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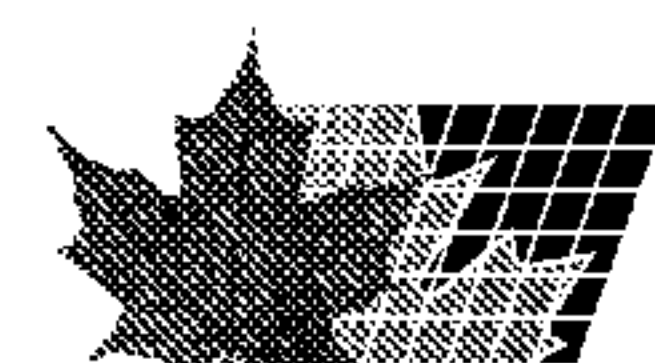
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(54) Titre : SYSTÈME EMULSIFIANT

(54) Title: EMULSIFIER SYSTEM

(57) **Abrégé/Abstract:**

The present invention is directed to a particulate emulsifier system and to baked goods utilizing the emulsifier system. The emulsifier system can be used as a partial or complete replacement for shortening in flour based baked goods. The emulsifier system includes in combination (a) an emulsifier powder which includes a carrier, propylene glycol monoester, mono- and di-glycerides, a polyoxyethylene derivative of polyol esters of fatty acids and diacetyl tartaric acid ester of monoglycerides and (b) an unhydrated mixture of a vegetable fiber, starch and a gum. The emulsifier system is present in the batter or dough used to provide a baked dough at a level of from about 0.5% to about 5% by weight.



**EMULSIFIER SYSTEM****Abstract**

The present invention is directed to a particulate emulsifier system and to baked goods  
5 utilizing the emulsifier system. The emulsifier system can be used as a partial or complete replacement for shortening in flour based baked goods. The emulsifier system includes in combination (a) an emulsifier powder which includes a carrier, propylene glycol monoester,  
10 mono- and di- glycerides, a polyoxyethylene derivative of polyol esters of fatty acids and diacetyl tartaric acid ester of monoglycerides and (b) an unhydrated mixture of a vegetable fiber, starch and a gum. The emulsifier system is present in the batter or dough used to provide  
15 a baked dough at a level of from about 0.5% to about 5% by weight.

**EMULSIFIER SYSTEM****Field of the Invention**

The present invention relates to the production of doughs and batters for producing baked goods, particularly reduced-fat and fat-free baked goods having a shelf life, softness and acceptance comparable to full-fat counterparts. More particularly, the present invention relates to a complete fat replacement system for use in bakery products.

**Background of the Invention**

The consumer demand for fat-free and low fat baked products has increased recently due to public awareness of the health risks of dietary fat. This is especially true with baked items which contain relatively medium to high levels of fat which contribute heavily to their appetizing taste, flavor and appearance.

Many efforts have been made to remove or lower the fat content of baked products and still obtain an edible product from the oven. Fat-free or reduced-fat baked products usually require major reformulation. Also, replacing fat with prior art fat mimetics may require special processing and handling (i.e., high shear mixing or homogenization) which adds extra steps and/or equipment to the bakery process.

Numerous efforts have been directed to providing fat mimetic replacements for fat in baked products. U.S. Patent No. 3,453,116 to Freund is directed to an emulsifier system which can be used to replace fat in baked products. The emulsifier system comprises a propylene glycol monoester of a fatty acid and a stabilizer for the fatty acid monoester. The stabilizer is an ionic surface active salt.

U.S. Patent No. 4,242,366 to Morgan, et al. is directed to an emulsifier system for use in baked products, such as cakes, as a replacement for some or all

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of the shortening in the cake. The emulsifier system includes propylene glycol monoester, alpha monoglyceride and glyceryl lactoester.

U.S. Patent No. 5,133,984 to Murphy, et al is directed to doughs and batters which contain hydrated polysaccharide hydrocolloid, hydrated insoluble fiber and hydrated protein. The hydrated materials are added to the dough or batter formulation as an aqueous dispersion. The aqueous dispersion of the hydrated polysaccharide hydrocolloid, hydrated insoluble fiber and hydrated protein can be used to replace fat in baked goods.

The present invention relates to an emulsifier system which can be used to completely replace fat in several bakery items, such as cakes, muffins, cookies, sweet dough products, pizza crust, pie crust and other baked goods. It is therefore an object of the present invention to provide fat-free and low fat bakery items which have similar organoleptic properties as those of full fat products.

It is also an object of the invention to provide a complete fat replacement system that is easy to use and does not require any further processing prior to use.

#### **Summary of the Invention**

The present invention is directed to a particulate emulsifier system and to baked goods utilizing the emulsifier system. The emulsifier system can be used as a partial or complete replacement for shortening in flour based baked goods.

In accordance with one embodiment of the present invention, the emulsifier system includes in combination (a) an emulsifier powder which includes a carrier, propylene glycol monoester, mono- and di-glycerides, a polyoxyethylene derivative of polyol esters of fatty acids and diacetyl

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tartaric acid ester of monoglycerides and (b) an unhydrated mixture of a vegetable fiber, starch and a gum.

In accordance with another embodiment of the present invention there is provided a particulate emulsifier system for use as a partial or complete replacement for shortening in flour based baked goods comprising in combination: (a) an emulsifier powder which includes a carrier, mono- and diglycerides, and diacetyl tartaric acid ester of monoglycerides; and (b) an unhydrated mixture of a vegetable fiber, starch, and a gum.

The emulsifier system is preferably present in the batter or dough used to provide

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20

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a baked dough at a level of from about 0.5% to about 5% by weight.

**Detailed Description of the Invention**

The emulsifier powder which is used in  
5 combination with the mixture of vegetable fiber, starch  
and a gum contains four emulsifiers, these being,  
propylene glycol monoester, mono- and di- glycerides, a  
polyoxyethylene derivative of polyol esters of fatty  
acids and diacetyl tartaric acid ester of monoglycerides.  
10 The propylene glycol monoester and mono- and di-  
glycerides are very lipophilic emulsifiers. These  
emulsifiers contribute to tenderness, moistness, volume  
and much of the fatty mouthfeel perceived. They are fat-  
like in nature. The polyoxyethylene derivatives have a  
15 positive influence on the closeness of the crumb cells  
(fine texture) and contributes to volume, perception of  
moistness and tenderness. The diacetyl tartaric acid  
ester of monoglycerides has a good balance of hydrophilic  
and lipophilic groups. The diacetyl tartaric acid ester  
20 of monoglycerides works as a dough conditioner in baked  
products contributing to gas retention and increased  
volume.

The propylene glycol monoester component in the  
emulsifier powder is preferably supplied by a  
25 commercially available food grade emulsifier containing  
from about 30%-60% propylene glycol monoester, most  
preferably 50-60% propylene glycol monoester. The  
esterification of propylene glycol usually forms, firstly  
monoesters, each containing one hydroxyl and one fatty  
30 acid radical, and secondly, diesters with both hydroxyls  
being substituted with the fatty acid radicals. The  
monoesters constitute the component desired in the  
emulsifier powder of the present invention; however, the  
usual mixture of about 60-90% monoester and the balance  
35 of diesters is satisfactory. The fatty acid used in the  
esterification reaction is preferably saturated and has a

chain length of from 12 to 22 carbon atoms, preferably palmitic or stearic acid, or admixtures thereof.

Specific partial esters which are suitable are propylene glycol monostearate, propylene glycol monopalmitate, propylene glycol monolaurate, alone or in combination with the comparable diesters and each other. Propylene glycol monoester is present in the emulsifier powder at a level of from about 14% to about 28% of a commercial food grade emulsifier, preferably from about 22% to about 28%.

10 All percentages used herein are by weight unless otherwise indicated.

The mono- and diglyceride component of the emulsifier powder is preferably supplied by a commercially-available food grade, mono-diglyceride emulsifier. This emulsifier may be prepared by known procedures involving the reaction of glycerin with certain fats, oils or fatty acids and is usually available as the crude reaction product which also comprises diglyceride, triglyceride, glycerin and free fatty acid. Commercial monoglyceride emulsifiers are also available in a relatively pure distilled form. Both alpha and beta isomers of monoglyceride are included in varying amounts, depending on whether the esterification occurs at the terminal or center carbon atom of the glycerin, but these isomers equilibrate by acyl migration upon storage to result in about 88% alpha monoglyceride. The mono- and di- glycerides are present in the emulsifier powder at a level of from about 9% to about 24%, preferably from about 10% to about 15%.

30 The polyoxyethylene derivatives of polyol esters of fatty acids are represented by polyoxyethylene (n) glyceryl monostearate or monopalmitate and polyoxyethylene (n) sorbitan monostearate or monopalmitate, in either of which (n) can be from about 5 to 100. The polyoxyethylene derivative is present in the emulsifier powder at a level of from about 5% to about

15%, preferably from about 8% to about 12%. The polyoxyethylene derivative is preferably Polysorbate 60 (TWEEN 60<sup>TM</sup>).

5 The diacetyl tartaric acid ester of monoglyceride has a fatty acid moiety which is esterified to the glycerine. The fatty acid can have from 10 to 24 carbons and can be saturated or unsaturated, preferably, the fatty acid is stearic acid. The diacetyl tartaric acid ester of monoglycerides is present in the emulsifier  
10 powder at a level of from about 1 to about 5%, preferably from about 1% to about 3%.

The carrier for the emulsifier powder is selected from a protein material, maltodextrins and corn syrup solids. The protein material can be an  
15 essentially-pure protein, as in the case of whey protein or casein, or as part of a protein containing material, such as dry non-fat milk solids, dried egg whites, soy protein, wheat protein and wheat gluten. Sweet whey is a preferred protein as it provides a desirable flavor when  
20 baked and contributes to browning of a baked product. The carrier is present in the emulsifier powder at a level of from about 44% to about 64%, preferably from about 44% to about 54%.

The emulsifier powder is produced by spray  
25 drying. An encapsulating agent, such as sodium caseinate, is optionally present in the emulsifier powder formulation to act as an encapsulating agent to assist making the emulsifier powder free flowing. The encapsulating agent, if used, is present in the  
30 emulsifier powder at a level of from about 1% to about 6%, preferably from about 1% to about 3%.

Dipotassium phosphate may optionally be present in the emulsifier powder to function as a buffer and for pH adjustment. If present, the dipotassium phosphate is  
35 present at a level of from about 0.5% to about 3%, preferably from about 0.75% to about 2%.

In preparing the emulsifier powder, the propylene glycol monoester and mono- and diglycerides are added to a steam jacketed kettle and heated to a temperature of about 140° F. Slow agitation is begun when the components are sufficiently melted. The Polysorbate 60 and diacetyl tartaric acid ester of monoglyceride are then added. Agitation is continued until a uniform mixture is attained. The sodium caseinate is added and thoroughly dispersed. Water, at a temperature of 160-180° F. is added to provide a slurry having from about 35% to about 75% solids. The slurry is mixed for 5 minutes after which the sweet whey or other protein is added to the kettle. Mixing is continued until the protein is completely hydrated. The temperature is brought to 160-170° F. and the mixture is held for 20 minutes. The slurry is then homogenized in a two-stage homogenizer using 2,000 psi combined with 1,500 psi in the first stage and 500 psi in the second stage. The slurry is then spray dried to provide the emulsifier powder.

The emulsifier powder is then combined with a mixture of vegetable fiber, starch and a gum to provide the emulsifier system of the invention. The emulsifier powder is present in the emulsifier system at a level of from about 50% to about 80%, preferably from about 60% to about 70%.

The vegetable fiber used in the present invention is an insoluble fiber which can be any edible fiber material, including powdered cellulose. Fiber derived from cereal grains are preferred. Oat fiber, which contains a relatively-high level of insoluble fiber, soy fiber and wheat fiber are particularly preferred for use in the present invention. Most preferred is oat fiber. The particles of fiber have an average particle size of between about 10 and about 200 microns, preferably between 10 and 100 microns. The

fiber is present in the mixture of vegetable fiber, starch and gum at a level of from about 45-55%.

5 The starch may be any of the food starches, such as corn starch, potato starch, tapioca starch and rice starch. Preferably, the starch is a pre-gelatinized starch. The starch is present in the mixture of vegetable fiber, starch and gum at a level of from about 45% to about 55%.

10 The gum is preferably a polysaccharide hydrocolloid and most preferably is a water soluble, non-gelling gum, such as xanthan, guar, carboxymethyl cellulose and the like. A preferred gum is xanthan gum. The gum is present in the mixture of vegetable fiber, starch and gum at a level of from about .5% to about 15 1.5%.

In another embodiment of the emulsifier system of the present invention, only two emulsifiers are present in the emulsifier powder, these being mono- and diglycerides and diacetyl tartaric ester monoglyceride. 20 This embodiment is less flexible in use than the four emulsifier powder previously described, but is functional for certain chemically leavened baked goods, such as pound cake and white cake. In this embodiment, the carrier is present at a level of from about 42% to about 25 64%, the mono- and diglycerides are present at a level of from about 20% to about 42%, the diacetyl tartaric acid ester of monoglycerides is present at a level of from about 6% to about 18%, and an emulsifying agent, if used, is present at a level of from about 1% to about 6%. The 30 emulsifier powder is prepared by the same spray dry method previously described.

In the final assembly of the emulsifier system, it is preferred to blend the gum with an anticaking agent, such as silicon dioxide or sodium silicoaluminate, 35 prior to adding the gum to the other components of the emulsifier system. The anticaking agent is used at a

level of from about 0.75% to about 2%, based on the weight of the mixture of vegetable powder, starch and gum.

5 The following examples illustrate various features of the invention, but are intended to in no way limit the scope of the invention as set forth in the appended claims.

#### Example 1

10 An emulsifier system was prepared from an emulsifier powder and a mixture of a vegetable fiber, starch and a gum in accordance with the following formulations.

#### Emulsifier Powder

| <u>Ingredients</u>                                                                     | <u>Weight %, Dry Basis</u> |
|----------------------------------------------------------------------------------------|----------------------------|
| 15 Sweet Dairy Whey                                                                    | 47.74                      |
| Propylene glycol monoester (PGME)                                                      | 24.93                      |
| 54% PGME, 15% total monoglycerides,<br>69.5 iodine value                               |                            |
| 20 Mono- and Diglycerides                                                              | 12.22                      |
| 43% alpha monoglyceride,<br>67.5 iodine value                                          |                            |
| Polysorbate 60                                                                         | 9.86                       |
| Sodium Caseinate                                                                       | 2.01                       |
| 25 Diacetyl Tartaric Acid Ester Mono-<br>glyceride (DATEM) less than<br>3 iodine value | 1.98                       |
| Dipotassium Phosphate                                                                  | <u>1.26</u>                |
| TOTAL                                                                                  | 100.00                     |

30 1. Add propylene glycol monoester and mono- and diglycerides to a steam jacketed blend kettle and heat to 140° F. Begin agitation when sufficiently melted.

2. Add Polysorbate 60 and DATEM. Agitate until uniformly mixed.

35 3. Stream in sodium caseinate, disperse thoroughly.

4. Rapidly add sufficient water (160-180° F.) to provide 40% solids in final slurry.

5. Stream in whey and hydrate completely.

6. Slowly add dipotassium phosphate (50% solids mixture).

7. Bring temperature to 160-170° F. and hold for 20 minutes to pasteurize.

5 8. Homogenize on two stage homogenizer. Use 2000 psi combined (1500 psi first stage and 500 psi second stage).

9. Spray dry.

10. Screen through 40 mesh and package.

10 The final emulsifier system has the following components at the indicated levels:

| <u>Ingredients</u>          | <u>Weight %, Dry Basis</u> |
|-----------------------------|----------------------------|
| Spray Dried Emulsifier Base | 66.600                     |
| Oat Fiber                   | 16.200                     |
| 15 Modified Food Starch     | 16.370                     |
| Xanthan Gum                 | 00.330                     |
| Silicon Dioxide             | 00.500                     |

1. Preblend xanthan gum in the silicon dioxide.

20 2. Add all ingredients to the dry blender with xanthan gum mixture being last.

3. Blend until homogeneous, a minimum of 8 minutes.

4. Screen through 40 mesh.

25 5. Package.

#### Example 2

The emulsifier system of Example 1 was used to produce a fat free pound cake having the following components at the indicated levels. A control pound cake  
30 was also produced which had conventional shortening.

|    | Ingredients                      | Control<br>Weight % | Fat Free<br>Weight % |
|----|----------------------------------|---------------------|----------------------|
|    | Vegetable Shortening             | 7.05%               | 0.00                 |
| 5  | Margarine                        | 9.07                | 0.00                 |
|    | Granulated Sugar                 | 28.72               | 31.73                |
|    | Cake Flour                       | 25.19               | 24.89                |
|    | Salt                             | 0.50                | 0.52                 |
| 10 | Pregelatinized Tapioca<br>Starch | 0.00                | 1.31                 |
|    | Baking Powder                    | 0.00                | 0.78                 |
|    | Vanilla Flavor                   | 0.00                | 0.21                 |
|    | Flavor                           | 0.10                | 0.10                 |
|    | Egg Shade Color                  | 0.15                | 0.03                 |
| 15 | Liquid Egg Whites                | 17.13               | 17.32                |
|    | NFDM                             | 1.21                | 0.00                 |
|    | Water                            | 10.88               | 19.18                |
|    | Emulsifier System of Ex. 1       | 0.00                | 3.94                 |
|    | TOTAL                            | 100.00              | 100.00               |

- 20           1.    Blend all dry ingredients in Hobart mixer  
at low speed for one minute.
2.    Add rest of ingredients, mix at low speed  
for one minute.
3.    Mix for one minute at medium and one minute  
25 at high speed.
4.    Scale 440 grams in a loaf pan cake.
5.    Bake for 36 minutes at 380° F.
- 30           Evaluation - Control: Brown top, white specs,  
nice texture, yellow color, moist soft touch. Fat Free:  
golden brown hard top at edge, very soft inside, dense  
texture like pound cake.

Example 3

A 98% fat free white cake was prepared using the emulsifier system of Example 1. A control white cake was also produced which had conventional shortening.

|    |                            |                     |                          |
|----|----------------------------|---------------------|--------------------------|
| 5  | Ingredients                | Control<br>Weight % | 98% Fat Free<br>Weight % |
|    | Granulated Sugar           | 30.50               | 31.00                    |
|    | Cake Flour                 | 23.35               | 23.67                    |
|    | Emulsified Shortening      | 5.90                | 0.00                     |
| 10 | Lecithin                   | 0.05                | 0.00                     |
|    | Non Fat Dry Milk           | 2.09                | 2.12                     |
|    | Baking Powder              | 1.43                | 1.46                     |
|    | Salt                       | 0.60                | 0.60                     |
|    | Emulsified System of Ex. 1 | 0.00                | 3.63                     |
| 15 | N&A Vanilla Flavor DY08125 | 0.00                | 0.20                     |
|    | Water                      | 24.80               | 26.66                    |
|    | Fresh Egg Whites           | 11.27               | 10.66                    |
|    | Emulsifier System          | 0.00                | 3.94                     |
|    | TOTAL                      | 100.00              | 100.00                   |
| 20 | Cake Score                 | 86                  | 92                       |
|    | Volume Index               | 118                 | 112                      |
|    | Symmetry Index             | 0                   | 2                        |
|    | Total Volume Index         | 569                 | 553                      |

1. Thoroughly mix dry ingredients together.
- 25 2. Blend dry mix, water and egg whites in Sunbeam mixer.
3. Mix at speed one for one minute and speed eight for three minutes.
4. Bake at 350° F. for 25-27 minutes.
- 30 Evaluation - Control: golden brown color, shriveled look top, top very tender. Fat Free: golden brown, top not as sticky, good cake for fat free.

Example 4

A fat free pizza crust was made using the emulsifier system of Example 1. A control pizza crust was also produced which had conventional shortening.

|    |                            |                  |                   |
|----|----------------------------|------------------|-------------------|
| 5  | Ingredients                | Control Weight % | Fat Free Weight % |
|    | Bread flour                | 62.00            | 61.22             |
|    | Water                      | 32.36            | 34.66             |
|    | Granulated Sugar           | 1.50             | 1.50              |
| 10 | Yeast                      | 0.60             | 0.60              |
|    | Salt                       | 0.90             | 0.90              |
|    | Soy Oil                    | 2.48             | 0.00              |
|    | Emulsifier System of Ex. 1 | 0.00             | 0.96              |
|    | SSL                        | 0.08             | 0.08              |
| 15 | Calcium Propionate         | 0.08             | 0.08              |
|    | TOTAL                      | 100.00           | 100.00            |

1. Add one half of the water to the flour and mix for 5 minutes.

20 2. Hydrate yeast (warm water and half of sugar) for 10 minutes.

3. Add oil and rest of water. Mix on low speed for another minute.

4. Mix for 7 minutes on speed 2.

5. Scale 55 grams and flatten in pizza pan.

25 6. Proof for 20 minutes.

7. Bake for 10 minutes at 450° F.

Evaluation - Fat free gave better crumb color than control. It was very hard to tell the difference between both.

30

Example 5

Fat free pancakes were made using the emulsifier system of Example 1. Control pancakes were also produced which had conventional shortening.

|    | Ingredients                | Control<br>Weight % | Fat Free<br>Weight % |
|----|----------------------------|---------------------|----------------------|
|    | Low Fat (2%) Milk          | 50.50               | 0.00                 |
|    | All Purpose Flour          | 25.88               | 26.72                |
| 5  | Eggs (Liquid)              | 11.85               | 0.00                 |
|    | Vegetable Oil              | 6.45                | 0.00                 |
|    | Sugar                      | 2.84                | 2.93                 |
|    | Baking Powder              | 2.18                | 2.27                 |
|    | Salt                       | 0.30                | 0.32                 |
| 10 | Non Fat Dry Milk           | 0.00                | 5.74                 |
|    | Water                      | 0.00                | 48.52                |
|    | Emulsifier System of Ex. 1 | 0.00                | 1.12                 |
|    | Egg Whites (Liquid)        | 0.00                | 12.38                |
|    | TOTAL                      | 100.00              | 100.00               |
| 15 | Specific Gravity           | 1.03                | 1.03                 |
|    | Water Temperature          | 81° F.              | 81° F.               |

1. Blend dry ingredients together for 10 minutes in a Hobart mixer.
  2. Prepare pancake batter by blending dry mix, water and eggs in Sunbeam mixer.
  3. Mix at low speed until all lumps are broken up.
  4. Mix for one minute at medium speed while continuously scraping the sides and pushing the batter into the beaters.
  5. Fry on hot griddle (390° F.). Turn when edges dry.
- Evaluation - Control: Light, fluffy and uniform.  
Fat Free: Light, fluffy, good taste, uniform with nice brown color.

Example 6

Low fat waffles were made using the emulsifier system of Example 1. Control waffles were also produced which had conventional shortening.

|    |                            |                     |                     |
|----|----------------------------|---------------------|---------------------|
| 5  | Ingredients                | Control<br>Weight % | Low Fat<br>Weight % |
|    | All Purpose Flour          | 33.88               | 36.64               |
|    | Egg Yolk (Liquid)          | 5.15                | 5.57                |
|    | Vegetable Oil              | 15.33               | 0.00                |
| 10 | Baking Powder              | 1.48                | 1.60                |
|    | Salt                       | 0.43                | 0.46                |
|    | Non Fat Dry Milk           | 3.86                | 4.18                |
|    | Water                      | 31.69               | 36.22               |
|    | Emulsifier System of Ex. 1 | 0.00                | 2.79                |
| 15 | Egg Whites (Liquid)        | 8.18                | 12.54               |
|    | TOTAL                      | 100.00              | 100.00              |

1. Blend dry ingredients together for one mixture in a Hobart mixer.

2. Add egg yolks and stir into dry  
20 ingredients.

3. Stir in cooking oil. Carefully fold in egg whites (do not over mix).

4. Mix for one minute at medium speed while continuously scraping the sides.

25 5. Pour approximately 1 cup batter onto the preheated grid.

6. Close and bake.

Evaluation - Control: Smells oily, good color and very fluffy. Low Fat: Very good compared to control,  
30 little darker color.

Example 7

An emulsifier system was prepared from an emulsifier powder and a mixture of a vegetable fiber,

starch and a gum in accordance with the following formulations.

Emulsifier Powder

| <u>Ingredients</u>                                                                                                                    | <u>Weight %, Dry Basis</u> |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 5 Sweet Dairy Whey<br>Mono- and Diglycerides<br>43% alpha monoglyceride,<br>67.5 iodine value                                         | 47.84<br>37.15             |
| 10 Diacetyl Tartaric Acid Ester Mono-<br>glyceride (DATEM) less than<br>3 iodine value                                                | 11.74                      |
| Sodium Caseinate                                                                                                                      | 2.00                       |
| Dipotassium Phosphate                                                                                                                 | 1.27                       |
| TOTAL                                                                                                                                 | 100.00                     |
| 15 1. Add mono- and diglycerides to a steam<br>jacketed blend kettle and heat to 140° F. Begin agitation<br>when sufficiently melted. |                            |
| 2. Add DATEM. Agitate until uniformly mixed.                                                                                          |                            |
| 20 3. Stream in sodium caseinate, disperse<br>thoroughly.                                                                             |                            |
| 4. Rapidly add sufficient water (160-180° F.)<br>to provide 40% solids in final slurry.                                               |                            |
| 5. Stream in whey and hydrate completely.                                                                                             |                            |
| 25 6. Slowly add dipotassium phosphate (50%<br>solids mixture).                                                                       |                            |
| 7. Bring temperature to 160-170° F. and hold<br>for 20 minutes to pasteurize.                                                         |                            |
| 30 8. Homogenize on two stage homogenizer. Use<br>2000 psi combined (1500 psi first stage and 500 psi second<br>stage).               |                            |
| 9. Spray dry.                                                                                                                         |                            |
| 10. Screen through 40 mesh and package.                                                                                               |                            |

The final emulsifier system has the following components at the indicated levels:

|                             |                            |
|-----------------------------|----------------------------|
| 35 <u>Ingredients</u>       | <u>Weight %, Dry Basis</u> |
| Spray Dried Emulsifier Base | 66.600                     |
| Oat Fiber                   | 16.200                     |
| Modified Food Starch        | 16.370                     |

Xanthan Gum 00.330  
Silicon Dioxide 00.500

1. Preblend xanthan gum in the silicon dioxide.
- 5 2. Add all ingredients to the dry blender with xanthan gum mixture being last.
3. Blend until homogeneous, a minimum of 8 minutes.
4. Screen through 40 mesh.
- 10 5. Package.

#### Example 8

A fat-free, white cake was prepared using the emulsifier system of Example 7. A control white cake was also prepared which used the emulsifier system of Example 1.

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25

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| Ingredients               | Fat-Free Weight % | Control Weight % |
|---------------------------|-------------------|------------------|
| Granulated Sugar          | 30.95             | 30.95            |
| Cake Flour                | 23.70             | 23.70            |
| Non-Fat Dry Milk          | 2.11              | 2.11             |
| Baking Soda               | 0.43              | 0.43             |
| Salt                      | 0.60              | 0.60             |
| Monocalcium Phosphate     | 0.43              | 0.43             |
| Sodium Aluminum Phosphate | 0.17              | 0.17             |
| Dicalcium Phosphate       | 0.43              | 0.43             |
| Example 7 Emulsifier      | 3.63              | 0.00             |
| Example 1 Emulsifier      | 0.00              | 3.63             |
| Vanilla Flavor 1%         | 0.40              | 0.40             |
| Water                     | 26.55             | 26.55            |
| Fresh Egg White           | 10.62             | 10.62            |
| TOTAL                     | 100.00            | 100.00           |

1. Thoroughly mix dry ingredients together.
  2. Blend dry mix, water and egg whites on Sunbeam Mixer.
  3. Mix at speed one for one minute and speed  
5 eight for three minutes.
  4. Bake at 350° F. for 25-27 minutes.
- Evaluation - The white cake with the emulsifier of Example 7 had higher volume and higher cake score than the control white cake.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A particulate emulsifier system for use as a partial or complete replacement for shortening in flour based baked goods comprising in combination:

(a) an emulsifier powder which includes a carrier, propylene glycol, monoester, mono- and diglycerides, a polyoxyethylene derivative of a polyol ester of fatty acids, and diacetyl tartaric acid ester of monoglycerides; and

(b) an unhydrated mixture of a vegetable fiber, starch and a gum.

2. The emulsifier system in accordance with claim 1, wherein said carrier is sweet whey.

3. The emulsifier system in accordance with claim 1 or 2, wherein said vegetable fiber is oat fiber.

4. The emulsifier system in accordance with any one of claims 1 to 3, wherein said starch is tapioca starch.

5. The emulsifier system in accordance with any one of claims 1 to 4, wherein said gum is xanthan gum.

6. The emulsifier system in accordance with any one of claims 1 to 5, wherein said carrier is present in said emulsifier powder at a level of from about 44% to about 64%.

7. The emulsifier system in accordance with any one of claims 1 to 6, wherein said propylene glycol monoester is present in said emulsifier powder at a level of from about 14% to about 28%.

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8. The emulsifier system in accordance with any one of claims 1 to 7, wherein said mono- and diglycerides are present in said emulsifier powder at a level of from about 9% to about 24%.

9. The emulsifier system in accordance with any one of claims 1 to 8, wherein said polyoxyethylene derivative is present in said emulsifier powder at a level of from about 5% to about 15%.

10. The emulsifier system in accordance with any one of claims 1 to 9, wherein an encapsulating agent is present in said emulsifier powder at a level of from about 1% to about 3%.

11. The emulsifier system in accordance with any one of claims 1 to 10, wherein said diacetyl tartaric acid ester of monoglycerides is present in said emulsifier powder at a level of from about 1% to about 6%.

12. A particulate emulsifier system for use as a partial or complete replacement for shortening in flour based baked goods comprising in combination:

(a) an emulsifier powder which includes a carrier, mono- and diglycerides, and diacetyl tartaric acid ester of monoglycerides; and

(b) an unhydrated mixture of a vegetable fiber, starch, and a gum.

13. The emulsifier system in accordance with any one of claims 1 to 11, wherein said emulsifier powder is present in said emulsifier system at a level of from about 50% to about 80% by weight.

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14. The emulsifier system in accordance with any one of claims 1 to 11, wherein said vegetable fiber is present in said mixture of a vegetable fiber, starch and a gum at a level of from about 45% to about 55%.

15. The emulsifier system in accordance with any one of claims 1 to 11, wherein said starch is present in said mixture of a vegetable fiber, starch and a gum at a level of from about 45% to about 55%.

16. The emulsifier system in accordance with any one of claims 1 to 11, wherein said gum is present in said mixture of a vegetable fiber, starch and a gum at a level of from about .5% to about 1.5%.

17. The emulsifier system in accordance with any one of claims 1 to 11, wherein an anticaking agent is also present in said mixture of a vegetable fiber, starch and gum.

18. The emulsifier system in accordance with claim 17, wherein said anticaking agent is silicon dioxide, which is present at a level in said mixture of a vegetable fiber, starch and a gum at a level of from about .75% to about 2%.

19. The emulsifier system in accordance with any one of claims 1 to 11, wherein said polyoxyethylene derivative is Polysorbate 60.

20. The emulsifier system in accordance with any one of claims 1 to 9, which includes an encapsulating agent.

21. The emulsifier system in accordance with claim 20, wherein said encapsulating agent is sodium caseinate.

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22. The emulsifier system in accordance with claim 20, wherein said encapsulating agent is present at a level of from about 1% to about 6%.

23. The emulsifier system in accordance with any one of claims 1 to 11, wherein dipotassium phosphate is present in said emulsifier powder at a level of from about 0.5% to about 3%.

24. The emulsifier system in accordance with any one of claims 1 to 7, wherein said mono- and diglycerides are present at a level of from about 20% to about 42% and said diacetyl tartaric acid ester of monoglycerides is present at a level of from about 6% to about 18%.

25. The emulsifier system in accordance with claim 1, wherein said carrier is selected from the group consisting of a protein material, maltodextrins and corn syrup solids.

26. A baked food product having the emulsifier system of any one of claims 1 to 25 incorporated therein.

27. A baked food product in accordance with claim 26, wherein said emulsifier system is present in the batter or dough used to provide the baked food product.

28. A baked food product in accordance with claim 27, wherein said emulsifier system is present at a level of from about 0.5% to about 5.0%.