

Description

PROCESSED KALE PRODUCT

Field of the Invention

[0001]

The present invention relates to a processed kale product having excellent physiological functions, as well as good taste and flavor and good appearance.

Background of the Invention

[0002]

Kale is a cruciferous plant, and is a type of cabbage but does not form a head in nature. Kale contains glucoraphanin (sulforaphane glucosinolate). When glucoraphanin is ingested, enteric bacteria degrade glucoraphanin into sulforaphane. Sulforaphane is reported to have an inhibitory effect on carcinogenesis, a phase II detoxification enzyme-inducing effect, an inhibitory effect on *Helicobacter pylori* infection, etc. Therefore, green juice made from kale as a starting material has attracted attention as a food product having not only various nutrients but also physiological functions.

[0003]

When such green juice made from kale as a starting material is manufactured, a heat treatment (blanching treatment) is conducted since there is a need to prevent

deterioration due to enzymes contained in kale. The blanching treatment is also conducted for the purpose of reducing the grassy smell of kale. However, there was a problem, even in green juice manufactured from kale having undergone a blanching treatment as a starting material, that the green juice gave a strong distinctive grassy smell of kale, etc., and tasted bad. In addition, the color (appearance) of the green juice manufactured from kale having undergone a blanching treatment as a starting material was light yellow-green, which was far from the bright green color of natural kale (Patent Literature 1).

Citation List

Patent Literature

[0004]

Patent Literature 1: JP-A-2002-186445

Summary of the Invention

Problems to be Solved by the Invention

[0005]

As described above, glucoraphanin contained in kale is a useful substance having various physiological functions, but the content of glucoraphanin in kale green juice obtained by conventional means is about 0.1 mg to 0.6 mg per 1 g of kale-derived solids yet, which is not fully satisfactory. Also, as described above, green juice made from kale as a starting material has a drawback such as bad taste and flavor or bad appearance

(color tone), and green juice having good taste and flavor and good appearance as well as a high glucoraphanin content, made from kale as a starting material of kale has not yet been attained.

Therefore, it is an object of the present invention to provide a processed kale product having a high glucoraphanin content as well as good taste and flavor and good appearance.

Means for Solving the Problems

[0006]

Accordingly, the present inventors extensively studied to solve the above problems, and found that a processed kale product manufactured from kale having undergone a blanching treatment as a starting material, the processed kale product having a glucoraphanin content of at least 1 mg per 1 g of kale-derived solids, has a higher glucoraphanin content as well as better taste and flavor and color tone compared to conventional processed kale products, thus completed the present invention.

[0007]

Namely, the present invention provides [1] to [13] below.

[1] A processed kale product manufactured from kale having undergone a blanching treatment as a starting material, the processed kale product having a glucoraphanin content of at least 1 mg per 1 g of kale-derived solids.

[2] The processed kale product according to [1], wherein the processed kale product has a sinigrin content of less than 1 mg per 1 g of kale-derived solids.

[3] The processed kale product according to [1] or [2], wherein the processed kale product has a progoitrin content of less than 0.1 mg per 1 g of kale-derived solids.

[4] The processed kale product according to any of [1] to [3], wherein the blanching treatment is conducted under a condition satisfying Expression 1 below:

(Expression 1)

$$\text{when } 1 \leq x \leq 5, -2.5x + 92.5 \leq y \leq 100$$

$$\text{when } 5 < x \leq 10, -2.5x + 92.5 \leq y \leq -3x + 110$$

where x: Time (min), and y: Temperature (°C).

[5] The processed kale product according to any of [1] to [4], wherein the blanching treatment is conducted under a condition satisfying Expression 2 below:

(Expression 2)

$$\text{when } 1 \leq x \leq 5, -1.25x + 96.25 \leq y \leq 100$$

where x: Time (min), and y: Temperature (°C).

[6] The processed kale product according to any of [1] to [5], wherein the processed kale product is a squeezed kale juice composition.

[7] The processed kale product according to any of [1] to [6], wherein the kale is Hyperle (MAFF (the Japanese Ministry of Agriculture, Forestry and Fisheries) Plant Variety Registration No. 20555).

[8] A method for manufacturing a processed kale product having a glucoraphanin content of at least 1 mg per 1 g of kale-derived solids, the method comprising conducting a blanching treatment of kale.

[9] The method for manufacturing a processed kale product according to [8], wherein the processed kale product has a sinigrin content of less than 1 mg per 1 g of kale-derived solids.

[10] The method for manufacturing a processed kale product according to [8] or [9], wherein the processed kale product has a progoitrin content of less than 0.1 mg per 1 g of kale-derived solids.

[11] The method for manufacturing a processed kale product according to any of [8] to [10], wherein the blanching treatment is conducted under a condition satisfying Expression 1 below:

(Expression 1)

$$\text{when } 1 \leq x \leq 5, -2.5x + 92.5 \leq y \leq 100$$

$$\text{when } 5 < x \leq 10, -2.5x + 92.5 \leq y \leq -3x + 110$$

where x: Time (min), and y: Temperature (°C).

[12] The method for manufacturing a processed kale product according to any of [8] to [11], wherein the blanching treatment is conducted under a condition satisfying Expression 2 below:

(Expression 2)

$$\text{when } 1 \leq x \leq 5, -1.25x + 96.25 \leq y \leq 100$$

where x: Time (min), and y: Temperature (°C).

[13] The method for manufacturing a processed kale product according to any of [8] to [12], wherein the kale is Hyperle (MAFF Plant Variety Registration No. 20555).

Effects of the Invention

[0008]

The processed kale product of the present invention has effects that its glucoraphanin content is high, its taste and flavor and appearance are good, and it is easy to drink.

Modes for Carrying out the Invention

[0009]

The processed kale product of the present invention is a processed kale product manufactured from kale having undergone a blanching treatment as a starting material, and characterized in that the processed kale product has a glucoraphanin content of at least 1 mg per 1 g of kale-derived solids.

[0010]

The glucoraphanin content per 1 g of kale-derived solids of the processed kale product of the present invention is at least 1 mg, and in terms of physiological functions, preferably at least 2 mg, more preferably at least 3 mg, and even more preferably at least 7 mg. The glucoraphanin contents per 1 g of kale-derived solids of conventional processed kale products are about 0.1 mg to 0.6 mg, and the glucoraphanin content of the processed

kale product of the present invention is higher compared to the conventional processed kale products.

The glucoraphanin content in the processed kale product is measured by HPLC following a method described in Examples mentioned below.

[0011]

The sinigrin content per 1 g of kale-derived solids of the processed kale product of the present invention is not particularly limited, but in terms of the taste and flavor of the processed kale product, it is preferably less than 1 mg, more preferably less than 0.1 mg, and even more preferably less than 0.02 mg. The sinigrin contents per 1 g of kale-derived solids of conventional processed kale products are at least 2 mg, and the sinigrin content of the processed kale product of the present invention is lower compared to the conventional processed kale products. Sinigrin is a glucosinolate, and produces a pungent component when in contact with oxygen. The pungent component is one of causes of the grassy smell of processed kale products. Therefore, the low sinigrin content in the processed kale product is considered to contribute to the good taste and flavor of the processed kale product.

The sinigrin content in the processed kale product is measured by HPLC following a method described in Examples mentioned below.

[0012]

The progoitrin content per 1 g of kale-derived solids of the processed kale product of the present invention is not particularly limited, but in terms of the effect on a living body, it is preferably less than 0.1 mg, and more preferably less than 0.02 mg. The progoitrin contents per 1 g of kale-derived solids of conventional processed kale products are at least 0.2 mg, and the progoitrin content in the processed kale product of the present invention is lower than the conventional processed kale products. Progoitrin is reported to be associated with the incidence of enlargement of the thyroid gland or a goiter, and a lower content thereof is desirable.

The progoitrin content in the processed kale product is measured by HPLC following a method described in Examples mentioned below.

[0013]

The processed kale product of the present invention is manufactured from kale having undergone a blanching treatment as a starting material. In general, even a processed kale product manufactured from kale having undergone a blanching treatment as a starting material has a grassy smell or the like, but the processed kale product of the present invention have good taste and flavor.

[0014]

With respect to the temperature and time of the blanching treatment, the heating is preferably conducted under a condition where the relationship between the temperature (y : °C) and time (x : min) are shown in the following expression, in terms of the glucoraphanin content, odor and appearance of the processed kale product.

[0015]

(Expression 1)

when $1 \leq x \leq 5$, $-2.5x + 92.5 \leq y \leq 100$

when $5 < x \leq 10$, $-2.5x + 92.5 \leq y \leq -3x + 110$

[0016]

Moreover, a more preferable heating condition is a condition of the following expression, in terms of the glucoraphanin content of the processed kale product.

[0017]

(Expression 2)

when $1 \leq x \leq 5$, $-1.25x + 96.25 \leq y \leq 100$

[0018]

These heating conditions are derived from Examples mentioned below.

[0019]

The blanching method is not particularly limited, and examples thereof include steaming treatment and heat treatment in water (boiling treatment). In the case of steaming treatment, a variation in exposure to steam is easily caused in a state where steam flows

unsatisfactorily, and so called "uneven steaming" occurs. Thus, uniform blanching treatment is difficult in some cases, and for this reason, heat treatment in water is more preferred. In the case of heating kale in water, the amount of kale charged based on the weight of water is not particularly limited, and any ratio may be used as long as the heating can be conducted uniformly. In the heat treatment in water, an alkaline agent may be added to water as a pH modifier, such as sodium citrate, sodium ascorbate, sodium lactate, calcium hydroxide, sodium hydroxide, sodium carbonate, and sodium hydrogen carbonate. The pH of water for the heat treatment in water is not particularly limited, but it is preferably a pH of 6 to 9, since the degradation of chlorophyll in kale is accelerated under a strong acidic condition, so that the color tone of the processed kale product is deteriorated.

[0020]

Kale after the blanching treatment is preferably rapidly cooled in terms of the color tone. Examples of the cooling means include natural cooling, and a method using a coolant such as ice and water.

[0021]

For the processed kale product of the present invention, a whole plant of kale may be used as a starting material, or a part thereof such as the leaf, stem, root, and flower bud may be used, but the stem

and/or leaf is preferably used in view of the color tone and nutritional value. The kale used as a starting material is kale having undergone a blanching treatment. Note that when kale having undergone no blanching treatment is used as a starting material, the glucoraphanin content per 1 g of kale-derived solids is less than 1 mg, and there are problems that the glucoraphanin content is lower and an unpleasant taste such as the grassy smell of kale is stronger compared to the case where kale having undergone a blanching treatment is used as a starting material.

[0022]

For the processed kale product of the present invention, Hyperle (MAFF Plant Variety Registration No. 20555) having undergone a blanching treatment is preferably used as a starting material in view of the glucoraphanin content and taste and flavor of the processed kale product, and the stem and/or leaf of Hyperle having undergone a blanching treatment is more preferably used as a starting material. Hyperle is a kale variety (*Brassica oleracea* L. convar. *acephala* (DC.) Alef. var. *sabellica* L.).

[0023]

Examples of the form of the processed kale product of the present invention include a shredded composition, a crushed composition, and a squeezed juice composition, and the squeezed juice composition is preferred in view

of the ease of drinking. After kale is blanched, a shredding treatment, a crushing treatment, or a juice squeezing treatment may be conducted. The shredded composition, crushed composition, squeezed juice composition or the like may be as it is, but it is preferably powdered by such means as hot-air drying, spray drying, and freeze-drying in terms of preservation. In particular, spray drying is preferred as a drying method, since deterioration caused by heat is smaller compared to hot-air drying, and the drying time is shorter compared to freeze-drying.

[0024]

The processed kale product of the present invention may be subjected to a sterilization treatment as needed. The method of the sterilization treatment is not particularly limited, and an example thereof includes sterilization using a plate heat exchanger. Also, the condition thereof may be set as appropriate.

Examples

[0025]

The present invention will be described specifically using Examples below, but the present invention is not limited to these Examples.

Evaluation methods in the Examples are as follows.

(Evaluation methods)

(1) The measurement of glucosinolates

The quantification of glucosinolates (hereinafter sometimes referred to as GSLs, and specifically glucoraphanin, progoitrin, and sinigrin) was performed as follows. To a Falcon tube (15 mL), 1 mL (around 1000 mg) of a sample (squeezed kale juice, or a dried product thereof dissolved in water) was precisely weighed out. 9 mL of 0.1% formic acid solution (where 1 mL of formic acid was mixed with 80% methanol aqueous solution to give a total volume of 1 L) was added to the sample, and the mixture was suspended by vortexing. The suspension was centrifuged (2,100 g, 15 min), and the supernatant was separated to obtain a specimen.

A solid-phase extraction column (OasisTM WAX 1cc Cartridge 30mg Sorbent per Cartridge 30 μ m Particle size, Waters Corporation) was activated with 1 mL of methanol, and equilibrated with 1 mL of 0.1% formic acid aqueous solution (where 1 mL of formic acid was mixed with water to make a total volume of 1 L), and 100 μ L of the previously prepared specimen was adsorbed on the column, then the column was washed with 1 mL of 0.1% formic acid aqueous solution and then 1 mL of methanol. The fraction adsorbed on the column was eluted with 1 mL of 5% ammonia solution (where 28% ammonia water was diluted with methanol), concentrated under a reduced pressure with an evaporator, and then dried to solid under a reduced pressure in a desiccator. To the dried solid, 300 μ L of 0.1% formic acid aqueous solution was added to redissolve

the dried solid, and the resultant was transferred to a vial with a filter, and the filtered product was used as a sample for the analysis.

The analysis is performed using HPLC-Prominence (Shimadzu Corporation) on the following conditions. The injection amount is 10 μ L.

Note that the kale-derived solids of the squeezed juice are calculated by drying the squeezed juice, evaporating the water content, then measuring the mass after drying.

<Analysis condition>

Column: Develosil RPAQUEOUS AR-5 (Nomura Chemical, ϕ 4.6 $\times$ 250 mm)

Mobile phase A: 10 mM ammonium formate aqueous solution (pH 3.75)

Mobile phase B: 10 mM ammonium formate in 90% (v/v) acetonitrile/water (pH 3.75)

Flow rate: 1 mL/min

Column oven temperature: 40°C

Mobile phase gradient:	min	A	B
	0	100	0
	10	100	0
	12	0	100
	17	0	100
	17.1	100	0
	30	100	0

Detector: UV detector

Detector voltage: 100 V

Wavelength: 226 nm

Measurement time: 30 min

The quantification of GSLs was performed by comparing the peak area corresponding to GSLs of the analysis data with the peak area of standard GSLs.

[0026]

(2) Measurement with a taste sensing system

As a taste sensing system, SA402B (Intelligent Sensor Technology, Inc.) was used. Bitterness, which is a characteristic unpleasant taste of kale, was selected as a parameter, and comparison was performed. A lower value of bitterness indicates less bitterness. "Initial taste of bitterness" is an index of bitterness felt at the moment when a sample is put in the mouth, and "aftertaste of bitterness" is an index of bitterness which appears as an aftertaste.

[0027]

(3) Sensory evaluation

As the measurement method in sensory evaluation, evaluation by panelists was performed. Note that evaluation criteria are described below respective tables.

[0028]

Example 1(study on blanching condition)

Raw leaves of kale (Hyperle: MAFF Plant Variety Registration No. 20555, planted in April, harvested in November) was washed with water, heat-treated in a hot

bath following each blanching condition, and then cooled in a water bath. The cooled kale was cut, crushed with Millser (Iwatani Corporation: IFM-600D) for 1 minute, and then homogenized with a homogenizing mixer (Tokushu Kika Kogyo Co., Ltd.: TK HOMOMIXER MARK II) at 12,000 rpm for 5 minutes. This crushed kale product was filtered with a 16-mesh sieve, and the kale-derived solids in the filtrate was adjusted to 2% w/w with ion exchange water to give a squeezed juice sample.

With respect to the obtained squeezed juice sample, the quantification of glucosinolates and sensory evaluation were performed following the above methods. The results are shown in Tables 1 to 4.

[0029]

[Table 1]

Glucoraphanin measurement results (mg/1 g of kale-derived solids)

Blanching condition	1 min	5 min	10 min
80°C	0.16	3.6	3.6
85°C	0.15	5.0	8.0
90°C	5.5	8.5	11
95°C	7.5	7.5	7.0
98°C	7.0	7.5	6.5

[0030]

Under the blanching condition at 80°C for 1 min or at 85°C for 1 min, the content of glucoraphanin was less than 1 mg per 1 g of kale-derived solids, but under the

other conditions, the content was 1 mg or more per 1 g of kale-derived solids.

[0031]

[Table 2]

Sensory evaluation results (odor)

Blanching condition	1 min	5 min	10 min
80°C	b	b	b
85°C	b	b	c
90°C	b	b	c
95°C	b	b	c
98°C	b	b	c

(Odor)

- a No heated smell (burnt smell)
- b Slight heated smell (burnt smell)
- c Heated smell (burnt smell)
- d Intense heated smell (burnt smell)

[0032]

Under the blanching conditions at 85 to 98°C, for 10 min, heated smell was observed, but on the other conditions, heated smell was not observed.

[0033]

[Table 3]

Sensory evaluation results (bitterness/astringency)

Blanching condition	1 min	5 min	10 min
80°C	b	b	b
85°C	b	b	b
90°C	b	b	b
95°C	b	b	b
98°C	b	b	b

(Bitterness/astringency)

- a No bitterness/astringency
- b Slight bitter/astringent
- c Bitter/astringent
- d Very bitter/astringent

[0034]

Under all blanching conditions performed, the bitterness and astringency was slight.

[0035]

[Table 4]

Sensory evaluation results (appearance)

Blanching condition	1 min	5 min	10 min
80°C	a	a	b
85°C	a	b	c
90°C	b	b	c
95°C	b	b	c
98°C	b	b	c

(Appearance)

- a Original green color of kale remained
- b The green color faded to some extent
- c The green color faded into almost yellow-green
- d The green color faded into yellow-green

[0036]

In the case of blanching at 85 to 98°C for 10 min, the green color faded into almost yellow-green, and the appearance was poor. Under the other conditions, the appearance was good.

[0037]

From the results in Tables 1 to 4, blanching conditions where the glucoraphanin content is at least 1 mg per 1 g of kale-derived solids, and the evaluations of the odor, bitterness/astringency and appearance are each b or a were, in the case of heating time of 1 min, 90°C to 98°C, and in the case of 5 min, 80°C to 98°C, and in the case of 10 min, 80°C. These results are as shown in Table 5, and based on Table 5, preferred blanching conditions are calculated to be Expression 1.

[0038]

[Table 5]

Blanching condition	1 min	5 min	10 min
80°C	d	b	b
85°C	d	b	d
90°C	b	b	d
95°C	b	b	d
98°C	b	b	d

b The glucoraphanin content is at least 1 mg per 1 g of kale-derived solids, and the evaluations of the odor, bitterness/astringency and appearance are each b or a.

d The glucoraphanin content is less than 1 mg per 1 g of kale-derived solids, or at least one of the evaluations of the odor, bitterness/astringency, appearance is c or d.

[0039]

(Expression 1)

when $1 \leq x \leq 5$, $-2.5x + 92.5 \leq y \leq 100$

when $5 < x \leq 10$, $-2.5x + 92.5 \leq y \leq -3x + 110$

(x: Time (min), y: Temperature (°C))

[0040]

Moreover, blanching conditions where the glucoraphanin content is at least 7 mg per 1 g of kale-derived solids, and the evaluations of the odor, bitterness/astringency and appearance are each b or a were, in the case of the heating time of 1 min, 95°C to 98°C, and in the case of 5 min, 90°C to 98°C. These results are as shown in Table 6, and based on Table 6, preferred blanching conditions are calculated to be Expression 2.

[0041]

[Table 6]

Blanching condition	1 min	5 min	10 min
80°C	d	d	d
85°C	d	d	d
90°C	d	b	d
95°C	b	b	d
98°C	b	b	d

b The glucoraphanin content is at least 7 mg per 1 g of kale-derived solids, and the evaluations of the odor, bitterness/astringency and appearance are each b or a.

d The glucoraphanin content is less than 7 mg per 1 g of kale-derived solids, or at least one of the evaluations of the odor, bitterness/astringency and the evaluation of appearance is c or d.

[0042]

(Expression 2)

when $1 \leq x \leq 5$, $-1.25x + 96.25 \leq y \leq 100$

(x: Time (min), y: Temperature (°C))

[0043]

Example 2 (difference between varieties)

Raw leaves of each kale (Hyperle: MAFF Plant Variety Registration No. 20555, planted in April, harvested in November, Hi-Crop: Takii & Co., Ltd., Esthe: Sakata Seed Corporation, these 2 varieties were planted in August, and harvested in November) were washed with water, heat-treated in a hot bath of 90°C for 3 minutes, and then cooled in a water bath. The cooled kale was cut, crushed with Millser (Iwatani Corporation: IFM-600D) for 1 minute, and then homogenized with a homogenizing mixer (Tokushu Kika Kogyo Co., Ltd.: TK HOMOMIXER MARK II) at 12,000 rpm for 5 minutes. This crushed kale product was filtered with a 16-mesh sieve, and the kale-derived solids in the filtrate were adjusted to 2% w/w with ion exchange water to give a squeezed juice sample.

With respect to the obtained squeezed juice sample, the quantification of glucosinolates, evaluation with the taste sensing system, and sensory evaluation were performed following the above methods. The results are shown in Tables 7 to 9.

[0044]

[Table 7]

Glucosinolates measurement results (mg/1 g of kale-derived solids)

	Glucoraphanin	Progoitrin	Sinigrin
Hyperle	5.0	ND	ND
Hi-Crop	0.59	0.33	2.8
Esthe	0.21	4.6	2.8

ND: Not Detected (the detection limit was 0.025 mg/1 g of kale-derived solids)

[0045]

Hyperle had a higher glucoraphanin content compared to the other varieties of kale, and progoitrin and sinigrin were not detected therein. On the other hand, Hi-Crop and Esthe had glucoraphanin contents of less than 1 mg per 1 g of kale-derived solids, and sinigrin contents of 1 mg or more per 1 g of kale-derived solids. Also, the progoitrin contents thereof were 0.1 mg or more per 1 g of kale-derived solids.

[0046]

[Table 8]

Measurement results with the taste sensing system (taste differences when the value of Hyperle is set to 0)

	Initial taste of bitterness	Aftertaste of bitterness
Hyperle	0.00	0.00
Hi-Crop	1.21	0.21
Esthe	0.96	0.04

[0047]

Taking Hyperle as a standard, green juice made from Hi-Crop or Esthe as a starting material had stronger bitterness.

[0048]

[Table 9]

Sensory evaluation results

	Odor	Bitterness/astringency
Hyperle	b	b
Hi-Crop	c	c
Esthe	c	c

(Odor)

- a No grassy smell
- b Slight grassy smell
- c Grassy smell
- d Intense grassy smell

(Bitterness/astringency)

- a No bitterness/astringency
- b Slight bitter/astringent
- c Bitter/astringent
- d Very bitter/astringent

[0049]

Also in the sensory evaluation, green juice made from Hyperle as a starting material had slight grassy smell and bitterness/astringency, and a superior taste and flavor.

[0050]

Example 3 (powdered green juice)

Raw leaves of kale (Hyperle: MAFF Plant Variety Registration No. 20555, planted in March, harvested in November) were washed with water, heat-treated in a hot bath of 98°C for 2 minutes, and then cooled in a water bath. The cooled kale was crushed with a crushing pump (Sekiguchi Mfg Co.,Ltd.: SS-001), and then squeezed with a screw press (VETTER: DV) to give squeezed juice. The squeezed juice was sterilized with a plate heat exchanger at 117°C for 35 seconds. To the squeezed juice, added was 1.5 parts by weight of dextrin based on 1 part by weight of kale-derived solids, and the mixture was spray dried with a spray dryer (Sanyo Co.,Ltd.: SC-600) to give a powder sample.

With respect to the obtained powder sample dissolved in ion exchange water so that the concentration was 4% w/w, the quantification of glucosinolates, and sensory evaluation were performed following the above methods. The results are shown in Table 10 and Table 11.

[0051]

[Table 10]

Glucosinolates measurement results (mg/1 g of kale-derived solids)

	Glucoraphanin	Progoitrin	Sinigrin
Hyperle	9.3	ND	ND

ND: Not Detected (the detection limit was 0.025 mg/1 g of kale-derived solids)

[0052]

The powdered green juice of Hyperle had a glucoraphanin content of 1 mg or more per 1 g of kale-derived solids, and progoitrin and sinigrin were not detected therein.

[0053]

[Table 11]

Sensory testing results

	Odor	Bitterness/astringency
Hyperle	b	b

(Odor)

- a No grassy smell
- b Slightly grassy smell
- c Grassy smell
- d Intense grassy smell

(Bitterness/astringency)

- a No bitterness/astringency
- b Slight bitter/astringent
- c Bitter/astringent
- d Very bitter/astringent

[0054]

The powdered green juice of Hyperle had no grassy smell or bitterness/astringency, and had a good taste and flavor.

Claims

[Claim 1]

A processed kale product manufactured from kale having undergone a blanching treatment as a starting material, the processed kale product having a glucoraphanin content of at least 1 mg per 1 g of kale-derived solids.

[Claim 2]

The processed kale product according to claim 1, wherein the processed kale product has a sinigrin content of less than 1 mg per 1 g of kale-derived solids.

[Claim 3]

The processed kale product according to claim 1 or 2, wherein the processed kale product has a progoitrin content of less than 0.1 mg per 1 g of kale-derived solids.

[Claim 4]

The processed kale product according to any one of claims 1 to 3, wherein the blanching treatment is conducted under a condition satisfying Expression 1 below:

(Expression 1)

when $1 \leq x \leq 5$, $-2.5x + 92.5 \leq y \leq 100$

when $5 < x \leq 10$, $-2.5x + 92.5 \leq y \leq -3x + 110$

where x: Time (min), and y: Temperature (°C).

[Claim 5]

The processed kale product according to any one of claims 1 to 4, wherein the blanching treatment is conducted under a condition satisfying Expression 2 below:

(Expression 2)

$$\text{when } 1 \leq x \leq 5, -1.25x + 96.25 \leq y \leq 100$$

where x: Time (min), and y: Temperature (°C).

[Claim 6]

The processed kale product according to any one of claims 1 to 5, wherein the processed kale product is a squeezed kale juice composition.

[Claim 7]

The processed kale product according to any one of claims 1 to 6, wherein the kale is Hyperle (MAFF (the Japanese Ministry of Agriculture, Forestry and Fisheries) Plant Variety Registration No. 20555).

[Claim 8]

A method for manufacturing a processed kale product having a glucoraphanin content of at least 1 mg per 1 g of kale-derived solids, the method comprising conducting a blanching treatment of kale.

[Claim 9]

The method for manufacturing a processed kale product according to claim 8, wherein the processed kale product has a sinigrin content of less than 1 mg per 1 g of kale-derived solids.

[Claim 10]

The method for manufacturing a processed kale product according to claim 8 or 9, wherein the processed kale product has a progoitrin content of less than 0.1 mg per 1 g of kale-derived solids.

[Claim 11]

The method for manufacturing a processed kale product according to any one of claims 8 to 10, wherein the blanching treatment is conducted under a condition satisfying Expression 1 below:

(Expression 1)

$$\text{when } 1 \leq x \leq 5, -2.5x + 92.5 \leq y \leq 100$$

$$\text{when } 5 < x \leq 10, -2.5x + 92.5 \leq y \leq -3x + 110$$

where x: Time (min), and y: Temperature (°C).

[Claim 12]

The method for manufacturing a processed kale product according to any one of claims 8 to 11, wherein the blanching treatment is conducted under a condition satisfying Expression 2 below:

(Expression 2)

$$\text{when } 1 \leq x \leq 5, -1.25x + 96.25 \leq y \leq 100$$

where x: Time (min), and y: Temperature (°C).

[Claim 13]

The method for manufacturing a processed kale product according to any one of claims 8 to 12, wherein the kale is Hyperle (MAFF Plant Variety Registration No. 20555).