

The present invention relates to a powdery foaming agent having good stability which is suitable for cake and fry batters and premixes therefor.

Foaming agents formulated with an emulsifier are often used in the preparation of cake batter and fry batter and the foaming property thereof originates from α -crystals of monoglyceride. The α -crystals are thermodynamically unstable and, as they transfer to β' and β crystals in sequence, the foaming property gradually decreases. How to maintain the α -crystals for a long term has been a significant aim in the field of food improvers.

For cake batters, gel-like foaming agents, in which the α -crystals of monoglyceride are combined with other emulsifiers for foods, for example, propyleneglycol fatty acid ester, sorbitan fatty acid ester and sucrose fatty acid ester and which are stabilized in sorbitol, are routinely used. They have however drawbacks that the handling property is poor, the effect drops on strong agitation and the foaming property after being converted to a premix also decreases over time. On the other hand, with respect to powder-type foaming agents, various methods have been proposed (e.g. as described in Japanese Unexamined Patent Publication No. Sho 62-503021, Japanese Patent Publication No. Sho 63-472,

Japanese Unexamined Patent Publication No. Hei 176436 and Japanese Unexamined Patent Publication No. Hei 1-240134), but they have the drawback that the moisture in the raw material of premix, particularly in wheat flour, migrates to the side of powdery foaming agent to decrease the forming power in time, thus limiting the life to 12 months at 25°C at the longest. Storage of the premix by the user cannot be assumed to be under ideal conditions, hence stability under summer conditions of 30 to 35°C is required and the development of a powdery foaming agent with good stability has been desired.

As a result of diligent studies, the present inventors have developed a powdery foaming agent having easy handling property, which is capable of addition to cake and fry premixes and which has excellent foaming stability also at 30 to 35°C.

Thus, the invention provides a powdery foaming agent containing a saturated monoglyceride, saturated diglycerine monoester, lecithin and polyphosphate as essential ingredients which may be obtained by adding dextrin, sodium caseinate and water thereto and pulverizing by spray drying or with an extruder.

The saturated monoglyceride used in the present invention preferably comprises a saturated fatty acid

with 10 to 22 carbon atoms which preferably has 50% or more stearic acid as constituting fatty acid, further a distilled monoglyceride with a monoester purity of not lower than 90% is preferable.

The diglycerine monoester used in the invention has an increased monoester purity to an aimed level usually by molecular distillation technique after esterification reaction between diglycerine and saturated fatty acid or ester-exchange reaction between diglycerine and saturated triglyceride. The constituting fatty acid is saturated fatty acid with 10 to 22 carbon atoms which preferably has 50% or more stearic acid content, for which cost-effective fatty acid based on extremely hardened oil of tallow is often used.

According to liquid chromatography analysis, the monoester purity of the saturated diglycerine monoester used in the composition according to the invention is 65 to 95% and it contains 2 to 15% free diglycerine.

The lecithin used in the invention, which homogenizes monoglyceride and diglycerine monoester and affords the foaming property, implies one or more types of lecithins selected from soybean lecithin, yolk lecithin, fractionated lecithin thereof and enzymolysis lecithin, for which cost-effective soybean lecithin is usually used. The addition level is 0.5 to 4%, preferably 1 to 3%.

The polyphosphate may be one or more types of polyphosphate selected from sodium polyphosphate, sodium metaphosphate, sodium pyrophosphate, potassium polyphosphate, potassium metaphosphate and potassium pyrophosphate, which forms a colloid in aqueous solution and contributes to the foaming stability by sequestering metallic ions. In addition, it prevents the migration of moisture to the site of the powdery foaming agent and improves the stability of foaming power in the mix. The addition level is preferably 0.2 to 5%, most preferably 0.5 to 3% as regards taste.

The ingredient ratio of saturated monoglyceride to saturated diglycerine monoester in the emulsifier contained in the powdery foaming agent according to the invention is 1:0.5 to 1:5.5 and, if being out of this range, the foaming power would be insufficient and the stability over days would also be poor.

For producing the powdery foaming agent of the invention, sugars, for example, milk sugar, grape sugar, maltose and dextrin, sodium caseinate and polyphosphate are converted to an aqueous solution of 50 to 70°C, heat-molten saturated monoglyceride, saturated diglycerine monoester and lecithin are added to this to convert to an emulsion, and spray drying is performed to obtain a powder with a moisture content of 5% or less. Also, by continuously feeding the raw materials into a biaxial extruder for pressure

treatment, a good powdery foaming agent can be obtained.

The invention is further illustrated in the following examples and comparative examples.

Example 1

As the ingredients in the aqueous side, 38 parts of dextrin, 25 parts of milk sugar, 3 parts of sodium caseinate and 1 part of polyphosphate (Takeda Chemical Industries Ltd., Polyphosphoric acid 1-D) were dissolved in 185 parts of warm water at 60°C and, as the emulsifiers, 10 parts of glycerine monostearate, 20 parts of diglycerine monostearate and 3 parts of soybean lecithin were mixed to this after being molten under heat. This was converted to an emulsion by passing through a high-pressure piston homogenizer (pressure, 150 kg/cm² → 50 kg/cm²) and then spray drying was performed to obtain a sample of the powdery foaming agent.

Example 2

As the ingredients in the aqueous side, 53 parts of dextrin, 15 parts of maltose, 3 parts of sodium caseinate and 1 part of polyphosphate and, as the emulsifiers, 5 parts of glycerine monostearate, 20 parts of diglycerine monostearate and 3 parts of enzymolysis lecithin were used to prepare a sample of powdery foaming agent according to Example 1.

Example 3

As the ingredients in the aqueous side, 39 parts of dextrin, 22 parts of maltose, 3 parts of sodium caseinate and 3 parts of polyphosphate and, as the emulsifiers, 10 parts of glycerine monostearate, 20 parts of diglycerine monostearate and 3 parts of soybean lecithin were used to prepare a sample of powdery foaming agent according to Example 1.

Example 4

As the ingredients in the aqueous side, 38 parts of dextrin, 20 parts of milk sugar and 3 parts of sodium caseinate and 1 part of polyphosphate and, as the emulsifiers, 10 parts of glycerine monostearate, 25 parts of diglycerine monostearate, 2 parts of phosphatidylcholine and 1 part of enzymolysis lecithin were used to prepare a sample of powdery foaming agent according to Example 1.

Example 5

53 Parts of dextrin, 15 parts of maltose, 3 parts of sodium caseinate and 1 part of polyphosphate in powder form were mixed and further 5 parts of glycerine monostearate, 20 parts of diglycerine monostearate and 3 parts of enzymolysis lecithin after molten were uniformly adsorbed onto the side of powders. This was continuously fed into a biaxial extruder and treated under the conditions of temperature of the article

120°C, pressure: 150 kg/cm² and number of screw revolutions: 150 rpm to prepare a sample of powdery foaming agent.

Comparative example 1

As the ingredients in the aqueous side, 41 parts of dextrin, 20 parts of milk sugar, 3 parts of sodium caseinate and 1 part of polyphosphate and, as the emulsifiers, 10 parts of glycerine monostearate and 25 parts of diglycerine monostearate were used to prepare a sample of a powdery foaming agent according to Example 1.

Comparative example 2

As the ingredients in the aqueous side, 40 parts of dextrin, 19 parts of milk sugar, 3 parts of sodium caseinate and 1 part of polyphosphate and, as the emulsifiers, 4 parts of glycerine monostearate, 30 parts of diglycerine monostearate and 3 parts of enzymolysis lecithin were used to prepare a sample of powdery foaming agent according to Example 1.

Comparative example 3

As the ingredients in the aqueous side, 45 parts of dextrin, 20 parts of milk sugar, 3 parts of sodium caseinate and 1 part of polyphosphate and, as the emulsifiers, 5 parts of glycerine monostearate, 25 parts of tetraglycerine monostearate and 1 part of soybean lecithin were used to prepare a sample of powdery foaming agent according to Example 1.

Comparative example 4

As the ingredients in the aqueous side, 39 parts of dextrin, 25 parts of milk sugar and 3 parts of sodium caseinate and, as the emulsifiers, 10 parts of glycerine monostearate, 20 parts of diglycerine monostearate and 3 parts of soybean lecithin were used to prepare a sample of powdery foaming agent according to Example 1.

<Example effect 1. Evaluation with cake mix>

In order to evaluate the samples of powdery foaming agents obtained in Example 1 through 5 and Comparative example 1 through 4, 100 parts of wheat flour, 100 parts of sugar, 1 part of baking powder and 10 parts of the powdery foaming agent sample were mixed in powder - form. The mixture was weighed into a laminate bag with high gas-barrier property and heat-sealed, which was then preserved in a thermostat of 35°C. After a lapse of 12 months, 85 parts of egg complete and 45 parts of water were added and mixed for 1 minute at low speed and for 5 minutes at high speed with 5 feet vertical type mixer (Shinagawa Seisakusho Co.) to measure the specific gravity of the dough. The results are shown in Table 1.

Table 1 Evaluation with cake mix

	Example					Comparative example			
	1	2	3	4	5 *	1	2	3	4
Glycerine monostearate	10	5	10	10	5	10	4	5	10
Diglycerine monostearate	20	20	20	25	20	25	30	-	20
Tetraglycerine monostearate	-	-	-	-	-	-	-	25	-
Soybean lecithin	3	-	3	-	-	-	-	1	3
Enzymolysis lecithin	-	3	-	1	3	-	3	-	-
Phosphatidylcholine	-	-	-	2	-	-	-	-	-
Dextrin	38	53	39	38	53	41	40	45	39
Maltose	-	15	22	-	15	-	-	-	-
Milk sugar	25	-	-	20	-	20	19	20	25
Sodium caseinate	3	3	3	3	3	3	3	3	3
Polyphosphate	1	1	3	1	1	1	1	1	-
<u>Saturated monoglyceride</u> <u>Saturated diglycerine monester</u> ** Formulating ratio	1/2	1/4	1/2	1/2.5	1/4	1/2.5	1/7.5	/	1/2
Ingredient ratio ***	1/1.6	1/3.2	1/1.6	1/2.0	1/3.2	1/2.0	1/6.1		1/1.6
Specific gravity of dough on starting	0.349	0.352	0.341	0.347	0.358	0.408	0.487	0.785	0.351
Specific gravity of dough after mix was kept for 12 months at 35°C	0.355	0.357	0.343	0.351	0.357	0.450	0.527	0.813	0.453

* Powdery foaming agent sample prepared with biaxial extruder

** Formulating ratio of glycerine monostearate/diglycerine monostearate used

*** Ingredient ratio of saturated monoglyceride/saturated diglycerine monester determined by means of liquid chromatography

<Example of effect 2. Evaluation with fry batter mix>

In order to evaluate the samples of powdery foaming agents obtained in Examples 1, 2 and 5 and Comparative examples 1 and 2, 100 parts of wheat flour and 5 parts of powdery foaming agent were mixed in powder-form and then the stability test was carried out according to Example of effect 1. After a lapse of 12 months, 200 parts of water were added and mixed for 1 minute at low speed and for 5 minutes at high speed to measure the specific gravity of the dough. The results are shown in Table 2.

Table 2 Evaluation with fry batter mix

	Example			Comparative example	
	1	2	5	1	2
Specific gravity of dough on starting	0.245	0.253	0.242	0.375	0.537
Specific gravity of dough after 12 months at 35 °C	0.250	0.251	0.244	0.457	0.609

As shown in Tables 1 and 2, the specific gravity of doughs used the powdery foaming agents according to the invention are little changed from the specific gravity of the initial dough sample under severe conditions of 35°C - 12 months, thus they have excellent long-term stability and good handling property and can be utilized for the premixes of cake and fry batters to a great extent.



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CLAIMS

1. A powdery foaming agent comprising a saturated monoglyceride, a saturated diglycerine monoester, lecithin and a polyphosphate.

2. The powdery foaming agent according to claim 1, wherein the weight ratio of saturated monoglyceride to saturated diglycerine monoester is 1:0.5 to 1:5.5 and the lecithin and polyphosphate are added in amounts of 0.5 to 4% and 0.2 to 5%, respectively, based on the total weight.

3. A powdery foaming agent according to claim 1 or 2, wherein the saturated monoglyceride comprises a saturated fatty acid and with 10 to 22 carbon atoms with 50% or more stearic acid content.

4. A powdery foaming agent according to any of claims 1 to 3, wherein the saturated diglycerine monoester comprises a saturated fatty acid with 10 to 22 carbon atoms which has 50% or more stearic acid content.

5. A powdery foaming agent according to any of claims 1 to 4, wherein the polyphosphate is added in an amount of 0.5 to 3%, based on the total weight.



6. A powdery foaming agent according to any of claims 1 to 5, wherein the lecithin is added in an amount of 1 to 3%, based on the total weight.
