin(s) from red radish or may also include other components. In embodiments where the red radish anthocyanins are naturally sourced, an anthocyanin-containing juice or extract of red radish may be used as a source of anthocyanin(s) for a natural red radish anthocyanin-containing colorant. The red radish raw material for obtaining the juice or extract may desirably be a red-fleshed vegetable of the plant family, *Brassicaceae*, and genus, *Raphanus*. An anthocyanin-containing juice of red radish is obtained by pressing liquid out of the red radish. An anthocyanin-containing extract of red radish is obtained by washing macerated red radish with a solvent (e.g., water, alcohol). Juices and extracts of red radish contain anthocyanins as well as many other naturally occurring compounds,

including, for example, carbohydrates, acids, flavonoids, metal ions, phenolic acids, phenolic acid esters, and vitamins. Accordingly, suitable juices and extracts of red radish may be processed, for example, by deodorizing, reconstituting, or subjecting the juice or extract to other processes for removing specific or broad classes of compounds. This processing may reduce a potential negative impact of a non-anthocyanin compound on the red or orange hue provided by the red radish anthocyanin-containing colorant. In some embodiments, the red radish anthocyanin-containing colorant comprises non-anthocyanin compounds in an amount of less than about 10 wt%, or less than about 5 wt%, or less than about 3 wt%, or less than about 2 wt%, or less than about 1 wt%, or less than about 0.5 wt%, or less than about 0.1 wt%. In other embodiments, the red radish anthocyanin-containing colorant comprises non-anthocyanin compounds in an amount of from about 0.01 wt% to about 10 wt%, or from about 0.01 wt% to about 5 wt%, or from about 0.01 wt% to about 3 wt%, or from about 0.01 wt% to about 2 wt%, or from about 0.01 wt% to about 1 wt%, or from about 0.01 wt% to about 0.5 wt%, or from about 0.01 wt% to about 0.1 wt%. Cell culture and fermentation methods may also provide raw materials for naturally sourcing red radish anthocyanins.

[0038] In an embodiment, the red radish anthocyanin-containing colorant is free of synthetic red colorants, lycopene, β -carotene, carmine, and betalains. In another embodiment, the red radish anthocyanin-containing colorant is free of colorants capable of providing a red hue other than red radish anthocyanins.

[0039] The red radish anthocyanin-containing colorant may take the form of a solid, e.g., a powder; a semi-solid, e.g., a paste; or a liquid, e.g., a solution or dispersion. The colorant is preferably provided in a form that is soluble or dispersible in water and in a sucrose-based syrup.

[0040] In some embodiments, the red radish anthocyanin-containing colorant is pH adjusted in aqueous solution to a pH of from about 4 to about 6 to create a pH-adjusted red radish anthocyanin-containing colorant. The pH range of from about 4 to about 6 is targeted because it is the range at which the red radish anthocyanins exhibit desired components of the red and orange hues sought in the hard panned coating. In some of these and other embodiments, the pH-adjusted aqueous solution of red radish anthocyanin-containing colorant has a pH value of from about 4.25 to

about 6, or from about 4.5 to about 6, or from about 4.75 to about 6, or from about 5 to about 6.

[0041] In some embodiments, a red radish anthocyanin-containing colorant in any form is admixed with water to create an aqueous colorant solution. The water with which the red radish anthocyanin-containing colorant is admixed may desirably be reduced in ion content or deionized. If the pH of the aqueous colorant solution is outside the range of from about 4 to about 6, the pH is adjusted to from about 4 to about 6 to create a pH-adjusted red radish anthocyanin-containing colorant in the form of an aqueous solution. If pH adjustment of the aqueous colorant solution is desired or required, it is accomplished by admixing a food-grade pH adjusting agent with the solution in an amount necessary to adjust the pH of the solution to from about 4 to about 6. The pH adjusting agent may be provided in any water-soluble form, e.g., as solid particles or in aqueous solution. If the pH adjusting agent is provided in aqueous solution, the water of solution is desirably reduced in ion content or deionized in some embodiments.

[0042] The food-grade pH adjusting agent, in an embodiment, is a strong base which substantially dissociates in water; that is, the percent dissociation of the agent in water is at least about 95%, or at least about 96%, or at least about 97%, or at least about 98%, or at least about 99%, or from about 95% to about 99.99%, or from about 98% to about 99.99%. The strong base does not act as a buffer, but substantially dissociates and adjusts the pH of the aqueous colorant solution. In some embodiments, the pH adjusting agent which is a strong base is admixed with the aqueous colorant solution in an amount of from about 0.5 wt% to about 10 wt%, where the weight percentage of the agent is by weight of the red radish anthocyanin-containing colorant. In other embodiments, the amount of the pH adjusting agent is from about 0.5 wt% to about 8 wt%, or from about 0.5 wt% to about 6 wt%, or from about 0.5 wt% to about 5 wt%, or from about 1 wt% to about 6 wt%, or from about 2 wt% to about 5 wt%, where the weight percentage of the agent is by weight of the colorant.

[0043] The strong bases, sodium hydroxide and potassium hydroxide, are preferred food-grade pH adjusting agents, in particular embodiments, because of their ability to adjust the pH of the aqueous colorant solution without contributing noticeable odor or flavor and without interacting with the colorant in a way that shifts hue away

from the intended target. In a preferred embodiment, the food-grade pH adjusting agent is sodium hydroxide.

[0044] The pH adjustment of the red radish anthocyanin-containing colorant in aqueous solution simplifies the production of a colored sucrose-based syrup for hard panning by providing a complete coloring material for admixing with an uncolored syrup. That is, provision of the pH-adjusted colorant avoids the need to adjust the pH of the bulk colored syrup to make it suitable for hard panning. As a result, the production of the sucrose-based, hard panned coating is streamlined.

[0045] In one embodiment where a pH-adjusted red radish anthocyanin-containing colorant is first created in the form of an aqueous solution, the water content is then reduced to create a pH-adjusted red radish anthocyanin-containing colorant in the form of a semi-solid or solid. The water content of the pH-adjusted solution may be reduced by any suitable process, e.g., a drying process or a separations process. The resulting pH-adjusted semi-solid or solid colorant is used to color an uncolored sucrose-based syrup for hard panning without the necessity of pH adjustment of the bulk colored syrup. The pH-adjusted red radish anthocyanin-containing colorant, in any form, is preferably soluble or dispersible in water and in a sucrose-based syrup.

[0046] The amount of the red radish anthocyanin-containing colorant to be used in making the sucrose-based, hard panned coating is limited only by practicality; for example, enough should be used so that the desired coating hue is obtained, but desirably, no greater amount will be used than that needed to achieve the same. Suitable concentrations of the red radish anthocyanin-containing colorant in a colored sucrose-based syrup used to prepare the coating can range from about 0.01 wt% to about 20 wt%, or from about 0.05 wt % to about 15 wt%, or from about 0.1 wt% to about 10 wt%. In embodiments where the colorant has low coloring power, the colorant may be used at concentrations from about 15 wt% to about 20 wt% of the syrup. In other embodiments where the colorant has a higher coloring power, the colorant may be used at concentrations from about 5 wt% up to less than about 15 wt% of the syrup. Where the colorant has an even higher coloring power, the colorant may be used at concentrations from about 0.01 wt% up to less than about 5 wt% of the syrup, or from about 0.01 wt% up to less than about 3 wt% of the syrup, or from about 0.01 wt% up to less than about 2 wt% of the syrup, or from about 0.01

wt% up to less than about 1.5 wt% of the syrup, or from about 0.01 wt% up to less than about 1 wt% of the syrup.

[0047] A wide range of red and orange hues may be produced in the sucrose-based, hard panned coating by incorporating a yellow colorant along with the pH-adjusted red radish anthocyanin-containing colorant in a colored sucrose-based syrup used for coating. In general, red hues are produced when lesser amounts of the yellow colorant are incorporated, and the hue of the coating progresses from red through orange-red, red-orange, orange, and yellow-orange as the amount of yellow colorant in the syrup is increased. Therefore, the specific red or orange hue obtained in the coating may be tailored as desired by adjusting the relative amounts of the pH-adjusted red radish anthocyanin-containing colorant and the yellow colorant in the syrup.

[0048] Accordingly, in one embodiment of the present application, a yellow colorant is included in the sucrose-based, hard panned coating along with the pH-adjusted red radish anthocyanin-containing colorant. In an embodiment, the yellow colorant is a natural colorant. The source of the natural yellow colorant is turmeric in some embodiments. For example, curcuminoids from turmeric may be used. The yellow colorant may take the form of a solid, e.g., a powder; a semi-solid, e.g., a paste; or a liquid, e.g., a solution or dispersion, and is preferably provided in a form that is soluble or dispersible in water and in a sucrose-based syrup.

[0049] The yellow colorant may be admixed with the red radish anthocyanin-containing colorant or an aqueous solution of the same or a pH-adjusted form of the same before being admixed with the sucrose-based syrup. In embodiments where the yellow colorant is admixed with the red radish anthocyanin-containing colorant prior to adjusting the pH of the latter in solution, the yellow colorant is subjected to the pH adjustment along with the red radish anthocyanin-containing colorant. Alternatively, the yellow colorant may be admixed directly with the syrup before, after, or at the same time as the red radish anthocyanin-containing colorant or an aqueous solution of the same or a pH-adjusted form of the same.

[0050] The pH-adjusted red radish anthocyanin-containing colorant and the yellow colorant, whether admixed with the sucrose-based syrup as an admixture or as separate components, together provide a complete coloring material for the syrup. That is, provision of the colorants as disclosed avoids the need to adjust the pH of

the bulk colored syrup to make it suitable for hard panning. As a result, the production of the sucrose-based, hard panned coating is streamlined.

[0051] The amount of the yellow colorant to be used in making the sucrose-based, hard panned coating is selected to yield the desired coloring effect. Suitable concentrations of the yellow colorant in a colored sucrose-based syrup used to prepare the coating can range from about 0.01 wt% to about 20 wt%, or from about 0.05 wt % to about 15 wt%, or from about 0.1 wt% to about 10 wt%. In embodiments where the colorant has low coloring power, the colorant may be used at concentrations from about 15 wt% to about 20 wt% of the syrup. In other embodiments where the colorant has a higher coloring power, the colorant may be used at concentrations from about 5 wt% up to less than about 15 wt% of the syrup. Where the colorant has an even higher coloring power, the colorant may be used at concentrations from about 0.01 wt% up to less than about 5 wt% of the syrup, or from about 0.01 wt% up to less than about 3 wt% of the syrup, or from about 0.01 wt% up to less than about 2 wt% of the syrup, or from about 0.01 wt% up to less than about 1.5 wt% of the syrup, or from about 0.01 wt% up to less than about 1 wt% of the syrup.

[0052] The weight ratio of red radish anthocyanin-containing colorant to yellow colorant included in a colored sucrose-based syrup may also be selected to provide the desired red or orange hue in the hard panned coating prepared with the syrup. The concentration and relative coloring power of each colorant are considered in determining an appropriate usage ratio for the two colorants. In some embodiments where a red hued coating is prepared, the weight ratio of red radish anthocyanin-containing colorant to yellow colorant is about 3:1 to about 5:1. In some embodiments where an orange hued coating is prepared, the weight ratio of red radish anthocyanin-containing colorant to yellow colorant is about 0.4:1 to about 2:1.

[0053] The sucrose-based, hard panned coating comprises sucrose from one or more sucrose-based syrups.

[0054] A base composition of sucrose solids and water makes up at least 90 percent by weight of a sucrose-based syrup. The base composition of a sucrose-based syrup may contain at least 60 wt% sucrose solids, or at least 65 wt% sucrose solids, or at least 70 wt% sucrose solids. The base composition of a syrup may contain less than

75 wt% sucrose solids, or less than 80 wt% sucrose solids. In some embodiments, the base composition of a syrup contains from 70 wt% to 80 wt% sucrose solids. The base composition of a sucrose-based syrup may be at least 60° Brix, or at least 65° Brix, or at least 70° Brix. The base composition of a syrup may be less than 75° Brix, or less than 80° Brix. In some embodiments, the base composition of a syrup is from 70° Brix to 80° Brix.

[0055] At least one sucrose-based syrup is admixed with a pH-adjusted red radish anthocyanin-containing colorant to provide a colored sucrose-based syrup. In some embodiments, at least one sucrose-based syrup is admixed with both a pH-adjusted red radish anthocyanin-containing colorant and a yellow colorant to provide a colored sucrose-based syrup.

[0056] Other sucrose-based syrups may comprise white or light-colored materials such as titanium dioxide and calcium carbonate as colorants, i.e., whiteners or lighteners, when producing a white or light-colored coating. However, these white or light-colored materials are considered to be non-colorant components when they are incorporated in still other sucrose-based syrups to serve as an opacifier in the coating.

[0057] A sucrose-based syrup may also optionally include other non-colorant components conventionally used in hard panned coatings. The total amount of non-colorant components will not exceed 10 percent by weight of the combined syrup base composition and non-colorant components. In some embodiments, the total amount of non-colorant components will not exceed 5 percent by weight, or 3 percent by weight, or 2 percent by weight, or 1 percent by weight, or 0.5 percent by weight of the combined syrup base composition and non-colorant components.

Many such components are known in the art and include, but are not limited to, polyols, natural polymers, stabilizers, flavors, sensates, emulsifiers, gums, vitamins, minerals, nutraceuticals, stabilizers, or combinations of these. For example, a gum such as gum arabic may be included in a sucrose-based syrup applied directly to the edible core to be coated to fill irregularities and provide a smoother surface for later applied sucrose-based syrups, to provide a substrate that improves adhesion of subsequent sucrose-based syrup layers, or to create a barrier to oil, moisture, etc. Gums may also be included in intermediate and/or outer sucrose-based syrup layers in order to plasticize the hardened coating.

[0058] In embodiments, the sucrose-based, hard panned coating comprises multiple sucrose-based syrup layers, and the pH-adjusted red radish anthocyanin-containing colorant is present in at least one of the sucrose-based syrup layers. In some of these embodiments, the sucrose-based, hard panned coating further comprises a yellow colorant, and the yellow colorant is present in one or more of the same sucrose-based syrup layers as the pH-adjusted red radish anthocyanin-containing colorant. In other embodiments of the multilayered coating further comprising the yellow colorant, the yellow colorant and the pH-adjusted red radish anthocyanin-containing colorant are in different layers.

[0059] Some of the multiple sucrose-based syrup layers may have the same syrup formulations, while other layers may have different formulations. For example, 3 to 30 layers of a colored sucrose-based syrup may form a portion of the coating, and 3 to 30 layers of an uncolored sucrose-based syrup may form another portion of the coating. Layers with the same syrup formulation may be next to each other or separated by layers with different formulations, and the order of the layers may vary through the multilayered coating. In one embodiment, the pH-adjusted red radish anthocyanin-containing colorant is present in at least the outermost sucrose-based syrup layer of the multilayered coating. In other embodiments, the pH-adjusted red radish anthocyanin-containing colorant is present in at least the outermost 5, or at least the outermost 10, or at least the outermost 15, or at least the outermost 20, or at least the outermost 30 sucrose-based syrup layers of the multilayered coating.

[0060] In embodiments, the total number of sucrose-based syrup layers (uncolored or colored) in the sucrose-based, hard panned coating is fewer than 50, or fewer than 40, or fewer than 30 layers. In some of these and other embodiments, the number of sucrose-based syrup layers in the coating is greater than 10, or greater than 15, or greater than 20 layers. The total number of sucrose-based syrup layers in the coating may suitably be from 10 to 50, or from 15 to 40, or from 20 to 30 layers.

[0061] Once hardened, the hard panned coating may be expected to have a thickness of no more than 3.0 mm, or no more than 2.5 mm, or no more than 2.0 mm, or no more than 1.5 mm, or no more than 1.0 mm. The hard panned coating may also have a thickness of greater than 0.1 mm or greater than 0.2 mm, or greater than 0.3 mm, or greater than 0.4 mm, or greater than 0.5 mm. In some embodiments, the hard panned coating may have a thickness of from 0.1 mm to 3.0

mm, or from 0.2 mm to 2.5 mm, or from 0.3 mm to 2.0 mm, or from 0.4 mm to 1.5 mm, or from 0.5 mm to 1.0 mm.

[0062] The sucrose-based, hard panned coating is substantially crystalline. In particular embodiments, at least 85% by volume of the coating is crystalline; or at least 87% by volume, or at least 89% by volume, or at least 91% by volume, or at least 93% by volume, or at least 95% by volume, or from 85% to 100% by volume, or from 87% to 100% by volume, or from 89% to 100% by volume, or from 91% to 100% by volume, or from 93% to 100% by volume, or from 95% to 100% by volume of the coating is crystalline.

[0063] The sucrose-based, hard panned coatings provided herein have a red or orange hue contributed at least in part by a pH-adjusted red radish anthocyanin-containing colorant. A yellow colorant also contributes components of the red or orange hue in some embodiments.

[0064] Colors characterized by the same hue may vary in both chroma (purity of color) and value (lightness or darkness). Therefore, colors of the same hue may be perceived differently by the eye and commonly described by different names. For example, two colors having the same red hue but different chroma and/or value may be perceived and described as red in one instance and as pink in the other instance. Similarly, two colors having the same hue falling somewhere between red and yellow may be perceived and described as orange in one instance and as tangerine in the other instance. On the other hand, two colors having different but relatively close hues may be perceived and described as being part of the same hue family, e.g., an apple red and a brick red. Therefore, it is to be understood that the terms, “red hue” and “orange hue,” do not signify single colors, but rather, are characteristics of a broad range of colors described by different names, but all having hues in the red and orange families.

[0065] The color property, hue, may be modeled and described in terms of an h° coordinate, or hue angle, h° , in the CIE 1976 CIELCH color model system. h° is specified as an angle from 0° to 360° moving counterclockwise around the L^* (value) axis. As defined by the model, pure red has a hue angle of 0° , pure yellow has a hue angle of 90° , pure green has a hue angle of 180° , and pure blue has a hue angle of 270° . Hue angles between any two of these anchor points represent a continuous spectrum of ‘blended’ hues between the two pure hues. Therefore, it is

possible to model and numerically describe hues in color space, including ‘blended’ hues such as orange that arise from the ‘blending’ of red and yellow.

[0066] In an embodiment, the red or orange hue of the sucrose-based, hard panned coating is described by a CIELCH color space h° coordinate, or hue angle, h° , of from about 15° to about 70° . In some embodiments, when a strong yellow component is not desired in an orange hue, the hue angle is in the range of from about 15° to about 60° . Another orange hued embodiment of the coating has a hue angle in the range of from about 40° to about 50° . In other embodiments where a red hue is desired, lower hue angles may not provide an added benefit, and the hue angle is in the range of from about 20° to about 70° . Another red hued embodiment of the coating has a hue angle in the range of from about 20° to about 30° . A hue angle in the range of from about 20° to about 60° may be desirable in still other embodiments of the red or orange hued coating.

[0067] In some embodiments, the chroma of the sucrose-based, hard panned coating is described by a CIELCH color space C^* coordinate of at least about 20, or at least about 22, or at least about 24, or at least about 26, or at least about 28, or at least about 30, or from about 20 to about 80.

[0068] In another embodiment, the color of the sucrose-based, hard panned coating has a ΔE color difference of 10 or less compared to the color of a sucrose-based, hard panned coating colored with the synthetic red colorant, FD&C Red No. 40. In some embodiments, the ΔE is 8 or less, or 6 or less, or as low as 4 or less.

[0069] In another embodiment disclosed herein, a hard panned confection comprises an edible core and a sucrose-based, hard panned coating, wherein the coating comprises sucrose and a pH-adjusted red radish anthocyanin-containing colorant. The coating is substantially crystalline and has a red or orange hue described by a CIELCH color space h° coordinate of from about 15° to about 70° .

[0070] The sucrose-based, hard panned coating of the hard panned confection may be provided according to any of the coating embodiments disclosed in the present application. The sucrose in the coating may be provided by one or more sucrose-based syrups used to prepare the coating. A red radish anthocyanin-containing colorant may be pH adjusted in aqueous solution to a pH of from about 4 to about 6, and the water content of the solution optionally reduced, to provide the pH-adjusted

red radish anthocyanin-containing colorant in the coating. The coating may further comprise a yellow colorant.

[0071] In some embodiments of the hard panned confection, the coating comprises multiple sucrose-based syrup layers, and the pH-adjusted red radish anthocyanin-containing colorant is present in at least one of the sucrose-based syrup layers. In some of these embodiments, the sucrose-based, hard panned coating further comprises a yellow colorant, and the yellow colorant is present in one or more of the same sucrose-based syrup layers as the pH-adjusted red radish anthocyanin-containing colorant. In other embodiments of the multilayered coating further comprising the yellow colorant, the yellow colorant and the pH-adjusted red radish anthocyanin-containing colorant are in different layers.

[0072] The red radish anthocyanin-containing colorant in the coating of the hard panned confection may be a natural colorant. In embodiments where the coating of the hard panned confection comprises a yellow colorant, the yellow colorant may be a natural colorant, and the source of such a natural yellow colorant may be turmeric. The coating of the hard panned confection may be free of synthetic red colorants, lycopene, β -carotene, carmine, and betalains and/or free of colorants capable of providing a red hue other than the red radish anthocyanin-containing colorant.

[0073] The coating of the hard panned confection is substantially crystalline. In particular embodiments of the hard panned confection, at least 85% by volume of the sucrose-based, hard panned coating is crystalline; or at least 87% by volume, or at least 89% by volume, or at least 91% by volume, or at least 93% by volume, or at least 95% by volume, or from 85% to 100% by volume, or from 87% to 100% by volume, or from 89% to 100% by volume, or from 91% to 100% by volume, or from 93% to 100% by volume, or from 95% to 100% by volume of the coating is crystalline.

[0074] In some embodiments, the sucrose-based, hard panned coating of the hard panned confection has a red or orange hue described by a CIELCH color space h° coordinate of from about 15° to about 70° . In other embodiments, the chroma of the coating is described by a CIELCH color space C^* coordinate of at least 20. In these and other embodiments, the color of the coating may have a ΔE color difference of 10 or less compared to the color of a sucrose-based, hard panned coating colored with the synthetic red colorant, FD&C Red No. 40.

[0075] In some embodiments of the hard panned confection, sucrose-based syrups may be applied as coating layers directly to the surface of the edible core to form the sucrose-based, hard panned coating. In other embodiments, sucrose-based syrups may be applied as coating layers to a prepared surface of the edible core, wherein the surface has been prepared according to a known technique including, but not limited to, gumming, isolating, and stabilizing. In still other embodiments, sucrose-based syrups may be applied as coating layers to a crystallized sucrose-based syrup layer overlying any number of coating layers overlying the edible core. As the phrase that follows in quotation marks is used herein, the application of a sucrose-based syrup as a coating layer “to an edible core” does not necessarily denote that the sucrose-based syrup is applied directly to the edible core. Rather, a sucrose-based syrup that is applied as a coating layer “to an edible core” may be applied directly to the surface of the edible core, or to a prepared surface of an edible core, or to a crystallized sucrose-based syrup layer overlying any number of coating layers overlying the edible core, within the meaning of the phrase.

[0076] The sucrose-based syrup layers may be applied to any desired edible core. In some embodiments, the edible core may comprise a natural center, such as a nut, groundnut, nut meat, nut paste, dried fruit piece, or dried fruit paste. Or, the edible core may comprise a confection, such as a boiled sugar syrup, caramel, nougat, taffy, toffee, fondant, chocolate, confectionery coating, or combinations of these. Alternatively, the edible core may comprise a grain-based item, such as a cookie, pretzel, biscuit, wafer, cracker, or other baked, crisped, or puffed material. In some embodiments, the edible core may comprise a natural center, confection, or grain-based item which is then coated with a confection.

[0077] In an embodiment of the hard panned confection, the sucrose-based, hard panned coating substantially surrounds the edible core. That is, although a pinhole, crack, or chip may exist in the coating, the coating traverses the entire outer surface of the core.

[0078] In yet another embodiment of the present application, a method of hard pan coating an edible core is disclosed.

[0079] The method comprises:

- (a) admixing a red radish anthocyanin-containing colorant with water to form an aqueous colorant solution;

- (b) adjusting the pH of the aqueous colorant solution to from about 4 to about 6, and, optionally, reducing the water content of the solution to form a pH-adjusted colorant;
- (c) admixing the pH-adjusted colorant with a sucrose-based syrup to form a colored sucrose-based syrup;
- (d) admixing a yellow colorant with one or more constituents and admixtures of steps (a), (b), and (c) such that the yellow colorant is incorporated into the colored sucrose-based syrup; and
- (e) applying the colored sucrose-based syrup to an edible core to provide at least one layer of a hard panned coating.

[0080] For performing the method, the red radish anthocyanin-containing colorant, yellow colorant, sucrose-based syrup, and edible core may be provided according to any of the embodiments disclosed in the present application.

[0081] In embodiments, the mixing steps of the method may be performed using conventional food processing techniques and equipment, e.g., mixing powders into fluids in a 316 stainless steel vessel with an agitator.

[0082] The water used to prepare the aqueous colorant solution of step (a) and the sucrose-based syrup is desirably reduced in ion content or deionized in some embodiments. Water is admixed with the red radish anthocyanin-containing colorant in an amount sufficient to dissolve or disperse the colorant. A suitable amount of water may be a volume in milliliters that is twice the numerical mass in grams of the colorant, e.g., 30 ml water with 15 g colorant. In an embodiment, the aqueous colorant solution is prepared under ambient conditions without heating the constituent materials.

[0083] The pH of the aqueous colorant solution is adjusted to from about 4 to about 6 to create a pH-adjusted red radish anthocyanin-containing colorant in the form of an aqueous solution. In some embodiments, the pH of the aqueous colorant solution is adjusted to from about 4.25 to about 6, or from about 4.5 to about 6, or from about 4.75 to about 6, or from about 5 to about 6. In other embodiments, a food-grade pH adjusting agent is admixed with the aqueous colorant solution in an amount necessary to adjust the pH of the solution to from about 4 to about 6. The pH adjusting agent may be provided in any water-soluble form, e.g., as solid particles or in aqueous solution. If the pH adjusting agent is provided in aqueous solution, the

water of solution is desirably reduced in ion content or deionized in some embodiments. In one embodiment, the pH adjustment is performed under ambient conditions without heating the constituent materials.

[0084] The food-grade pH adjusting agent, in an embodiment, is a strong base which substantially dissociates in water; that is, the percent dissociation of the agent in water is at least about 95%, or at least about 96%, or at least about 97%, or at least about 98%, or at least about 99%, or from about 95% to about 99.99%, or from about 98% to about 99.99%. The strong base does not act as a buffer, but substantially dissociates and adjusts the pH of the aqueous colorant solution. In some embodiments, the pH adjusting agent which is a strong base is admixed with the aqueous colorant solution in an amount of from about 0.5 wt% to about 10 wt%, where the weight percentage of the agent is by weight of the red radish anthocyanin-containing colorant. In other embodiments, the amount of the pH adjusting agent is from about 0.5 wt% to about 8 wt%, or from about 0.5 wt% to about 6 wt%, or from about 0.5 wt% to about 5 wt%, or from about 1 wt% to about 6 wt%, or from about 2 wt% to about 5 wt%, where the weight percentage of the agent is by weight of the colorant.

[0085] The strong bases, sodium hydroxide and potassium hydroxide, are preferred food-grade pH adjusting agents, in particular embodiments, because of their ability to adjust the pH of the aqueous colorant solution without contributing noticeable odor or flavor and without interacting with the colorant in a way that shifts hue away from the intended target. In a preferred embodiment, the food-grade pH adjusting agent is sodium hydroxide.

[0086] In some embodiments, the water content of the prepared aqueous colorant solution, after pH adjustment of the solution, may optionally be reduced by any suitable process, such as a drying process or a separations process, to create the pH-adjusted red radish anthocyanin-containing colorant in the form of a semi-solid or solid.

[0087] The yellow colorant, in embodiments of step (d), may be admixed with one or more constituents and admixtures of steps (a), (b), and (c), including the red radish anthocyanin-containing colorant, the water of solution for the colorant, the aqueous colorant solution, the pH-adjusted colorant, the sucrose-based syrup, and

the colored sucrose-based syrup, as a means for incorporating the yellow colorant into the colored sucrose-based syrup.

[0088] In one embodiment, the yellow colorant is admixed with the red radish anthocyanin-containing colorant, the water of solution for the colorant, the aqueous colorant solution, or the pH-adjusted colorant before the pH-adjusted colorant is admixed with the sucrose-based syrup. In another embodiment, the yellow colorant is admixed with the sucrose-based syrup before, after, or at the same time as admixing the pH-adjusted colorant with the sucrose-based syrup.

[0089] The pH-adjusted red radish anthocyanin-containing colorant and the yellow colorant, whether admixed with the sucrose-based syrup as an admixture or as separate components according to steps (c) and (d), together provide a complete coloring material for the syrup. That is, provision of the colorants according to the disclosed method avoids the need to adjust the pH of the bulk colored syrup to make it suitable for hard panning. As a result, the overall hard pan coating method is streamlined.

[0090] In an embodiment, the pH-adjusted red radish anthocyanin-containing colorant and the yellow colorant are admixed with the sucrose-based syrup when the syrup is at a temperature in the range from about 65°C to about 85°C, or from about 67°C to about 83°C, or from about 70°C to about 80°C, or from about 74°C to about 82°C.

[0091] In some embodiments, the red radish anthocyanin-containing colorant is incorporated into the colored sucrose-based syrup in an amount of from about 0.01 wt% up to less than about 5 wt% of the colored sucrose-based syrup. In these and other embodiments, the yellow colorant is incorporated into the colored sucrose-based syrup in an amount of from about 0.01 wt% up to less than about 5 wt% of the colored sucrose-based syrup.

[0092] The colored sucrose-based syrup is applied to the desired edible core to provide at least one layer of the hard panned coating according to conventional hard pan coating, or hard panning, processes known in the art, in some embodiments. Generally speaking, in a hard panning process, multiple applications of one or more highly concentrated sugar syrups are used to build up a sugar coating on an edible product core. Some of the highly concentrated sugar syrups may contain one or more colorants, while others may not. In embodiments, the hard panning process

comprises the repetitive application of thin layers of the coating materials onto an intermixed mass of centers, while mixing the mass of centers, and the drying of each layer of coating material, during which the sugar in the coating material crystallizes between the applications of layers. The successive phases of coating material application and drying are carried out, for example, in a rotating pan, drum, or similar apparatus, and the process is tailored to give a finished coating with the desired thickness, surface appearance, opacity, and organoleptic and other properties. Such processes are described, for example, in “Sugar Confectionery and Chocolate Manufacture, R. Lees and E.B. Jackson, Chemical Publishing Company, February 7, 1975, and “Industrial Chocolate Manufacture and Use,” editor, S.T. Beckett, Blackie & Son Ltd., Glasgow, 1988, each hereby incorporated herein by reference in its entirety for any and all purposes. Hard panning is distinguished herein from a soft panning process, at least in part because the hard panning process does not include applying particulate solids such as crystalline sugar to the syrup-wetted centers to dry the coating. In other embodiments, the colored sucrose-based syrup is applied to the edible core according to a non-conventional hard pan coating, or hard panning, process that substantially replicates the properties of a conventionally hard panned coating.

[0093] In some embodiments, the method of hard pan coating the edible core further comprises applying the colored sucrose-based syrup to the edible core to provide multiple layers of a hard panned coating. Whether applying one or multiple layers to the core, the colored sucrose-based syrup may be applied at a temperature in the range from about 65°C to about 85°C, or from about 67°C to about 83°C, or from about 70°C to about 80°C, or from about 74°C to about 82°C.

[0094] The method of hard pan coating the edible core may further comprise crystallizing the colored sucrose-based syrup after it is applied such that the at least one layer of the hard panned coating is substantially crystalline. In some embodiments, at least 85% by volume of the at least one layer of the hard panned coating is crystalline; or at least 87% by volume, or at least 89% by volume, or at least 91% by volume, or at least 93% by volume, or at least 95% by volume, or from 85% to 100% by volume, or from 87% to 100% by volume, or from 89% to 100% by volume, or from 91% to 100% by volume, or from 93% to 100% by volume, or from 95% to 100% by volume of the at least one layer of the hard panned coating is

crystalline. In an embodiment, the colored sucrose-based syrup is crystallized by subjecting it to conditions which promote a phase change of the sucrose. For example, the syrup-coated cores may be tumbled and mixed in a rotating pan to promote crystallization.

[0095] In some embodiments, the method of hard pan coating the edible core further comprises at least partially drying the colored sucrose-based syrup after it is applied. In other embodiments, the colored sucrose-based syrup is applied to a prepared surface of the edible core.

[0096] Specific embodiments will now be demonstrated by reference to the following examples. It should be understood that the examples are disclosed solely for the purpose of illustration, and variations to these embodiments are anticipated.

EXAMPLE 1

Hard Panned Confections Colored Red with a Natural Red Radish Anthocyanin-Containing Colorant and a Natural Yellow Colorant

[0097] Sucrose-based coatings were applied to lentil-shaped chocolate centers by a hard panning process. A 74° Brix base sucrose syrup was prepared with deionized water. A first coating syrup was prepared with the base sucrose syrup and 2.5 wt% titanium dioxide added as an opacifier. An aqueous solution of a natural red radish anthocyanin-containing colorant ("NRRA-1") was prepared by dissolving 8 grams of a natural red radish anthocyanin-containing powder (San Red ADF-EX, San-Ei Gen F.F.I. (USA), Inc., New York, NY) in 16 ml of deionized water and adjusting to a pH of 5 with 2 M NaOH. A second coating syrup was prepared with the base sucrose syrup and the pH-adjusted, aqueous solution of natural red radish anthocyanin-containing colorant added so that the natural red radish anthocyanin-containing powder was incorporated in the syrup at 0.4 wt%. A natural yellow colorant powder (CH Cap Colors Turmeric WSS-P-500, Chr. Hansen, Inc., Milwaukee, WI) was then mixed into the second coating syrup at 0.1 wt%. The first coating syrup containing titanium dioxide was applied to the centers and dried in 5 layers. The colored second coating syrup was then applied to the centers and dried in 17 layers. The colored centers were finished with a coating of a polishing gum followed by a wax.

[0098] The above process was repeated with an alternative second coating syrup prepared with 0.25 wt% of the same natural yellow colorant powder and 0.8 wt% of an alternative natural red radish anthocyanin-containing powder (CH Red Radish, Chr. Hansen, Inc., Milwaukee, WI). The alternative natural red radish anthocyanin-containing powder was provided to the alternative second coating syrup in an aqueous solution of 16 grams of powder in 32 ml of deionized water, adjusted to a pH of 5 with 2 M NaOH (solution “NRRA-2”). The process was again repeated with another alternative second coating syrup prepared with the base sucrose syrup and the synthetic red colorant, FD&C Red No. 40. The first coating syrup and finishing coats were the same for the second and third trials as for the first trial.

[0099] Color measurements were performed and $L^*a^*b^*C^*h^\circ$ values calculated and averaged for 10 confectionery pieces from each trial, as shown in Table 1:

TABLE 1

Sample Name	L^*	a^*	b^*	C^*	h°	ΔE compared to sample with synthetic FD&C Red No. 40
NRRA-1 and Natural Yellow Colorant	49.98	31.02	12.83	33.57	22.47	20.28
NRRA-2 and Natural Yellow Colorant	39.06	38.77	16.55	42.16	23.12	7.51
Synthetic FD&C Red No. 40	37.09	44.05	21.52	49.03	26.04	---

[00100] Table 1 shows ΔE color difference values for the natural colorant trial samples compared to the synthetic colorant trial sample. All three samples had a red hue. The NRRA-2 red radish anthocyanin-containing colorant produced a closer red hue to that provided by the synthetic colorant than the NRRA-1 red radish anthocyanin-containing colorant, as indicated by the lower ΔE value of 7.51.

EXAMPLE 2

Hard Panned Confections Colored Orange with a Natural Red Radish Anthocyanin-Containing Colorant and a Natural Yellow Colorant

[00101] Sucrose-based coatings were applied to lentil-shaped chocolate centers by a hard panning process. A 74° Brix base sucrose syrup was prepared with deionized water. A first coating syrup was prepared with the base sucrose syrup and 2.5 wt% titanium dioxide added as an opacifier. An aqueous solution of a natural red radish anthocyanin-containing colorant ("NRRA-3") was prepared by dissolving 4 grams of a natural red radish anthocyanin-containing powder (San Red ADF-EX, San-Ei Gen F.F.I. (USA), Inc., New York, NY) in 8 ml of deionized water and adjusting to a pH of 5 with 2 M NaOH. A second coating syrup was prepared with the base sucrose syrup and the pH-adjusted, aqueous solution of natural red radish anthocyanin-containing colorant added so that the natural red radish anthocyanin-containing powder was incorporated in the syrup at 0.2 wt%. A natural yellow colorant powder (CH Cap Colors Turmeric WSS-P-500, Chr. Hansen, Inc., Milwaukee, WI) was then mixed into the second coating syrup at 0.2 wt%. The first coating syrup containing titanium dioxide was applied to the centers and dried in 5 layers. The colored second coating syrup was then applied to the centers and dried in 17 layers. The colored centers were finished with a coating of a polishing gum followed by a wax.

[00102] The above process was repeated with an alternative second coating syrup prepared with 0.4 wt% of the same natural yellow colorant powder and 0.175 wt% of an alternative natural red radish anthocyanin-containing powder (CH Red Radish, Chr. Hansen, Inc., Milwaukee, WI). The alternative natural red radish anthocyanin-containing powder was provided to the alternative second coating syrup in an aqueous solution of 3.5 grams of powder in 7 ml of deionized water, adjusted to a pH of 5 with 2 M NaOH (solution "NRRA-4"). The process was again repeated with another alternative second coating syrup prepared with the base sucrose syrup and a mixture of synthetic FD&C colorants selected to produce a vivid orange hue. The first coating syrup and finishing coats were the same for the second and third trials as for the first trial.

[00103] Color measurements were performed and $L^*a^*b^*C^*h^\circ$ values calculated and averaged for 10 confectionery pieces from each trial, as shown in Table 2:

TABLE 2

Sample Name	L^*	a^*	b^*	C^*	h°	ΔE compared to sample with synthetic FD&C colorant mixture
NRRA-3 and Natural Yellow Colorant	58.52	24.09	32.79	40.69	53.70	33.21
NRRA-4 and Natural Yellow Colorant	59.09	28.86	43.08	51.85	56.18	24.31
Synthetic FD&C Colorant Mixture	58.81	51.82	51.06	72.75	44.58	---

[00104] Table 2 shows ΔE color difference values for the natural colorant trial samples compared to the synthetic colorant trial sample. All three samples had an orange hue. The NRRA-4 red radish anthocyanin-containing colorant produced a closer orange hue to that provided by the synthetic colorant than the NRRA-3 red radish anthocyanin-containing colorant, as indicated by the lower ΔE value of 24.31.

EXAMPLE 3

Hard Panned Confection Colored with a Natural Red Radish Anthocyanin-Containing Colorant Adjusted to pH 9

[00105] A sucrose-based coating was applied to lentil-shaped chocolate centers by a hard panning process. A 74° Brix base sucrose syrup was prepared with deionized water. A first coating syrup was prepared with the base sucrose syrup and 2.5 wt% titanium dioxide added as an opacifier. An aqueous solution of a natural red radish anthocyanin-containing colorant ("NRRA-5") was prepared by dissolving 14 grams of a natural red radish anthocyanin-containing powder (San Red AD-DS, San-Ei Gen F.F.I. (USA), Inc., New York, NY) in 28 ml of deionized water and adjusting to a pH of 9 with 2 M NaOH. A second coating syrup was prepared with the base sucrose syrup and the pH-adjusted, aqueous solution of natural red radish

anthocyanin-containing colorant added so that the natural red radish anthocyanin-containing powder was incorporated in the syrup at 0.7 wt%. The first coating syrup containing titanium dioxide was applied to the centers and dried in 5 layers. The colored second coating syrup was then applied to the centers and dried in 17 layers. The colored centers were finished with a coating of a polishing gum followed by a wax.

[00106] Color measurements were performed and $L^*a^*b^*C^*h^\circ$ values calculated and averaged for 10 confectionery pieces from the trial, as shown in Table 3:

TABLE 3

Sample Name	L^*	a^*	b^*	C^*	h°
NRRA-5 (pH 9)	31.72	8.09	-8.96	12.07	312.08

[00107] Table 3 shows that the NRRA-5 red radish anthocyanin-containing colorant adjusted to a pH of 9 provided a violet hue to the trial sample.

[00108] Other variations and modifications of the embodiments will be obvious to those skilled in this art. The scope of protection is not to be limited except as set forth in the following claims.

CLAIMS:

1. A method of hard pan coating an edible core comprising:
 - (a) admixing a red radish anthocyanin-containing colorant with water to form an aqueous colorant solution;
 - (b) adjusting the pH of the aqueous colorant solution to from about 4 to about 6, and, optionally, reducing the water content of the solution to form a pH-adjusted colorant;
 - (c) admixing the pH-adjusted colorant with a sucrose-based syrup to form a colored sucrose-based syrup;
 - (d) admixing a yellow colorant with one or more constituents and admixtures of steps (a), (b), and (c) such that the yellow colorant is incorporated into the colored sucrose-based syrup; and
 - (e) applying the colored sucrose-based syrup to an edible core to provide at least one layer of a hard panned coating.
2. The method of claim 1, wherein the red radish anthocyanin-containing colorant is incorporated into the colored sucrose-based syrup in an amount of from about 0.01 wt% up to less than about 5 wt% of the colored sucrose-based syrup.
3. The method of claim 1, wherein the yellow colorant is admixed with the red radish anthocyanin-containing colorant, the water of solution for the colorant, the aqueous colorant solution, or the pH-adjusted colorant before the pH-adjusted colorant is admixed with the sucrose-based syrup.
4. The method of claim 1, wherein the yellow colorant is admixed with the sucrose-based syrup before, after, or at the same time as admixing the pH-adjusted colorant with the sucrose-based syrup.
5. The method of claim 3 or 4, wherein the yellow colorant is incorporated into the colored sucrose-based syrup in an amount of from about 0.01 wt% up to less than about 5 wt% of the colored sucrose-based syrup.
6. The method of claim 1, wherein the pH of the aqueous colorant solution is adjusted by admixing a food-grade pH adjusting agent with the solution.
7. The method of claim 1, further comprising crystallizing the colored sucrose-based syrup after it is applied such that the at least one layer of the hard panned coating is substantially crystalline.

8. The method of claim 1, further comprising applying the colored sucrose-based syrup to the edible core to provide multiple layers of a hard panned coating.
9. A sucrose-based, hard panned coating comprising sucrose and a pH-adjusted red radish anthocyanin-containing colorant, wherein the coating is substantially crystalline and has a red or orange hue described by a CIELCH color space h° coordinate of from about 15° to about 70° .
10. The sucrose-based, hard panned coating of claim 9, wherein a red radish anthocyanin-containing colorant is pH-adjusted in aqueous solution to a pH of from about 4 to about 6 and the water content of the solution is optionally reduced to provide the pH-adjusted red radish anthocyanin-containing colorant.
11. The sucrose-based, hard panned coating of claim 9, wherein at least 85% by volume of the coating is crystalline.
12. The sucrose-based, hard panned coating of claim 9, wherein the coating comprises multiple sucrose-based syrup layers, and the pH-adjusted red radish anthocyanin-containing colorant is present in at least one of the sucrose-based syrup layers.
13. The sucrose-based, hard panned coating of claim 9 or 12, further comprising a yellow colorant.
14. The sucrose-based, hard panned coating of claim 12, wherein the coating further comprises a yellow colorant, and the yellow colorant is present in one or more of the same sucrose-based syrup layers as the pH-adjusted red radish anthocyanin-containing colorant.
15. The sucrose-based, hard panned coating of claim 9, wherein the chroma of the coating is described by a CIELCH color space C^* coordinate of at least about 20.
16. The sucrose-based, hard panned coating of claim 9, wherein the color of the coating has a ΔE color difference of 10 or less compared to the color of a sucrose-based, hard panned coating colored with the synthetic red colorant, FD&C Red No. 40.
17. A hard panned confection comprising an edible core and the sucrose-based, hard panned coating of claim 9, 12, or 14.
18. The hard panned confection of claim 17, wherein a red radish anthocyanin-containing colorant is pH-adjusted in aqueous solution to a pH of from about 4 to about 6 and the water content of the solution is optionally reduced to provide the pH-adjusted red radish anthocyanin-containing colorant in the coating.

19. The hard panned confection of claim 17, wherein at least 85% by volume of the coating is crystalline.
20. The hard panned confection of claim 17, wherein the coating substantially surrounds the edible core.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2014/049020

A. CLASSIFICATION OF SUBJECT MATTER

*A23G 3/32 (2006.01)**A23L 1/27 (2006.01)**A23G 3/42 (2006.01)*

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)

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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)

Esp@cenet, PAJ, EAPATIS, RUPAT, USPTO, PatSearch (RUPTO internal), KIPRIS, CNPAT, WIPO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2011/065977 A1 (SENSIENT COLORS INC. et al) 03.06.2011, paragraphs [0029], [0031], [0032], [0036]-[0038], [0052], [0053], [0056], [0057], [0058], claims	1-20
Y	US 2005/0181101 A1 (KOICHI HARADA et al) 18.08.2005, claims, example 1	1-20
A	KHARLAMOVA O. A. et al. «Naturalnye pischevye krasiteli», M., «Pischevaya promyshlennost» , 1979, s.17, paragraph 3	1-20
A	BOLOTOV V. M. et al. «Pischevye krasiteli : klassifikatsiya, svoistva, analiz, primeneniye», Sankt-Peterburg, GIORD, 2008, s.125-126	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:		"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
"A" document defining the general state of the art which is not considered to be of particular relevance		"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
"E" earlier document but published on or after the international filing date		"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
"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)		"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
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权利要求书2页 说明书16页

(54) 发明名称

含花青素苷的橙色和红色着色剂

(57) 摘要

本申请涉及一种对可食用夹心进行硬抛光涂布的方法、一种蔗糖基硬质抛光包衣和一种包括涂布有该包衣的可食用夹心的硬质抛光糖食。该蔗糖基硬质抛光包衣包括蔗糖和经 pH 调节的含花青素苷的红萝卜着色剂,基本上是结晶态的,且具有由 CIELCH 颜色空间 h° 坐标描述为约 15° 至约 70° 的红色色调或橙色色调。在一些实施方案中,该包衣进一步包括黄色着色剂。这些着色剂理想地是天然来源的,以对用于为硬质抛光糖食包衣着色红色色调或橙色色调的合成着色剂提供替代方式。

1. 一种对可食用夹心进行硬抛光涂布的方法,所述方法包括:
 - (a)将含花青素苷的红萝卜着色剂与水混合以形成着色剂水性溶液;
 - (b)将该着色剂水性溶液的pH调节到约4至约6,且任选地降低该溶液的水含量以形成经pH调节的着色剂;
 - (c)将该经pH调节的着色剂与蔗糖基糖浆混合以形成着色的蔗糖基糖浆;
 - (d)将黄色着色剂与步骤(a)、步骤(b)和步骤(c)的一种或多种成分和混合物混合,使得该黄色着色剂被加入到该着色的蔗糖基糖浆中;和
 - (e)将该着色的蔗糖基糖浆施用到可食用夹心上以提供至少一层硬质抛光包衣。
2. 根据权利要求1所述的方法,其特征在于,其中将该含花青素苷的红萝卜着色剂以该着色的蔗糖基糖浆的约0.01wt%直到小于约5wt%的量加入到该着色的蔗糖基糖浆中。
3. 根据权利要求1所述的方法,其特征在于,其中将该黄色着色剂与该含花青素苷的红萝卜着色剂、该着色剂溶液的水、该着色剂水性溶液或经pH调节的着色剂混合,该混合在将该pH调节的着色剂与该蔗糖基糖浆混合之前进行。
4. 根据权利要求1所述的方法,其特征在于,其中该黄色着色剂与该蔗糖基糖浆混合,该混合在将经pH调节的着色剂与该蔗糖基糖浆混合之前、之后或同时进行。
5. 根据权利要求3或4所述的方法,其特征在于,其中将该黄色着色剂以该着色的蔗糖基糖浆的约0.01wt%直到小于约5wt%的量加入到该着色的蔗糖基糖浆中。
6. 根据权利要求1所述的方法,其特征在于,其中通过将食品级pH调节剂与该溶液混合而调节该着色剂水性溶液的pH。
7. 根据权利要求1所述的方法,其特征在于,所述方法进一步包括在施用着色的蔗糖基糖浆之后使其结晶,使得该硬质抛光包衣的至少一层基本上是结晶态的。
8. 根据权利要求1所述的方法,其特征在于,所述方法进一步包括将该着色的蔗糖基糖浆施用到该可食用夹心上以提供多层硬质抛光包衣。
9. 一种蔗糖基硬质抛光包衣,所述包衣包括蔗糖和经pH调节的含花青素苷的红萝卜着色剂,其中该包衣基本上是结晶态的,且具有由CIELCH颜色空间 h° 坐标描述为约 15° 至约 70° 的红色色调或橙色色调。
10. 根据权利要求9所述的蔗糖基硬质抛光包衣,其特征在于,其中该含花青素苷的红萝卜着色剂在水性溶液中被pH调节到约4至约6的pH,且任选地降低该溶液的水含量以提供该经pH调节的含花青素苷的红萝卜着色剂。
11. 根据权利要求9所述的蔗糖基硬质抛光包衣,其特征在于,其中该包衣的按体积计至少85%是结晶态的。
12. 根据权利要求9所述的蔗糖基硬质抛光包衣,其特征在于,其中该包衣包括多个蔗糖基糖浆层,且该经pH调节的含花青素苷的红萝卜着色剂存在于至少一个该蔗糖基糖浆层中。
13. 根据权利要求9或12所述的蔗糖基硬质抛光包衣,其特征在于,所述包衣进一步包括黄色着色剂。
14. 根据权利要求12所述的蔗糖基硬质抛光包衣,其特征在于,其中该包衣进一步包括黄色着色剂,且该黄色着色剂存在于与该经pH调节的含花青素苷的红萝卜着色剂相同的一个或多个该蔗糖基糖浆层中。

15. 根据权利要求9所述的蔗糖基硬质抛光包衣, 其特征在于, 其中该包衣的色度被CIELCH颜色空间C*坐标描述为至少约20。

16. 根据权利要求9所述的蔗糖基硬质抛光包衣, 其特征在于, 其中与用合成红色着色剂药品和化妆品法案红40号着色的蔗糖基硬质抛光包衣的颜色相比, 该包衣的颜色具有10或更小的 ΔE 色差。

17. 一种硬质抛光糖食, 所述硬质抛光糖食包括可食用夹心和根据权利要求9、12或14所述的蔗糖基硬质抛光包衣。

18. 根据权利要求17所述的硬质抛光糖食, 其特征在于, 其中该含花青素苷的红萝卜着色剂在水性溶液中被pH调节到约4至约6的pH, 且任选地降低该溶液的水含量以在该包衣中提供该经pH调节的含花青素苷的红萝卜着色剂。

19. 根据权利要求17所述的硬质抛光糖食, 其特征在于, 其中该包衣的按体积计至少85%是结晶态的。

20. 根据权利要求17所述的硬质抛光糖食, 其特征在于, 其中该包衣基本上包围该可食用夹心。

含花青素苷的橙色和红色着色剂

技术领域

[0001] 本申请涉及一种硬质抛光包衣、一种涂有该包衣的硬质抛光糖食以及一种用该包衣对可食用夹心(core)进行硬抛光涂布的方法。

背景技术

[0002] 消费者喜爱的糖食产品包括具有通过硬抛光方法涂布蔗糖基包衣的糖食或其他可食用夹心(center)的产品。

[0003] 已知,食品的颜色能够向消费者传递很多不同的产品属性,例如良好的味道、质量、新鲜度,甚至是有兴趣的感觉。因为该包衣是消费者看到的硬质抛光糖食的第一组分,所以理想的是在该包衣中使用着色剂传递所需的产品属性。

[0004] 然而,在包衣中使用着色剂时,在传递其他包衣属性(例如目标质地、味道和对环境因素的稳定性)的同时提供所需的色调通常在技术上是具有挑战性的。因此,同时呈现所需的色调和其他目标属性的包衣能够扩展能被消费者喜爱的硬质抛光糖食的多样性。

发明内容

[0005] 本申请涉及一种蔗糖基硬质抛光包衣,其包括蔗糖和经pH调节的含花青素苷的红萝卜着色剂,其中该包衣基本上是结晶态的,且具有由CIELCH颜色空间 h° 坐标描述为约 15° 至约 70° 的红色色调或橙色色调。在一种实施方案中,该含花青素苷的红萝卜着色剂在水性溶液中经pH调节到约4至约6的pH,且任选地降低该溶液的水含量以提供该经pH调节的含花青素苷的红萝卜着色剂。在另一实施方案中,该包衣进一步包括黄色着色剂。

[0006] 在一个实施方案中,该蔗糖基硬质抛光包衣包括多个蔗糖基糖浆层,且该经pH调节的含花青素苷的红萝卜着色剂存在于至少一个该蔗糖基糖浆层中。在该实施方案中,该包衣可以进一步包括黄色着色剂。在进一步包括黄色着色剂的多层包衣的一些实施方案中,该黄色着色剂存在于与该经pH调节的含花青素苷的红萝卜着色剂相同的一个或多个该蔗糖基糖浆层中。

[0007] 在一些实施方案中,与用合成红色着色剂药品和化妆品法案红40号(FD&C Red No. 40)着色的蔗糖基硬质抛光包衣的颜色相比,该蔗糖基硬质抛光包衣的颜色具有10或更小的 ΔE 色差。

[0008] 本申请还涉及一种硬质抛光糖食,其包括可食用夹心和蔗糖基硬质抛光包衣,该包衣包括蔗糖和经pH调节的含花青素苷的红萝卜着色剂,其中该包衣基本上是结晶态的,且具有由CIELCH颜色空间 h° 坐标描述为约 15° 至约 70° 的红色色调或橙色色调。本文公开的蔗糖基硬质抛光包衣的任何实施方案都可以用作该硬质抛光糖食的包衣。在实施方案中,该包衣基本上包围该可食用夹心。

[0009] 在另一方面,本申请涉及一种对可食用夹心进行硬抛光涂布的方法。该方法包括:(a)将含花青素苷的红萝卜着色剂与水混合以形成着色剂水性溶液;(b)将该着色剂水性溶液的pH调节到约4至约6,且任选地降低该溶液的水含量以形成经pH调节的着色剂;(c)将该

经pH调节的着色剂与蔗糖基糖浆混合以形成着色的蔗糖基糖浆;(d)将黄色着色剂与步骤(a)、步骤(b)和步骤(c)的一种或多种成分和混合物混合,使得该黄色着色剂被加入到该着色的蔗糖基糖浆;和(e)将该着色的蔗糖基糖浆施用到可食用夹心以提供至少一层硬质抛光包衣。在一些实施方案中,通过将食品级pH调节剂与该溶液混合来调节该着色剂水性溶液的pH。

[0010] 在一个实施方案中,该硬抛光涂布的方法可以进一步包括在该着色的蔗糖基糖浆施用之后使其结晶,使得该硬质抛光包衣的至少一层基本上是结晶态的。在另一实施方案中,该方法可以进一步包括将该着色的蔗糖基糖浆施用到该可食用夹心以提供多层硬质抛光包衣。

具体实施方式

[0011] 定义

[0012] 本说明书提供了与所公开的组合物和方法相关的一些定义。对特定的术语或短语提供或不提供定义并不意味着隐含着其具有或不具有任何特别的重要性。而是除非另外指明,术语应当依照相关领域普通技术人员的常规用法进行理解。

[0013] 在整个说明书中提及“一个实施方案”或“一种实施方案”表示与实施方案相关描述的具体的特点、结构或特征包括在至少一个实施方案中。因此,在整个说明书中很多地方出现的表述“在一个实施方案中”或“在一种实施方案中”不一定是指同一个实施方式。此外,该具体的特点、结构或特征可以以任何适合的方式组合在一个或多个实施方案中。

[0014] 本申请考虑了省略本文所列的任何组分或步骤的可能性。本申请进一步考虑了任何组分或步骤的省略,即使它们没有被明确作为该说明书中包括或排除的组分或步骤。

[0015] 本文所用的“包括(comprising)”和“包括(comprises)”表示存在特点、步骤或组分,而不排除可能也存在其他的特点、步骤或组分。

[0016] 本文所用的“蔗糖基糖浆”表示包括至少90重量百分比(wt%)的基础组合物的糖浆,该基础组合物具有约60wt%至约80wt%的蔗糖固体和约40wt%至约20wt%(即剩余部分)的水;且该糖浆任选地包括总量不超过该结合的基础组合物和非着色剂组分重量的10%的非着色剂组分。在一些实施方案中,蔗糖可以是该蔗糖基糖浆中唯一的碳水化合物,或者蔗糖可以是该蔗糖基糖浆中唯一的可结晶的碳水化合物。当其在包衣中用作遮光剂时,非着色剂组分包括白色或浅色物质,例如二氧化钛和碳酸钙。可以将一种或多种着色剂与该蔗糖基糖浆进行组合以制备“着色的蔗糖基糖浆”。在使用其制备白色或浅色包衣时,着色剂可以包括白色或浅色物质,例如二氧化钛和碳酸钙。

[0017] “蔗糖基硬质抛光包衣”是通过硬抛光方法用一种或多种蔗糖基糖浆制备的包衣,添加或不添加一种或多种着色剂。常规硬抛光包括在转盘、转筒、移动带系统或类似装置中混合可食用夹心,同时将一种或多种蔗糖基糖浆多次施用到该夹心的表面上。该方法包括在蔗糖基糖浆的施用之间在盘中引入干燥气体(例如空气)以干燥该包衣。干燥从蔗糖基糖浆中去除水,导致很大部分蔗糖结晶。因此,蔗糖基硬质抛光包衣基本上是结晶态的。硬抛光产生了抛光糖食,其具有光滑的硬质包衣和在咬时易碎的质地。该硬质抛光包衣在本文与软质抛光包衣是不同的,其区别至少部分是因为其不具有软质抛光包衣的柔软结持度和质地。可替代地,蔗糖基硬质抛光包衣可以通过能基本复制常规硬质抛光包衣的性质的非

常规方法制备。

[0018] 本文所用的“着色剂”是能够通过吸收或散射不同波长的光而赋予颜色的任何物质。“食品级着色剂”是指适用于意于供人类或动物消费的食品中的着色剂,且与可提供颜色但通常不包括在或仅以痕量包括在食品中的无毒物质不同。术语“天然着色剂”包括在天然存在或天然生成或来源于天然的着色剂。

[0019] “含花青素苷的红萝卜着色剂”是包括来源于红萝卜的一种或多种花青素苷或可能来源于红萝卜的一种或多种类型的一种或多种花青素苷的着色剂。

[0020] “色调”是指为颜色命名的颜色性质,例如红色、桔红色、蓝色、紫罗兰色等。“色度”是指示颜色纯度的颜色性质,其中较高的色度与较高纯度的色调以及较少被白色、灰色或黑色稀释有关。“值(value)”是指示颜色的明度或暗度的颜色性质,较高的值与较高的明度有关。

[0021] 术语“颜色”和“颜色特征”可互换使用,且包括颜色性质,例如色调、色度和值以及用于描述这些性质的颜色模型系统的参数,例如国际照明委员会(Commission Internationale de l'Eclairage)CIE 1976CIELAB颜色空间的 $L^*a^*b^*$ 值和CIELCH颜色空间的 $L^*C^*h^\circ$ 值。CIELAB和CIELCH颜色模型提供了比更早期的颜色模型在视觉上更均匀的颜色空间。用分光光度计分析着色剂,并且由光谱数据计算CIELAB $L^*a^*b^*$ 值和CIELCH $L^*C^*h^\circ$ 值。 $L^*a^*b^*$ 值和 $L^*C^*h^\circ$ 值提供了表示颜色特征和评价两种颜色之间差异程度大小的方法。

[0022] $L^*a^*b^*$ 值由三维笛卡尔坐标系中定义的一组坐标值组成。 L^* 是值坐标或亮度坐标。 L^* 提供了竖直坐标上从黑色(0 L^* 单位)到白色(100 L^* 单位)的亮度标度。 a^* 和 b^* 是与色调和色度相关的坐标。 a^* 提供了水平轴上从绿色(- a^* 单位)至红色(+ a^* 单位)的标度,中性色位于中心点处(0 a^* 单位)。 b^* 提供了第二水平轴上从蓝色(- b^* 单位)至黄色(+ b^* 单位)的标度,中性色位于在中心点处(0 b^* 单位),第二水平轴垂直于第一水平轴。在 L^* 值为50且 a^* 和 b^* 均为0时三个轴相交。

[0023] $L^*C^*h^\circ$ 值由三维笛卡尔坐标系中定义的一组坐标值组成。 L^* 是值坐标或亮度坐标。 L^* 提供了纵坐标上从黑色(0 L^* 单位)到白色(100 L^* 单位)的亮度标度。 h° 是色调坐标。 h° 被指定为围绕 L^* 轴逆时针反向移动 0° 至 360° 的角度。纯红色具有 0° 的色调角,纯黄色具有 90° 的色调角,纯绿色具有 180° 的色调角,纯蓝色具有 270° 的色调角。 C^* 坐标表示色度,并被指定为距 L^* 轴的径向距离。随着坐标从 L^* 轴远移(直至100或更多 C^* 单位), C^* 提供了在 L^* 轴(0 C^* 单位)处从非彩色,即中性的白色、灰色或黑色,至更高纯度的色调。使用方程式1和2可由 a^* 和 b^* 计算 C^* 和 h° 。

$$C^* = (a^{*2} + b^{*2})^{0.5} \quad (1)$$

$$h^\circ = \arctan\left(\frac{b^*}{a^*}\right) \quad (2)$$

[0024] “德尔塔E(Delta E)”、“ ΔE_{ab}^* ”或“ ΔE ”是CIELAB $L^*a^*b^*$ 颜色空间中表示的两个颜色之间总的色差大小的量度。据报道,当 ΔE 为约2.3或更小时,有经验的颜色观察者也不能分辨两种颜色之间的任何差别。用方程式3计算 $L^*a^*b^*$ 值为 $L^*_1a^*_1b^*_1$ 和 $L^*_2a^*_2b^*_2$ 的两种不同颜色的 ΔE :

$$\Delta E_{ab}^* = \sqrt{(L^*_{1} - L^*_{2})^2 + (a^*_{1} - a^*_{2})^2 + (b^*_{1} - b^*_{2})^2} \quad (3)$$

[0025] 在所有情况中,除非另外指明,本文提供的硬质抛光糖食的CIELAB $L^*a^*b^*$ 值和CIELCH $L^*C^*h^\circ$ 值都是由柯尼卡美能达(Konica Minolta)分光光度计CM-3500d获得的光谱数据计算,该分光光度计以反射模式,采用CIE标准光源D65和10°观察角来操作。

[0026] 描述

[0027] 在硬质抛光糖食包衣的一个或多个蔗糖基糖浆层中通常包括可食用食品级着色剂。可以得到很多可食用食品级合成着色剂用于对硬质抛光糖食包衣进行有效地着色。然而,尽管合成着色剂多年来具有令人喜爱的消费者接受度,仍需要可能对消费者具有吸引力的天然来源的替代品。

[0028] 有许多可以得到的可食用食品级着色剂被描述为“天然的”。其中有含天然花青素苷的着色剂,包括以含花青素苷的蔬菜和水果的汁和提取物形式提供的那些。

[0029] 含花青素苷的蔬菜和水果的汁和提取物的颜色特征能够随pH的变化而改变。含花青素苷的汁和提取物通常在低pH时(例如在约1至约3的pH范围内)呈红色色调,随着pH升高,色调转变为紫色。

[0030] 然而,用于硬抛光的蔗糖基糖浆通常具有约5至约8的pH,该范围的下限仅在较高糖浆温度下是耐受的。在该pH范围之外操作能够导致蔗糖的转化(inversion),这使该糖浆不适合抛光。当糖浆的pH在该范围之外时产生的包衣缺陷可包括不平整、不规则的表面和有斑点的不均匀的着色。因此,添加到蔗糖基糖浆中的有效的着色剂需要不使糖浆的pH高于或低于该范围。

[0031] 目前,在市场上可得到的含花青素苷的着色剂尚未发现在蔗糖基糖浆或用该糖浆制备的硬质抛光包衣中提供红色色调。而是蔗糖基糖浆和得到的包衣都呈紫色色调。进一步地,尚未发现含花青素苷的着色剂和黄色着色剂的组合在蔗糖糖浆或得到的包衣中提供红色色调或橙色色调,而是导致暗褐色色调(muddy brownish hue)。注意到市场上可得到的用于提供红色色调和橙色色调的着色剂(例如番茄红素、 β -胡萝卜素、胭脂红和甜菜红素(betalain))都不是含花青素苷的着色剂。因此,需要能够用于在有利于用蔗糖基糖浆进行硬抛光涂布的pH范围内提供红色色调和橙色色调的天然含花青素苷的着色剂。

[0032] 令人惊讶地发现,在使用通过将水性溶液中的含花青素苷的红萝卜着色剂的pH调节到约4至约6的pH而得到的经pH调节的含花青素苷的红萝卜着色剂时,可以制备具有红色色调或橙色色调的蔗糖基硬质抛光包衣。即,将该经pH调节的含花青素苷的红萝卜着色剂加入到蔗糖基糖浆中不会导致例如用该糖浆制备的硬质抛光包衣中的紫色色调或暗褐色色调。含花青素苷的红萝卜着色剂在该pH范围内有助于蔗糖基硬质抛光包衣中提供红色色调和橙色色调的可能性之前在现有技术中尚未认识到。

[0033] 名称为“萝卜花青素苷提取物作为天然酒浸樱桃的红色着色剂”(Radish Anthocyanin Extract as a Natural Red Colorant for Maraschino Cherries),食物科学杂志(Journal of Food Science),61:688-694,1996,朱斯蒂(Giusti)等人的出版物公开了将红萝卜花青素苷提取物用于pH 3.5高果糖玉米糖浆中为酒浸樱桃着色。这是在涂布可食用夹心所用的着色的蔗糖基糖浆的pH范围之外,该文献并未公开使用该糖浆用于为蔗糖基硬质抛光包衣着色。此外,所公开的方法不包括制备经pH调节的含花青素苷的红萝卜

着色剂用于与蔗糖基糖浆混合以形成着色的蔗糖基糖浆的步骤。

[0034] WO 2012/059590 A1, 梅森(Mason)等人, 公开了用红萝卜花青素苷物质着色的蔗糖糖浆的制备以及这些糖浆用于在可食用夹心上制备硬质抛光包衣的用途。所公开的方法不包括制备经pH调节的含花青素苷的红萝卜着色剂用于与蔗糖基糖浆混合以形成着色的蔗糖基糖浆的步骤。对所得到的包衣测定的色调角 h° 为356和13.3, 这都在本文公开的在蔗糖基硬质抛光包衣中产生红色色调或橙色色调的 h° 值的范围之外。

[0035] US 2005/0181101 A1, 哈拉达(Harada)等人公开了一种提高花青素苷颜料的耐热性的方法。在实施例1中, 将红萝卜颜料的水性溶液进行碱处理, 并在90°C的温度下加热一个小时。据报道, 该经过处理的颜料适于为在小于4的pH下进行加热步骤的食物进行着色。这也在涂布可食用夹心所用的着色的蔗糖基糖浆的pH范围之外, 且该参考文献未公开该经处理的颜料用于为蔗糖基硬质抛光包衣着色红色色调或橙色色调。

[0036] 在本申请的一个实施方案中, 提供了一种蔗糖基硬质抛光包衣。该包衣包括蔗糖和经pH调节的含花青素苷的红萝卜着色剂。该包衣基本上是结晶态的, 且具有由CIELCH颜色空间 h° 坐标描述为约15°至约70°的红色色调或橙色色调。

[0037] 作为该经pH调节的含花青素苷的红萝卜着色剂的基础物质, 含花青素苷的红萝卜着色剂是一种组合物, 其可以仅包括来自红萝卜的一种或多种花青素苷, 或者也可以包括其他组分。在该红萝卜花青素苷是天然来源的实施方案中, 可以使用含花青素苷的红萝卜的汁或提取物作为天然含花青素苷的红萝卜着色剂的一种或多种花青素苷来源。用于获得该汁或提取物的红萝卜原料可以理想地为十字花科(Brassicaceae)萝卜属(Raphanus)植物的红色果肉蔬菜。红萝卜的含花青素苷的汁是通过从红萝卜中压出液体而得到的。红萝卜的含花青素苷的提取物是通过用溶剂(例如水、醇)洗涤浸软的红萝卜而得到的。红萝卜的汁和提取物包含花青素苷以及很多其他天然生成的化合物, 包括例如碳水化合物、酸、类黄酮、金属离子、酚酸、酚酸酯和维生素。因此, 适合的红萝卜的汁和提取物可以通过例如脱臭、复原(constituting)、或将该汁或提取物进行其他方法进行处理以除去特定种类的或宽泛多种化合物。该处理可以降低非花青素苷化合物对该含花青素苷的红萝卜着色剂提供的红色色调或橙色色调的潜在负面影响。在一些实施方案中, 该含花青素苷的红萝卜着色剂包括量小于约10wt%、或小于约5wt%、或小于约3wt%、或小于约2wt%、或小于约1wt%、或小于约0.5wt%、或小于约0.1wt%的非花青素苷化合物。在其他实施方案中, 该含花青素苷的红萝卜着色剂包括含量为约0.01wt%至约10wt%、或约0.01wt%至约5wt%、或约0.01wt%至约3wt%、或约0.01wt%至约2wt%、或约0.01wt%至约1wt%、或约0.01wt%至约0.5wt%、或约0.01wt%至约0.1wt%的非花青素苷化合物。细胞培养和发酵方法也可以提供用于天然来源的红萝卜花青素苷的原料。

[0038] 在一种实施方案中, 该含花青素苷的红萝卜着色剂不含合成红色着色剂、番茄红素、 β -胡萝卜素、胭脂红和甜菜红素。在另一实施方案中, 除红萝卜花青素苷之外, 该含花青素苷的红萝卜着色剂不含其他能够提供红色色调的着色剂。

[0039] 该含花青素苷的红萝卜着色剂可以是固体(例如粉末)、半固体(例如糊状)或液体(例如溶液或分散液)的形式。该着色剂优选以可溶于或可分散于水和蔗糖基糖浆中的形式提供。

[0040] 在一些实施方案中, 将该含花青素苷的红萝卜着色剂在水性溶液中进行pH调节到

约4至约6的pH以产生经pH调节的含花青素苷的红萝卜着色剂。目标的pH范围是约4至约6,因为在该范围内该红萝卜花青素苷呈现出硬质抛光包衣中追求的红色色调和橙色色调的所需成分。在这些和其他实施方案的一些中,该含花青素苷的红萝卜着色剂的经pH调节的水性溶液具有约4.25至约6、或约4.5至约6、或约4.75至约6、或约5至约6的pH值。

[0041] 在一些实施方案中,将任何形式的含花青素苷的红萝卜着色剂与水混合产生着色剂水性溶液。与该含花青素苷的红萝卜着色剂混合的水可以理想地具有降低的离子含量或去离子化。如果该着色剂水性溶液的pH在约4至约6的范围之外,将pH调节到约4至约6以产生水性溶液形式的经pH调节的含花青素苷的红萝卜着色剂。如果该着色剂水性溶液的pH调节是理想的或需要的,那么其是通过将食品级pH调节剂与该溶液以所需的量混合以将该溶液的pH调节到约4至约6。该pH调节剂可以以任意水溶性形式提供,例如作为固体颗粒或在水性溶液中提供。如果该pH调节剂是在水性溶液中提供的,那么在一些实施方案中,该溶液的水理想地具有降低的离子含量或去离子化。

[0042] 在一种实施方案中,该食品级pH调节剂是在水中充分离解的强碱,即该作用剂在水中的离解百分比为至少约95%、或至少约96%、或至少约97%、或至少约98%、或至少约99%、或约95%至约99.99%、或约98%至约99.99%。该强碱并不用作缓冲液,而是充分离解并调节该着色剂水性溶液的pH。在一些实施方案中,将强碱pH调节剂以约0.5wt%至约10wt%的量与该着色剂水性溶液混合,其中该作用剂的重量百分比是基于该含花青素苷的红萝卜着色剂的重量计的。在其他实施方案中,该pH调节剂的量为约0.5wt%至约8wt%、或约0.5wt%至约6wt%、或约0.5wt%至约5wt%、或约1wt%至约6wt%、或约2wt%至约5wt%,其中该作用剂的重量百分比是基于该着色剂的重量计的。

[0043] 在特别的实施方案中,强碱氢氧化钠和氢氧化钾是优选的食品级pH调节剂,由于它们能够在不贡献显著的气味或风味且不与着色剂以使色调偏离预期目标的方式相互作用的情况下调节该着色剂水性溶液的pH。在优选实施方案中,该食品级pH调节剂是氢氧化钠。

[0044] 通过提供完整的着色材料与未着色的糖浆进行混合,该含花青素苷的红萝卜着色剂在水性溶液中的pH调节简化了用于硬抛光的着色的蔗糖基糖浆的生产。即,提供经pH调节的着色剂避免了调节大量着色的糖浆的pH使其适于进行硬抛光的需要。因此,简化了蔗糖基硬质抛光包衣的生产。

[0045] 在一个实施方案中,其中首先产生水性溶液形式的经pH调节的含花青素苷的红萝卜着色剂,然后降低水含量以产生半固体或固体形式的经pH调节的含花青素苷的红萝卜着色剂。该经pH调节的溶液的水含量可以通过任意适合的方法降低,例如干燥方法或分离方法。得到的经pH调节的半固体或固体着色剂用于对用于硬抛光的未着色的蔗糖基糖浆进行着色,而不需要对大量着色的糖浆进行pH调节。任何形式的经pH调节的含花青素苷的红萝卜着色剂优选可溶解或可分散在水和蔗糖基糖浆中。

[0046] 在蔗糖基硬质抛光包衣的制备中使用的该含花青素苷的红萝卜着色剂的量仅由实际情况限定,例如应当使用足够的量以便获得所需的包衣色调,但理想地,将使用不超过实现其所需的更多的量。该含花青素苷的红萝卜着色剂在用于制备包衣的着色的蔗糖基糖浆中的适合的浓度能够在约0.01wt%至约20wt%、或约0.05wt%至约15wt%、或约0.1wt%至约10wt%的范围内。在该着色剂具有低着色能力的实施方案中,该着色剂可以以该糖浆的

约15wt%至约20wt%的浓度使用。在该着色剂具有较高着色能力的其他实施方案中,该着色剂可以以该糖浆的约5wt%直到小于约15wt%的浓度使用。在其中该着色剂具有甚至更高的着色能力的情况下,该着色剂可以以糖浆的约0.01wt%直到小于约5wt%、或糖浆的约0.01wt%直到小于约3wt%、或糖浆的约0.01wt%直到小于约2wt%、或糖浆的约0.01wt%直到小于约1.5wt%、或糖浆的约0.01wt%直到小于约1wt%的浓度使用。

[0047] 通过在用于涂布的着色的蔗糖基糖浆中与该经pH调节的含花青素苷的红萝卜着色剂一起引入黄色着色剂,在蔗糖基硬质抛光包衣中可以制备宽范围的红色色调和橙色色调。总的来讲,在引入较少量的黄色着色剂时,产生红色色调,随着糖浆中黄色着色剂的量逐渐升高,包衣的色调从红色逐渐变为橙红色、红橙色、橙色和黄橙色。因此,可以通过调节糖浆中该经pH调节的含花青素苷的红萝卜着色剂和黄色着色剂的相对含量,根据需要调节包衣中得到的特定的红色色调或橙色色调。

[0048] 因此,在本申请的一个实施方案中,在该蔗糖基硬质抛光包衣中,与该经pH调节的含花青素苷的红萝卜着色剂一起还包括黄色着色剂。在一种实施方案中,该黄色着色剂是天然着色剂。在一些实施方案中,天然黄色着色剂的来源是姜黄。例如,可以使用来自姜黄的姜黄素(curcuminoid)。该黄色着色剂可以是固体(例如粉末)、半固体(例如糊状)或液体(例如溶液或分散液)的形式,且优选以可溶解或可分散于水和蔗糖基糖浆中的形式提供。

[0049] 该黄色着色剂可以与含花青素苷的红萝卜着色剂或其水性溶液或其经pH调节的形式混合,然后再与蔗糖基糖浆混合。在溶液中调节含花青素苷的红萝卜着色剂的pH值之前将其与黄色着色剂混合的实施方案中,将该黄色着色剂与该含花青素苷的红萝卜着色剂一起进行pH调节。可替代地,该黄色着色剂可以在含花青素苷的红萝卜着色剂或其水性溶液或其经pH调节的形式之前、之后或同时直接与糖浆混合。

[0050] 该经pH调节的含花青素苷的红萝卜着色剂与该黄色着色剂无论作为混合物或单独组分与蔗糖基糖浆混合,都共同提供了用于该糖浆的完整的着色材料。即,所公开的着色剂的提供避免了调节大量着色的糖浆的pH使其适于硬抛光的需要。因此,简化了蔗糖基硬质抛光包衣的生产。

[0051] 选择在该蔗糖基硬质抛光包衣的制备中使用的黄色着色剂的量以产生所需的着色效果。在用于制备包衣的着色的蔗糖基糖浆中黄色着色剂的适合的浓度能够在约0.01wt%至约20wt%、或约0.05wt%至约15wt%、或约0.1wt%至约10wt%的范围内。在该着色剂具有低着色能力的实施方案中,该着色剂可以以该糖浆的约15wt%至约20wt%的浓度使用。在该着色剂具有较高着色能力的其他实施方案中,该着色剂可以以该糖浆的约5wt%直到小于约15wt%的浓度使用。在该着色剂具有甚至更高的着色能力的情况下,该着色剂可以以糖浆的约0.01wt%直到小于约5wt%、或糖浆的约0.01wt%直到小于约3wt%、或糖浆的约0.01wt%直到小于约2wt%、或糖浆的约0.01wt%直到小于约1.5wt%、或糖浆的约0.01wt%直到小于约1wt%的浓度使用。

[0052] 也可以选择着色的蔗糖基糖浆中包括的含花青素苷的红萝卜着色剂与黄色着色剂的重量比以在用该糖浆制备的硬质抛光包衣中提供所需的红色色调或橙色色调。在确定两种着色剂适合的使用比例中要考虑每种着色剂的浓度和相对着色能力。在制备红色色调包衣的一些实施方案中,含花青素苷的红萝卜着色剂与黄色着色剂的重量比为约3:1至约5:1。在制备橙色色调包衣的一些实施方案中,含花青素苷的红萝卜着色剂与黄色着色剂的重量

比为约0.4:1至约2:1。

[0053] 该蔗糖基硬质抛光包衣包括来自一种或多种蔗糖基糖浆的蔗糖。

[0054] 蔗糖固体和水的基础组合物构成蔗糖基糖浆的至少90重量百分比(wt%)。该蔗糖基糖浆的基础组合物可以包含至少60wt%蔗糖固体、或至少65wt%蔗糖固体或至少70wt%蔗糖固体。该糖浆的基础组合物可以包含少于75wt%蔗糖固体或少于80wt%蔗糖固体。在一些实施方案中,该糖浆的基础组合物包含70wt%至80wt%蔗糖固体。该蔗糖基糖浆的基础组合物可以为至少60°Brix(白利糖度)、或至少65°Brix、或至少70°Brix。该糖浆的基础组合物可以为小于75°Brix或小于80°Brix。在一些实施方案中,该糖浆的基础组合物为70°Brix至80°Brix。

[0055] 至少一种蔗糖基糖浆与经pH调节的含花青素苷的红萝卜着色剂混合以提供着色的蔗糖基糖浆。在一些实施方案中,至少一种蔗糖基糖浆与经pH调节的含花青素苷的红萝卜着色剂和黄色着色剂一起混合以提供着色的蔗糖基糖浆。

[0056] 在生产白色包衣或浅色包衣时,其他蔗糖基糖浆可以包括白色物质或浅色物质(例如二氧化钛和碳酸钙)作为着色剂(即增白剂或增亮剂(lightener))。然而,这些白色物质或浅色物质在被引入其他蔗糖基糖浆中在包衣中用作遮光剂时,被认为是非着色剂组分。

[0057] 蔗糖基糖浆还可以任选地包括硬质抛光包衣中常用的其他非着色剂组分。非着色剂组分的总量不超过组合的糖浆基础组合物和非着色剂组分重量的10%。在一些实施方案中,非着色剂组分的总量不超过组合的糖浆基础组合物和非着色剂组分的5wt%、或3wt%、或2wt%、或1wt%、或0.5wt%。很多这些组分是现有技术中已知的,包括但不限于多元醇、天然聚合物、稳定剂、香料(flavor)、感知剂(sensate)、乳化剂、树胶(gum)、维生素、矿物质、营养制剂、稳定剂或它们的组合。例如,可以在直接施用到可食用夹心上的蔗糖基糖浆中包括树胶(例如阿拉伯树胶),用以填充不平整处和提供更光滑的表面用于随后施用的蔗糖基糖浆,以提供改善对随后蔗糖基糖浆层的粘着性的基体,或者以产生对油、水分等的阻隔。也可以在中间和/或外表的蔗糖基糖浆层中包括树胶以为硬化的包衣进行塑化。

[0058] 在实施方案中,该蔗糖基硬质抛光包衣包括多个蔗糖基糖浆层,且该经pH调节的含花青素苷的红萝卜着色剂存在于至少一个该蔗糖基糖浆层中。在这些实施方案的一些中,该蔗糖基硬质抛光包衣进一步包括黄色着色剂,且该黄色着色剂与该经pH调节的含花青素苷的红萝卜着色剂存在于一个或多个相同的蔗糖基糖浆层中。在该多层包衣进一步包括黄色着色剂的其他实施方案中,该黄色着色剂和该经pH调节的含花青素苷的红萝卜着色剂在不同的层中。

[0059] 该多个蔗糖基糖浆层的一些可以具有相同的糖浆配方,而其他层可以具有不同的配方。例如,3层至30层的着色的蔗糖基糖浆可以形成该包衣的一部分,且3层至30层的未着色的蔗糖基糖浆可以形成该包衣的另一部分。具有相同糖浆配方的层可以彼此相邻或用具有不同配方的层分隔开,且在整个多层包衣中,层的顺序可以变化。在一个实施方案中,该经pH调节的含花青素苷的红萝卜着色剂至少存在于该多层包衣中最外面的蔗糖基糖浆层中。在其他实施方案中,该经pH调节的含花青素苷的红萝卜着色剂存在于该多层包衣中至少最外面5层、或至少最外面10层、或至少最外面15层、或至少最外面20层、或至少最外面30层蔗糖基糖浆层中。

[0060] 在实施方案中,该蔗糖基硬质抛光包衣中蔗糖基糖浆层(未着色的或着色的)的总数量少于50层、或少于40层、或少于30层。在这些和其他实施方案中的一些中,该包衣中蔗糖基糖浆层的数量大于10层、或大于15层、或大于20层。该包衣中蔗糖基糖浆层的总数量可以适宜地为10层至50层、或15层至40层、或20层至30层。

[0061] 一旦经硬化,该硬质抛光包衣可以预期具有不超过3.0mm、或不超过2.5mm、或不超过2.0mm、或不超过1.5mm、或不超过1.0mm的厚度。该硬质抛光包衣也可以具有大于0.1mm、或大于0.2mm、或大于0.3mm、或大于0.4mm、或大于0.5mm的厚度。在一些实施方案中,该硬质抛光包衣可以具有0.1mm至3.0mm、或0.2mm至2.5mm、或0.3mm至2.0mm、或0.4mm至1.5mm、或0.5mm至1.0mm的厚度。

[0062] 该蔗糖基硬质抛光包衣基本上是结晶态的。在具体的实施方案中,该包衣按体积计至少85%是结晶态的,或者该包衣按体积计至少87%、或按体积计至少89%、或按体积计至少91%、或按体积计至少93%、或按体积计至少95%、或按体积计85%至100%、或按体积计87%至100%、或按体积计89%至100%、或按体积计91%至100%、或按体积计93%至100%、或按体积计95%至100%是结晶态的。

[0063] 本文提供的蔗糖基硬质抛光包衣具有至少部分由经pH调节的含花青素苷的红萝卜着色剂贡献的红色色调或橙色色调。在一些实施方案中,黄色着色剂也贡献该红色色调或橙色色调的组分。

[0064] 相同色调表征的颜色的色度(颜色纯度)和值(亮度或暗度)可能不同。因此,相同色调的颜色可能眼睛感觉到有差别,且通常由不同的名称描述。例如,具有相同红色色调但具有不同色度和/或值的两种颜色可能在一种情况中被感觉和描述为红色,而在另一种情况中被感觉和描述为粉色。类似地,具有落入红色和黄色之间某处的相同色调的两种颜色在一种情况中可能被感觉和描述为橙色,而在另一种情况中被感觉和描述为橘红色。另一方面,具有不同但相对接近的色调的两种颜色可能被感觉和描述为都是同一色调家族中的一部分,例如苹果红色和砖红色。因此,应当理解术语“红色色调”和“橙色色调”并不意味着单一的颜色,而意味着是由不同名称描述的但都具有在红色和橙色家族中的色调的宽颜色范围的表征。

[0065] 颜色性质色调可以根据CIE 1976CIELCH颜色模型系统中 h° 坐标或色调角 h° 进行建模和描述。 h° 表示绕 L^* (值)轴逆时针方向运动的从 0° 至 360° 的角。该模型定义纯红色具有 0° 的色调角,纯黄色具有 90° 的色调角,纯绿色具有 180° 的色调角,以及纯蓝色具有 270° 的色调角。在任意两个这些定位点之间的色调角表现了这两种纯色色调之间的“混合”色调的连续光谱。因此,可以在颜色空间中建模和用数值描述色调,包括“混合”色调,例如由红色和黄色“混合”形成的橙色。

[0066] 在一种实施方案中,该蔗糖基硬质抛光包衣的红色色调或橙色色调由CIELCH颜色空间 h° 坐标或色调角 h° 描述为约 15° 至约 70° 。在一些实施方案中,当在橙色色调中不需要强黄色成分时,该色调角在约 15° 至约 60° 范围内。该包衣的另一橙色色调实施方案具有在约 40° 至约 50° 范围内的色调角。在需要红色色调的其他实施方案中,较小的色调角可能不能提供附加的益处,该色调角在约 20° 至约 70° 范围内。该包衣的另一红色色调实施方案具有在约 20° 至约 30° 范围内的色调角。在红色色调或橙色色调的包衣的其他实施方案中,色调角在约 20° 至约 60° 范围内。

[0067] 在一些实施方案中,该蔗糖基硬质抛光包衣的色度由CIELCH颜色空间C*坐标描述为至少约20、或至少约22、或至少约24、或至少约26、或至少约28、或至少约30、或约20至约80。

[0068] 在另一实施方案中,与用合成红色着色剂药品和化妆品法案红40号(FD&C Red No. 40)着色的蔗糖基硬质抛光包衣相比,该蔗糖基硬质抛光包衣的颜色具有10或更小的 ΔE 色差。在一些实施方案中,该 ΔE 为8或更小、或6或更小、或低至4或更小。

[0069] 在本文公开的另一实施方案中,硬质抛光糖食包括可食用夹心和蔗糖基硬质抛光包衣,其中该包衣包括蔗糖和经pH调节的含花青素苷的红萝卜着色剂。该包衣基本上结晶态的,且具有由CIELCH颜色空间 h° 坐标描述为约 15° 至约 70° 的红色色调或橙色色调。

[0070] 该硬质抛光糖食的该蔗糖基硬质抛光包衣可以依照本申请中公开的任何包衣实施方案提供。该包衣中的蔗糖可以由用于制备该包衣的一种或多种蔗糖基糖浆提供。含花青素苷的红萝卜着色剂可以在水性溶液中进行pH调节到约4至约6的pH,且任选地降低该溶液的水含量,以在该包衣中提供经pH调节的含花青素苷的红萝卜着色剂。该包衣可以进一步包括黄色着色剂。

[0071] 在硬质抛光糖食的一些实施方案中,该包衣包括多个蔗糖基糖浆层,且该经pH调节的含花青素苷的红萝卜着色剂存在于至少一个该蔗糖基糖浆层中。在这些实施方案的一些中,该蔗糖基硬质抛光包衣进一步包括黄色着色剂,且该黄色着色剂存在于与该经pH调节的含花青素苷的红萝卜着色剂相同的一个或多个蔗糖基糖浆层中。在该多层包衣进一步包括黄色着色剂的其他实施方案中,该黄色着色剂和经pH调节的含花青素苷的红萝卜着色剂在不同的层中。

[0072] 该硬质抛光糖食的包衣中的该含花青素苷的红萝卜着色剂可以是天然着色剂。在该硬质抛光糖食的包衣包括黄色着色剂的实施方案中,该黄色着色剂可以是天然着色剂,该天然黄色着色剂的来源可以是姜黄。该硬质抛光糖食的包衣可以不含合成红色着色剂、番茄红素、 β -胡萝卜素、胭脂红和甜菜红素,和/或除含花青素苷的红萝卜着色剂之外不含其他能够提供红色色调的着色剂。

[0073] 该硬质抛光糖食的包衣基本上是结晶态的。在该硬质抛光糖食的具体实施方案中,该蔗糖基硬质抛光包衣按体积计至少85%是结晶态的,或者该包衣按体积计至少87%、或按体积计至少89%、或按体积计至少91%、或按体积计至少93%、或按体积计至少95%、或按体积计85%至100%、或按体积计87%至100%、或按体积计89%至100%、或按体积计91%至100%、或按体积计93%至100%、或按体积计95%至100%是结晶态的。

[0074] 在一些实施方案中,该硬质抛光糖食的蔗糖基硬质抛光包衣具有由CIELCH颜色空间 h° 坐标描述为约 15° 至约 70° 的红色色调或橙色色调。在其他实施方案中,该包衣的色度由CIELCH颜色空间C*坐标描述为至少20。在这些和其他实施方案中,与用合成红色着色剂药品和化妆品法案红40号着色的蔗糖基硬质抛光包衣的颜色相比,该包衣的颜色可以具有10或更小的 ΔE 色差。

[0075] 在硬质抛光糖食的一些实施方案中,蔗糖基糖浆可以作为包衣层直接施用到该可食用夹心的表面以形成该蔗糖基硬质抛光包衣。在其他实施方案中,蔗糖基糖浆可以作为包衣层施用到可食用夹心的制备的表面,其中该表面已依照已知技术制备,包括但不限于涂胶、离析(isolate)和稳定。在其他实施方案中,蔗糖基糖浆可以作为包衣层施用到位于

可食用夹心上的任意数量的包衣层之上的结晶态的蔗糖基糖浆层。作为本文所用的引号之后的术语,将蔗糖基糖浆作为包衣层施用“到可食用夹心”并不必然表示该蔗糖基糖浆直接施用到该可食用夹心。而是作为包衣层施用“到可食用夹心”的蔗糖基糖浆可以直接施用到该可食用夹心的表面,或者直接施用到可食用夹心的制备的表面上,或者直接施用到位于可食用夹心上的任意数量的包衣层之上的结晶态的蔗糖基糖浆层上,这些都在该短语的含义之内。

[0076] 该蔗糖基糖浆层可以施用到任意所需的可食用夹心上。在一些实施方案中,该可食用夹心可以包括天然夹心,例如坚果、花生、坚果仁、坚果酱、干果片或干果酱。或者,该可食用夹心可以包括糖食,例如煮沸的糖浆、焦糖、果仁糖、乳脂糖、太妃糖、软糖、巧克力、糖食的包衣或它们的组合。可替代地,该可食用夹心可以包括谷物类物质,例如甜饼干、咸饼干、软饼、薄饼、脆饼或其他烘焙的、松脆的或蓬松的物质。在一些实施方案中,该可食用夹心可以包括天然夹心、糖食或在其上涂布有糖食的谷物类物质。

[0077] 在硬质抛光糖食的实施方案中,该蔗糖基硬质抛光包衣基本上包围该可食用夹心。即,尽管在包衣中可能存在针孔、裂缝或缺口,但该包衣横越该夹心的整个外表面。

[0078] 在本申请的另一实施方案中,公开了一种对可食用夹心进行硬抛光涂布的方法。

[0079] 该方法包括:

- (a)将含花青素苷的红萝卜着色剂与水混合以形成着色剂水性溶液;
- (b)将该着色剂水性溶液的pH调节到约4至约6,且任选地降低该溶液的水含量以形成经pH调节的着色剂;
- (c)将该经pH调节的着色剂与蔗糖基糖浆混合以形成着色的蔗糖基糖浆;
- (d)将黄色着色剂与步骤(a)、步骤(b)和步骤(c)的一种或多种成分和混合物混合,使得该黄色着色剂被加入到该着色的蔗糖基糖浆中;和
- (e)将该着色的蔗糖基糖浆施用到可食用夹心上以提供至少一层硬质抛光包衣。

[0080] 为了执行该方法,该含花青素苷的红萝卜着色剂、黄色着色剂、蔗糖基糖浆和可食用夹心可以依照本申请中公开的任何实施方案提供。

[0081] 在实施方案中,该方法的混合步骤可以使用常规食品加工技术和设备执行,例如在具有搅拌器的316不锈钢容器中将粉末混合到液体中。

[0082] 在一些实施方案中,用于制备步骤(a)的着色剂水性溶液的水和蔗糖基糖浆被理想地降低离子含量或去离子化。将水与该含花青素苷的红萝卜着色剂以足以溶解或分散该着色剂的量混合。以毫升体积计的水的适合量可以是以克计的着色剂的质量数的两倍,例如30ml水与15g着色剂。在一种实施方案中,该着色剂的水性溶液是在周围环境条件下并不加热成分物质的情况下制备的。

[0083] 将该着色剂水性溶液的pH调节到约4至约6以产生水性溶液形式的经pH调节的含花青素苷的红萝卜着色剂。在一些实施方案中,将该着色剂水性溶液的pH调节到约4.25至约6、或约4.5至约6、或约4.75至约6、或约5至约6。在其他实施方案中,将食品级pH调节剂与该着色剂水性溶液以所需的量混合以将该溶液的pH调节到约4至约6。该pH调节剂可以以任意水溶性形式提供,例如作为固体颗粒或在水性溶液中。如果该pH调节剂是在水性溶液中提供的,那么在一些实施方案中,该溶液的水理想地具有降低的离子含量或去离子化。在一个实施方案中,该pH调节是在周围环境条件下并不加热组分物质的情况下进行的。

[0084] 在一种实施方案中,该食品级pH调节剂是在水中充分离解的强碱,即该作用剂在水中的离解百分比为至少约95%、或至少约96%、或至少约97%、或至少约98%、或至少约99%、或约95%至约99.99%、或约98%至约99.99%。该强碱并不用作缓冲液,而是充分离解并调节该着色剂水性溶液的pH。在一些实施方案中,将强碱pH调节剂以约0.5wt%至约10wt%的量与该着色剂水性溶液混合,其中该作用剂的重量百分比是基于该含花青素苷的红萝卜着色剂的重量计的。在其他实施方案中,该pH调节剂的量为约0.5wt%至约8wt%、或约0.5wt%至约6wt%、或约0.5wt%至约5wt%、或约1wt%至约6wt%、或约2wt%至约5wt%,其中该作用剂的重量百分比是基于该着色剂的重量计的。

[0085] 在具体的实施方案中,强碱氢氧化钠和氢氧化钾是优选的食品级pH调节剂,由于其能够在不贡献显著的气味或风味且不与着色剂以使色调偏离预期目标的方式相互作用的情况下调节该着色剂水性溶液的pH。在优选实施方案中,该食品级pH调节剂是氢氧化钠。

[0086] 在一些实施方案中,在对该溶液进行pH调节之后,制备的着色剂水性溶液可以任选地通过任意适合的方法(例如干燥方法或分离方法)降低其水含量,以产生半固体或固体形式的经pH调节的含花青素苷的红萝卜着色剂。

[0087] 在步骤(d)的实施方案中,该黄色着色剂可以与步骤(a)、步骤(b)和步骤(c)的一种或多种成分和混合物(包括含花青素苷的红萝卜着色剂、该着色剂溶液的水、该着色剂水性溶液、经pH调节的着色剂、蔗糖基糖浆和着色的蔗糖基糖浆)混合,作为将黄色着色剂加入该着色的蔗糖基糖浆中的方式。

[0088] 在一种实施方案中,将该黄色着色剂与该含花青素苷的红萝卜着色剂、该着色剂溶液的水、该着色剂水性溶液或经pH调节的着色剂混合,该混合在将该pH调节的着色剂与该蔗糖基糖浆混合之前进行。在另一实施方案中,该黄色着色剂与该蔗糖基糖浆混合,该混合在经pH调节的着色剂与该蔗糖基糖浆混合之前、之后或同时进行。

[0089] 该经pH调节的含花青素苷的红萝卜着色剂与该黄色着色剂无论作为混合物或单独组分依照步骤(c)和步骤(d)与蔗糖基糖浆混合,都共同提供了用于该糖浆的完整的着色物质。即,依照所公开的方法提供着色剂避免了调节整个着色的糖浆的pH值使其适于硬抛光的需要。因此,简化了整个硬质抛光包衣方法。

[0090] 在一种实施方案中,当糖浆在约65°C至约85°C、或约67°C至约83°C、或约70°C至约80°C、或约74°C至约82°C范围内的温度时,将该经pH调节的含花青素苷的红萝卜着色剂和该黄色着色剂与该蔗糖基糖浆混合。

[0091] 在一些实施方案中,将该含花青素苷的红萝卜着色剂以该着色的蔗糖基糖浆的约0.01wt%直到小于约5wt%的量加入到该着色的蔗糖基糖浆中。在这些和其他实施方案中,将该黄色着色剂以该着色的蔗糖基糖浆的约0.01wt%直到小于约5wt%的量加入到该着色的蔗糖基糖浆中。

[0092] 在一些实施方案中,将该着色的蔗糖基糖浆依照常规硬抛光涂布或现有技术中已知的硬抛光方法施用到适合的可食用夹心上,以提供至少一层硬质抛光包衣。一般而言,在硬抛光方法中,使用一个或多个高浓度糖浆的多次施用在可食用的产品夹心上构造糖包衣。一些高浓度糖浆可以包含一种或多种着色剂,而另一些可能不包含。在实施方案中,该硬抛光方法包括在混合夹心物质的同时在混合的夹心物质上重复施用该包衣材料的薄层,以及干燥各包衣材料的层,在此期间在层的施用之间使该包衣材料中的糖结晶。进行包衣

材料施用和干燥的连续阶段,例如在转盘、转筒或类似装置中进行,调节该方法得到具有所需厚度、表面外观、不透明度和感官感觉和其他性质的最终包衣。这些方法例如描述在“糖食和巧克力制造”,R·李和E·B·杰克逊,化学出版社,1975年2月7日(“Sugar Confectionery and Chocolate Manufacture”,R.Lees and E.B.Jackson,Chemical Publishing Company,February 7,1975)和“工业巧克力制造和使用”,S·T·贝克特编辑,布莱基父子有限公司,格拉斯哥,1998(“Industrial Chocolate Manufacture and Use”,editor,S.T.Beckett,Blackie&Son Ltd.,Glasgow,1988)中,由此将各自通过引用整体并入本文用于任意目的。本文的硬抛光与软抛光方法是不同的,其区别至少部分是因为硬抛光方法不包括将颗粒固体(例如晶体糖)施用到用糖浆润湿的夹心上以干燥该包衣。在其他实施方案中,依照能基本复制常规硬抛光包衣的性质的非常规的硬抛光涂布或硬抛光方法将着色的蔗糖基糖浆施用到可食用夹心上。

[0093] 在一些实施方案中,该可食用夹心的硬抛光涂布方法包括将着色的蔗糖基糖浆施用到可食用夹心上以提供多层硬质抛光包衣。无论在夹心上施用一个层或多个层,该着色的蔗糖基糖浆都可以在约65°C至约85°C、或约67°C至约83°C、或约70°C至约80°C、或约74°C至约82°C范围内的温度施用。

[0094] 该对可食用夹心进行硬抛光涂布的方法可以进一步包括在施用着色的蔗糖基糖浆之后使其结晶,使得该硬质抛光包衣的至少一层基本上是结晶态的。在一些实施方案中,该硬质抛光包衣的至少一层按体积计至少85%是结晶态的,或者该硬质抛光包衣的至少一层按体积计至少87%、或按体积计至少89%、或按体积计至少91%、或按体积计至少93%、或按体积计至少95%、或按体积计85%至100%、或按体积计87%至100%、或按体积计89%至100%、或按体积计91%至100%、或按体积计93%至100%、或按体积计95%至100%是结晶态的。在一种实施方案中,该着色的蔗糖基糖浆是通过将其经过促使蔗糖发生相变的条件而结晶的。例如,可以将该涂布有糖浆的夹心在转盘中翻滚并混合以促进结晶。

[0095] 在一些实施方案中,该对可食用夹心进行硬抛光涂布的方法进一步包括在施用该着色的蔗糖基糖浆之后将其至少部分干燥。在其他实施方案中,将该着色的蔗糖基糖浆施用到该可食用夹心的制备的表面上。

[0096] 现在将参照以下实施例验证具体实施方案。应当认识到实施例的公开仅用于示例的目的,也预期了这些实施方案的变型。

实施例1

用含花青素苷的天然红萝卜着色剂和天然黄色着色剂着色为红色的硬质抛光糖食

[0097] 通过硬抛光方法将蔗糖基包衣施用到扁豆状巧克力夹心上。用去离子水制备74°Brix基础蔗糖糖浆。用该基础蔗糖糖浆制备第一包衣糖浆,添加2.5wt%二氧化钛作为遮光剂。通过以下制备含花青素苷的天然红萝卜着色剂的水性溶液(“NRRA-1”):将8克含花青素苷的天然红萝卜粉末(San Red ADF-EX, San-Ei Gen F.F.I.(美国),有限公司,纽约,纽约州)溶解在16ml去离子水中,并用2M NaOH将pH调节到5。用该基础蔗糖糖浆制备第二包衣糖浆,添加该经pH调节的含花青素苷的天然红萝卜着色剂的水性溶液,使得该含花青素苷的红萝卜粉末在该糖浆中的加入量为0.4wt%。然后将天然黄色着色剂粉末(CH卡普颜色姜黄 WSS-P-500,科汉森公司,密尔沃基,美国威斯康星州(CH Cap Colors Turmeric WSS-P-500,Chr.Hansen,Inc.,Milwaukee,WI))以0.1wt%添加到该第二包衣糖浆中。将包含二氧

化钛的第一包衣糖浆在该夹心上施用5层并干燥。然后将该着色的第二包衣糖浆在该夹心上施用17层并干燥。用抛光树胶的包衣并随后用蜡对该着色的夹心进行最终处理。

[0098] 用可替代的第二包衣糖浆重复上述方法,该可替代的第二包衣糖浆是用0.25wt%的相同的天然黄色着色剂粉末和0.8wt%的可替代的含花青素苷的天然红萝卜粉末(CH红萝卜,科汉森公司,密尔沃基,美国威斯康星州)制备的。将该可替代的含花青素苷的天然红萝卜粉末以16克粉末在32ml去离子水的水性溶液提供到该可替代的第二包衣糖浆中,并用2M NaOH将pH调节到5(溶液“NRRA-2”)。用另一可替代的第二包衣糖浆再次重复该方法,该另一可替代的第二包衣糖浆是用基础蔗糖糖浆和合成红色着色剂药品和化妆品法案红40号制备的。对于第二次和第三次试验,该第一包衣糖浆和表面包衣(finishing coat)与第一次试验相同。

[0099] 对来自各次试验的10块糖食进行颜色测定,计算 $L^*a^*b^*C^*h^\circ$ 值并取平均值,如表1中所示:

表1

样品名称	L^*	a^*	b^*	C^*	h°	与具有合成药品和化妆品法案红 40 号的样品相比的 ΔE
NRRA-1 和天然黄色着色剂	49.98	31.02	12.83	33.57	22.47	20.28
NRRA-2 和天然黄色着色剂	39.06	38.77	16.55	42.16	23.12	7.51
合成药品和化妆品法案红 40 号	37.09	44.05	21.52	49.03	26.04	---

[0100] 表1显示了天然着色剂试验样品与合成着色剂试验样品相比的 ΔE 色差值。所有三个样品都具有红色色调。如7.51的更小的 ΔE 值所示,NRRA-2含花青素苷的红萝卜着色剂产生的红色色调比NRRA-1含花青素苷的红萝卜着色剂更接近合成着色剂提供的色调。

实施例2

用含花青素苷的天然红萝卜着色剂和天然黄色着色剂着色为橙色的硬质抛光糖食

[0101] 通过硬抛光方法将蔗糖基包衣施用到扁豆状巧克力夹心上。用去离子水制备74° Brix基础蔗糖糖浆。用该基础蔗糖糖浆制备第一包衣糖浆,添加2.5wt%二氧化钛作为遮光剂。通过以下制备含花青素苷的天然红萝卜着色剂的水性溶液(“NRRA-3”):将4克含花青素苷的天然红萝卜粉末(San Red ADF-EX, San-Ei Gen F.F.I.(美国),有限公司,纽约,纽约州)溶解在8ml去离子水中,并用2M NaOH将pH调节到5。用该基础蔗糖糖浆制备第二包衣糖浆,添加该经pH调节的含花青素苷的天然红萝卜着色剂的水性溶液,使得该含花青素苷的红萝卜粉末在该糖浆中的加入量为0.2wt%。然后将天然黄色着色剂粉末(CH卡普颜色姜黄 WSS-P-500,科汉森公司,密尔沃基,美国威斯康星州)以0.2wt%添加到该第二包衣糖浆中。

然后将包含二氧化钛的第一包衣糖浆在该夹心上施用5层并干燥。然后将该着色的第二包衣糖浆在该夹心上施用17层并干燥。用抛光树胶的包衣并随后用蜡对该着色的夹心进行最终处理。

[0102] 用可替代的第二包衣糖浆重复上述方法,该可替代的第二包衣糖浆是用0.4wt%的相同的天然黄色着色剂粉末和0.175wt%的可替代的含花青素苷的天然红萝卜粉末(CH红萝卜,科汉森公司,密尔沃基,美国威斯康星州)制备的。将该可替代的含花青素苷的天然红萝卜粉末以3.5克粉末在7ml去离子水的水性溶液提供到该可替代的第二包衣糖浆中,并用2M NaOH将pH调节到5(溶液“NRRA-4”)。用另一可替代的第二包衣糖浆再次重复该方法,该另一可替代的第二包衣糖浆是用基础蔗糖糖浆和选择以产生鲜艳的橙色色调的合成药品和化妆品法案着色剂的混合物制备的。对于第二次和第三次试验,该第一包衣糖浆和表面包衣与第一次试验相同。

[0103] 对来自各次试验的10块糖食进行颜色测定,计算 $L^*a^*b^*C^*h^\circ$ 值并取平均值,如表2中所示:

表2

样品名称	L^*	a^*	b^*	C^*	h°	与具有合成药品和化妆品法案着色剂混合物的样品相比的 ΔE
NRRA-3 和天然黄色着色剂	58.52	24.09	32.79	40.69	53.70	33.21
NRRA-4 和天然黄色着色剂	59.09	28.86	43.08	51.85	56.18	24.31
合成药品和化妆品法案着色剂混合物	58.81	51.82	51.06	72.75	44.58	---

[0104] 表2显示了天然着色剂试验样品与合成着色剂试验样品相比的 ΔE 色差值。所有三个样品都具有橙色色调。如24.31的更小的 ΔE 值所示,NRRA-4含花青素苷的红萝卜着色剂产生的橙色色调比NRRA-3含花青素苷的红萝卜着色剂更接近合成着色剂提供的橙色色调。

实施例3

用调节到pH 9的含花青素苷的天然红萝卜着色剂着色的硬质抛光糖食

[0105] 通过硬抛光方法将蔗糖基包衣施用到扁豆状巧克力夹心上。用去离子水制备74° Brix基础蔗糖糖浆。用该基础蔗糖糖浆制备第一包衣糖浆,添加2.5wt%二氧化钛作为遮光剂。通过以下制备含花青素苷的天然红萝卜着色剂的水性溶液(“NRRA-5”):将14克含花青素苷的天然红萝卜粉末(San Red ADF-EX, San-Ei Gen F.F.I.(美国),有限公司,纽约,纽约州)溶解在28ml去离子水中,并用2M NaOH将pH调节到9。用该基础蔗糖糖浆制备第二包衣糖浆,添加该经pH调节的含花青素苷的天然红萝卜着色剂的水性溶液,使得该含花青素苷的红

萝卜粉末在该糖浆中的加入量为0.7wt%。将包含二氧化钛的第一包衣糖浆在该夹心上施用5层并干燥。然后将该着色的第二包衣糖浆在该夹心上施用17层并干燥。用抛光树胶的包衣并随后用蜡对该着色的夹心进行最终处理。

[0106] 对来自该试验的10块糖食进行颜色测定,计算L*a*b*C*h°值并取平均值,如表3中所示:

表3

样品名称	L*	a*	b*	C*	h°
NRRA-5(pH 9)	31.72	8.09	-8.96	12.07	312.08

[0107] 表3显示了调节到pH 9的NRRA-5含花青素苷的红萝卜着色剂对试验样品提供了紫色色调。

[0108] 实施方案的其他变型和改进对本领域技术人员将是显而易见的。除以下权利要求中所提出的之外,保护范围不受限制。