processing raw materials containing pulverized pulse under specific conditions. Based on these findings, the inventors then proceeded with further research, and have completed the following inventions.

[0008]

Specifically, aspects of the present invention include Aspects [1] to [39] below.

[Aspect 1]

A solid paste composition for heat cooking comprising pulse, wherein:

(1) the composition has an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher;

(2) the composition has a starch content on a dry mass basis of 10 % by mass or higher;

(3) the composition has a protein content on a dry mass basis of 4 % by mass or higher; and

(4) when of the composition is isothermally treated in a 40-fold volume of water at 90 °C for 5 minutes, the resultant water has a haze value of 25 % or lower.

[Aspect 1a]

A solid paste composition for heat cooking comprising pulse, wherein:

the composition has an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher and 40 % by mass or lower;

(2) the composition has a starch content on a dry mass basis of 10 % by mass or higher and 60 % by mass or lower;

(3) the composition has a protein content on a dry mass basis of 4 % by mass or higher and 40 % by mass or lower; and

(4) when the composition is isothermally treated in a 40-fold volume of water at 90 °C for 5 minutes, the resultant water has a haze value of 25 % or lower as measured with a sample adjusted to 20 °C and placed in a quartz cell with an optical path length of 5 mm, using distilled water as a control,

wherein the solid paste composition is produced by a method comprising the steps of:

(i) preparing a paste dough composition containing pulverized pulse so as to have an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher and 40 % by mass or lower, a starch content on a dry mass basis of 10 % by mass or higher and 60 % by mass or lower, and a protein content on a dry mass basis of 4 % by mass or higher and 40 % by mass or lower;

(ii) kneading the composition from step (i) at a temperature of within a range of from 100 °C to 200 °C and under a condition with a specific mechanical energy (SME) of 350 kJ/kg or higher; and

(iii) cooling the composition from step (ii) to 110 °C or lower,

wherein step (ii) and step (iii) are carried out under a pressurized condition where a

pressure of 0.1 MPa or higher is applied.

[Aspect 2]

The composition as defined in Aspect 1, wherein:

(5) when the composition is treated in a 10-fold volume of iodine solution (0.25 mM) for 5 minutes at 20 °C and then filtered through a 0.20 μm filter to obtain a filtrate, the difference between the absorbance (500 nm) of the filtrate and the absorbance (500 nm) of iodine solution (0.25 mM) is 0.35 or lower.

[Aspect 3]

The composition as defined in Aspect 1 or 2, wherein:

(6) the composition has a total oil and fat content on a dry mass basis of lower than 17 % by mass.

[Aspect 4]

The composition as defined in any one of Aspects 1 to 3, wherein:

(7) the composition has a moisture content on a dry mass basis of 50 % by mass or lower.

[Aspect 5]

The composition as defined in any one of Aspects 1 to 4, wherein:

the composition does not contain native gluten.

[Aspect 6]

The composition as defined in any one of Aspects 1 to 5, wherein:

when the composition is subjected to Treatment A below and then to ultrasonication, the resultant composition has a particle size distribution represented by a d_{90} value of 1000 μm or smaller.

[Treatment A] A suspension of 6 % by mass of the composition in water is treated with 0.4 % by volume of protease and 0.02 % by mass of α-amylase at 20 °C for 3 days.

[Aspect 7]

The composition as defined in any one of Aspects 1 to 6, wherein:

the composition has a ratio of a pulse-derived starch content to a total starch content in the composition of 10 % by mass or higher on a dry mass basis.

[Aspect 8]

The composition as defined in any one of Aspects 1 to 7, wherein:

the pulse comprises one or more species of pulse selected from Pisum, Phaseolus, Cajanus, Vigna, Vicia, Cicer, and Lens species.

[Aspect 9]

A crushed composition prepared by crushing a composition as defined in any one of Aspects 1 to 8.

[Aspect 10]

A crushed composition agglomerate prepared by agglomerating a crushed composition as defined in Aspect 9.

[Aspect 11]

A method of producing a solid paste composition for heat cooking containing pulse, comprising the steps of:

(i) preparing a paste dough composition containing pulverized pulse so as to have an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher, a starch content on a dry mass basis of 10 % by mass or higher, and a protein content on a dry mass basis of 4 % by mass or higher;

(ii) kneading the composition from step (i) at a temperature of within a range of from 100 °C to 200 °C ; and

(iii) cooling the composition from step (ii) to a temperature at which the composition does not swell.

[Aspect 11a]

A method of producing a solid paste composition for heat cooking containing pulse, comprising the steps of:

(i) preparing a paste dough composition containing pulverized pulse so as to have an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher and 40% by mass or lower, a starch content on a dry mass basis of 10 % by mass or higher and 60% by mass or lower, and a protein content on a dry mass basis of 4 % by mass or higher and 40% by mass or lower;

(ii) kneading the composition from step (i) at a temperature of within a range of from 100 °C to 200 °C and under a condition with a specific mechanical energy (SME) of 350 kJ/kg or higher; and

(iii) cooling the composition from step (ii) to 110 °C or lower,

wherein step (ii) and step (iii) are carried out under a pressurized condition where a pressure of 0.1 MPa or higher is applied.

[Aspect 12]

The method as defined in Aspect 11, further comprising, after step (iii), the step of:

(iv) subjecting the composition from step (iii) to a moist treatment in an environment

where the relative humidity (RH%) of the atmosphere is over 50 RH%.

[Aspect 13]

The method as defined in Aspect 12, wherein:

the moist treatment in step (iv) is carried out under a condition which satisfies Formula 1 below:

$$A \times T \geqq 40 \quad \text{(Formula 1)}$$

where A represents a relative humidity (RH%) of the atmosphere, and T represents the treating time of the moist treatment (hr), provided that A > 50RH%.

[Aspect 14]

The method as defined in any one of Aspects 11 to 13, wherein:

step (ii) and/or step (iii) is carried out under a pressurized condition.

[Aspect 15]

The method as defined in Aspect 14, wherein:

the pressurized condition is a condition where a pressure of 0.1 MPa or higher is applied.

[Aspect 16]

(i) preparing a paste dough composition containing pulverized pulse so as to have an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher, a starch content on a dry mass basis of 10 % by mass or higher, and a protein content on a dry mass basis of 4 % by mass or higher;
(ii) kneading the composition from step (i) at a temperature of within a range of from 100 °C to 200 °C ; and
(iii) cooling the composition from step (ii) to a temperature at which the composition does not swell.

[Aspect 26a]

A method of improving a quality of a solid paste composition for heat cooking containing pulse, comprising the steps of:
(i) preparing a paste dough composition containing pulverized pulse so as to have an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher and 40% by mass or lower, a starch content on a dry mass basis of 10 % by mass or higher and 60% by mass or lower, and a protein content on a dry mass basis of 4 % by mass or higher and 40% by mass or lower;
(ii) kneading the composition from step (i) at a temperature of within a range of from 100 °C to 200 °C and under a condition wiht a specific mechanical energy (SME) of 350 kJ/kg or higher; and
(iii) cooling the composition from step (ii) to 110 °C or lower,

wherein step (ii) and step (iii) are carried out under a pressurized condition where a pressure of 0.1 MPa or higher is applied.

[Aspect 27]

The method as defined in Aspect 26, further comprising, after step (iii), the step of:
(iv) subjecting the composition from step (iii) to a moist treatment in an environment where the relative humidity (RH%) of the atmosphere is over 50 RH%.

[Aspect 28]

The method as defined in Aspect 27, wherein:

the moist treatment in step (iv) is carried out under a condition which satisfies Formula 1 below:

$$A \times T \geqq 40 \quad \text{(Formula 1)}$$

where A represents a relative humidity (RH%) of the atmosphere, and T represents the treating time of the moist treatment (hr), provided that A > 50RH%.

[Aspect 29]

The method as defined in any one of Aspects 26 to 28, wherein:

step (ii) and/or step (iii) is carried out under a pressurized condition.

[Aspect 30]

The method as defined in Aspect 29, wherein:

the pressurized condition is a condition where a pressure of 0.1 MPa or higher is applied.

[Aspect 31]

The method as defined in any one of Aspects 26 to 30, wherein:

when the pulverized pulse used in step (i) is subjected to Treatment A below and then to ultrasonication, the resultant composition has a particle size distribution represented by a d_{90} value of 1000 μm or smaller.

[Treatment A] A suspension of 6 % by mass of the pulverized pulse in water is treated with 0.4 % by volume of protease and 0.02 % by mass of α-amylase at 20 °C for 3 days.

[Aspect 32]

The method as defined in any one of Aspects 26 to 31, wherein:

the kneading in step (ii) is carried out under a condition with a specific mechanical energy (SME) of 350 kJ/kg or higher.

[Aspect 33]

The method as defined in any one of Aspects 26 to 32, wherein:

step (ii) and/or step (iii) are/is carried out using an extruder.

[Aspect 34]

[Table 4-4]

	Measurements of Composition			Elution of insoluble components	
	Total fat and oil (% by mass)	Salt equivalent (% by mass)	Water content (% by mass)	Appearance	Haze value (%)
Comparative Example 5	5	0	6	Turbidity observed	25.8
Example 28	5	0	6	−	4.5
Example 29	5	0	6	−	8.0
Example 30	2	0	7	Slight turbidity observed	21.9
Example 31	2	0	7	−	9.7
Example 32	2	0	7	−	5.7
Comparative Example 6	2	0	8	Turbidity observed	85.4
Example 33	2	0	8	−	13.2
Example 34	2	0	8	−	10.5
Example 35	2	0	8	−	4.5
Comparative Example 7	2	0	9	Turbidity observed	25.6
Example 36	2	0	9	−	8.5
Example 37	2	0	9	−	4.8
Example 13	3	0	5	Turbidity observed	38.0
Example 14	3	0	5	−	1.6
Example 15	3	0	5	Turbidity observed	27.0

CLAIMS

[Claim 1]

A solid paste composition for heat cooking comprising pulse, wherein:

(1) the composition has an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher and 40 % by mass or lower;

(2) the composition has a starch content on a dry mass basis of 10 % by mass or higher and 60 % by mass or lower;

(3) the composition has a protein content on a dry mass basis of 4 % by mass or higher and 40 % by mass or lower; and

(4) when the composition is isothermally treated in a 40-fold volume of water at 90 ℃ for 5 minutes, the resultant water has a haze value of 25 % or lower as measured with a sample adjusted to 20 ℃ and placed in a quartz cell with an optical path length of 5 mm, using distilled water as a control,

wherein the solid paste composition is produced by a method comprising the steps of:

(i) preparing a paste dough composition containing pulverized pulse so as to have an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher and 40 % by mass or lower, a starch content on a dry mass basis of 10 % by mass or higher and 60 % by mass or lower, and a protein content on a dry mass basis of 4 % by mass or higher and 40 % by mass or lower;

(ii) kneading the composition from step (i) at a temperature of within a range of from 100 ℃ to 200 ℃ and under a condition with a specific mechanical energy (SME) of 350 kJ/kg or higher; and

(iii) cooling the composition from step (ii) to 110 ℃ or lower,

wherein step (ii) and step (iii) are carried out under a pressurized condition where a pressure of 0.1 MPa or higher is applied.

[Claim 2]

The composition as defined in claim 1, wherein:

(5) when the composition is treated in a 10-fold volume of iodine solution (0.25 mM) for 5 minutes at 20 ℃ and then filtered through a 0.20 μm filter to obtain a filtrate, the difference between the absorbance (500 nm) of the filtrate and the absorbance (500 nm) of iodine solution (0.25 mM) is 0.35 or lower.

[Claim 3]

The composition as defined in claim 1 or 2, wherein:

(6) the composition has a total oil and fat content on a dry mass basis of lower than 17 % by mass.

[Claim 4]

The composition as defined in any one of claims 1 to 3, wherein:

(7) the composition has a moisture content on a dry mass basis of 50 % by mass or lower.

[Claim 5]

The composition as defined in any one of claims 1 to 4, wherein:

the composition does not contain native gluten.

[Claim 6]

The composition as defined in any one of claims 1 to 5, wherein:

when the composition is subjected to Treatment A below and then to ultrasonication, the resultant composition has a particle size distribution represented by a d_{90} value of 1000 μm or smaller.

[Treatment A] A suspension of 6 % by mass of the composition in water is treated with 0.4 % by volume of protease and 0.02 % by mass of α-amylase at 20 °C for 3 days.

[Claim 7]

The composition as defined in any one of claims 1 to 6, wherein:

the composition has a ratio of a pulse-derived starch content to a total starch content in the composition of 10 % by mass or higher on a dry mass basis.

[Claim 8]

The composition as defined in any one of claims 1 to 7, wherein:

the pulse comprises one or more species of pulse selected from Pisum, Phaseolus, Cajanus, Vigna, Vicia, Cicer, and Lens species.

[Claim 9]

A crushed composition prepared by crushing a composition as defined in any one of claims 1 to 8.

[Claim 10]

A crushed composition agglomerate prepared by agglomerating a crushed composition as defined in claim 9.

[Claim 11]

A method of producing a solid paste composition for heat cooking containing pulse, comprising the steps of:

(i) preparing a paste dough composition containing pulverized pulse so as to have an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher and 40 % by

mass or lower, a starch content on a dry mass basis of 10 % by mass or higher and 60 % by mass or lower, and a protein content on a dry mass basis of 4 % by mass or higher and 40 % by mass or lower;

(ii) kneading the composition from step (i) at a temperature of within a range of from 100 °C to 200 °C and under a condition with a specific mechanical energy (SME) of 350 kJ/kg or higher; and

(iii) cooling the composition from step (ii) to 110 °C or lower,

wherein step (ii) and step (iii) are carried out under a pressurized condition where a pressure of 0.1 MPa or higher is applied.

[Claim 12]

The method as defined in claim 11, further comprising, after step (iii), the step of:

(iv) subjecting the composition from step (iii) to a moist treatment in an environment where the relative humidity (RH%) of the atmosphere is over 50 RH%.

[Claim 13]

The method as defined in claim 12, wherein:

the moist treatment in step (iv) is carried out under a condition which satisfies Formula 1 below:

$$A \times T \geqq 40 \quad \text{(Formula 1)}$$

where A represents a relative humidity (RH%) of the atmosphere, and T represents the treating time of the moist treatment (hr), provided that A > 50RH%.

[Claim 14]

The method as defined in any one of claims 11 to 13, wherein:

when the pulverized pulse used in step (i) is subjected to Treatment A below and then to ultrasonication, the resultant composition has a particle size distribution represented by a d_{90} value of 1000 μm or smaller.

[Treatment A] A suspension of 6 % by mass of the pulverized pulse in water is treated with 0.4 % by volume of protease and 0.02 % by mass of α-amylase at 20 °C for 3 days.

[Claim 15]

The method as defined in any one of claims 11 to 14, wherein:

step (ii) and/or step (iii) are/is carried out using an extruder.

[Claim 16]

The method as defined in claim 15, wherein:

the extruder is a uniaxial extruder or a biaxial extruder.

[Claim 17]

The method as defined in claim 15 or 16, wherein:

the ratio of the length of a flight screw part to the total length of a barrel of the extruder is 95 % or lower.

[Claim 18]

The method as defined in any one of claims 11 to 17, wherein:

the kneading time in step (ii) is within a range of from 0.1 to 60 minutes.

[Claim 19]

The method as defined in any one of claims 11 to 18, wherein:

the cooling temperature in step (iii) is 95 ℃ or lower.

[Claim 20]

The method as defined in any one of claims 11 to 19, wherein:

the method further comprises, after step (iii), the step of:

(v) crushing the composition to produce a crushed composition step.

[Claim 21]

The method as defined in claim 20, wherein:

the method further comprises, after step (v), the step of:

(vi) agglomerating the crushed composition to produce a crushed composition agglomerate.

[Claim 22]

A method of improving a quality of a solid paste composition for heat cooking containing pulse, comprising the steps of:

(i) preparing a paste dough composition containing pulverized pulse so as to have an insoluble dietary fiber content on a dry mass basis of 3 % by mass or higher and 40 % by mass or lower, a starch content on a dry mass basis of 10 % by mass or higher and 60 % by mass or lower, and a protein content on a dry mass basis of 4 % by mass or higher and 40 % by mass or lower;

(ii) kneading the composition from step (i) at a temperature of within a range of from 100 ℃ to 200 ℃ and under a condition with a specific mechanical energy (SME) of 350 kJ/kg or higher; and

(iii) cooling the composition from step (ii) to 110 ℃ or lower,

wherein step (ii) and step (iii) are carried out under a pressurized condition where a pressure of 0.1 MPa or higher is applied.

[Claim 23]

The method as defined in claim 22, further comprising, after step (iii), the step of:

(iv) subjecting the composition from step (iii) to a moist treatment in an environment where the relative humidity (RH%) of the atmosphere is over 50 RH%.

[Claim 24]

The method as defined in claim 23, wherein:

the moist treatment in step (iv) is carried out under a condition which satisfies Formula 1 below:

$$A \times T \geqq 40 \quad \text{(Formula 1)}$$

where A represents a relative humidity (RH%) of the atmosphere, and T represents the treating time of the moist treatment (hr), provided that A > 50RH%.

[Claim 25]

The method as defined in any one of claims 22 to 24, wherein:

when the pulverized pulse used in step (i) is subjected to Treatment A below and then to ultrasonication, the resultant composition has a particle size distribution represented by a d_{90} value of 1000 μm or smaller.

[Treatment A] A suspension of 6 % by mass of the pulverized pulse in water is treated with 0.4 % by volume of protease and 0.02 % by mass of α-amylase at 20 ℃ for 3 days.

[Claim 26]

The method as defined in any one of claims 22 to 25, wherein:

step (ii) and/or step (iii) are/is carried out using an extruder.

[Claim 27]

The method as defined in claim 26, wherein:

the extruder is a uniaxial extruder or a biaxial extruder.

[Claim 28]

The method as defined in claim 26 or 27, wherein:

the ratio of the length of a flight screw part to the total length of a barrel of the extruder is 95 % or lower.

[Claim 29]

The method as defined in any one of claims 22 to 28, wherein:

the kneading time in step (ii) is within a range of from 0.1 to 60 minutes.

[Claim 30]

The method as defined in any one of claims 22 to 29, wherein:

the cooling temperature in step (iii) is 95 ℃ or lower.

[Claim 31]

The method as defined in any one of claims 22 to 30, wherein:

the improvement of the quality comprises suppressing adhesivity of the composition and/or a decline in elasticity of the composition after heat cooking.