Title: SHELF-STABLE, BROWNIE PRODUCT

Abstract: A shelf stable, brownie product. The brownie avoids off tastes and staling, due to reducing the likelihood of recrystallization of sugars and oils, but managing the moisture in the brownie, the fat level, the protein level, and the level and type of sweetener used.
SHELF-STABLE, BROWNIE PRODUCT

FIELD OF THE INVENTION

This application is directed to extend shelf life bakery food products, and methods of making the food products.

BACKGROUND

Most ready-to-eat bakery products available in the market have an ambient shelf life of 3 to 4 weeks. At or near the end of this shelf life, these food products are prone to failure due to microbiological issues (e.g., mold growth), fat/flavor degradation, and/or textural failure. Further, many of the products have a dry and excessively crumbly texture as they age, which is undesirable to the consumer.

A need exists for a convenient, bakery product having satisfactory sensory characteristics and a further extended shelf life.

SUMMARY

The present invention addresses the aforementioned need by providing a shelf stable food product such as a pie, bar, cookie, or pastry.

In one aspect, this disclosure provides a shelf stable, baked, brownie. The brownie is formed from a batter comprising 11-14 wt% flour, 40-50% sweetener, 14.5-16.5% whole egg, shortening, and optionally cocoa. The sweetener includes sucrose, corn syrup and fructose, present in a ratio of 2.5-3.5/0.5-1.5/0.05-0.15. The baked brownie has a moisture level of about 16%.

In some embodiments, the corn syrup has a DE of 42, the sucrose is powdered sugar, and the fructose is crystalline fructose.

Additionally in some embodiments, the sucrose, corn syrup and fructose are present in a ratio of about 3/1/0.1.

In another aspect, this disclosure provides a brownie batter having 11-14 wt% flour, 40-50% sweetener, and 14.5-16.5% whole egg. The sweetener includes powdered sucrose, corn syrup and crystalline fructose, present in a ratio of 2.5-3.5/0.5-1.5/0.05-0.15. The batter may further include cocoa.
The above summary of the various embodiments of the disclosure is not intended
to describe each illustrated embodiment or every implementation of the disclosure.
These and various other features and advantages will be apparent from a reading of the
following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be more completely understood in consideration of the
following detailed description of various embodiments of the invention in connection
with the accompanying drawings, in which:

FIG. 1 is a perspective view of a brownie product.
FIG. 2 is a schematic side view of an embodiment of a packaged brownie
product.
FIG. 3 is a process schematic depicting a method for making a brownie product.

While the disclosure is amenable to various modifications and alternative forms,
specifics thereof have been shown by way of example in the drawings and will be
described in detail. It should be understood, however, that the intention is not to limit the
disclosure to the particular embodiments described. On the contrary, the intention is to
cover all modifications, equivalents, and alternatives falling within the spirit and scope
of the disclosure as defined by the appended claims.

DETAILED DESCRIPTION

The present disclosure provides brownies and brownie products (usually single
serving products) that are shelf stable for at least 1 month at room temperature after
packaging, in some embodiments at least 3 months, and in other embodiments at least 6
months, and in other embodiments up to 9 months. The products are formed from a
batter that has narrow ranges of egg protein, of moisture, and of oil/fat, and that utilizes
precise ranges of certain sweeteners. The present disclosure also provides a method of
making brownies and brownie products that are shelf stable for at least 1 month at room
temperature after packaging, in some embodiments at least 3 months or at least 6
months, and up to 9 months in some embodiments.

In order to achieve extended shelf life of the brownie products of this disclosure,
the moisture content of the product is carefully managed by product design.
Additionally, sugar and fat recrystallization, which is typically undesirable in the product, is inhibited by product design.

In the following description, reference is made to the accompanying drawings that form a part hereof and in which are shown by way of illustration at least one specific embodiment. The following description provides additional specific embodiments. It is to be understood that still other embodiments are contemplated and may be made without departing from the scope or spirit of the present disclosure. The following detailed description, therefore, is not to be taken in a limiting sense. While the present disclosure is not so limited, an appreciation of various aspects of the disclosure will be gained through a discussion of the examples provided below.

Unless otherwise indicated, all numbers expressing feature sizes, amounts, and physical properties are to be understood as being modified by the term “about.” Accordingly, unless indicated to the contrary, the numerical parameters set forth are approximations that can vary depending upon the desired properties sought to be obtained by those skilled in the art utilizing the teachings disclosed herein.

As used herein, the singular forms “a”, “an”, and “the” encompass embodiments having plural referents, unless the content clearly dictates otherwise. As used in this specification and the appended claims, the term “or” is generally employed in its sense including “and/or” unless the content clearly dictates otherwise.

For purposes of this disclosure, water activity, or $a_w$, is measured as per AOAC 978.18, moisture content is as per AOAC 925.45, and pH is as per AOAC 943.02, where “AOAC” is the “Association of Analytical Communities.”

Referring now to the figures, a brownie or brownie product according to the present disclosure is illustrated in FIG. 1 as brownie 10. Brownie 10 is a chocolate (cocoa or carob), sugar and flour-based product, having a texture that is a cross between a cake and fudge. Brownie 10 may be either “fudgy” or “cakey”, the fudgy version being moister and having a higher density, usually about 1 gram/cc. Brownie 10 may include various additive ingredients or filling ingredients such as but not limited to nuts, chocolate chips or other chips, marshmallow, frosting, and/or caramel, depending on the desired final product.

“Brownies” as used herein includes both chocolate-flavored brownies and vanilla-flavored brownies, called “blondies”. Blondies are typically made with brown sugar (sucrose), vanilla and no chocolate.
Brownie 10 is a generally flat, rectangular or square bar, although brownie 10 could have other shapes. Brownie 10, in its ready-to-eat state, may have a size of, for example, from about 1 inch to 4 inches in any dimension, and weigh about 5 to 150 grams.

Brownie 10 is formed from a batter that includes flour or flour-substitute, fat (e.g., oil or shortening), sweetener, egg protein, optional moisture-retaining ingredients, and, for a chocolate brownie, chocolate or cocoa. In some recipes, a leavening agent or leavening system is added. Other ingredients such as flavorant(s), flavoring(s), emulsifier(s), acidulant(s), or antimicrobial(s) may be added.

A variety of different flours can be used for the batter for brownie 10, and the different flours can be selected to give a variety of textures, tastes, and appearances to the final product 10. Useful flours include, but are not limited to, hard wheat flour, soft wheat flour, corn flour, high amylose flour, rice flour, and low amylose flour. The relative proportions of the types of flours used can be varied as desired.

Natural shortenings, animal or vegetable, or synthetic shortenings can be used in the batter for brownie 10. In some embodiments, shortening, fat, oil, etc. may be referred to as lipid(s). Generally, shortening is comprised of triglycerides, fats and fatty oils made predominantly of triesters of glycerol with fatty acids. Fats and fatty oils useful in producing shortening include cotton seed oil, ground nut oil, soybean oil, sunflower oil, grapeseed oil, sesame oil, olive oil, corn oil, canola oil, vegetable oil, safflower oil, palm oil, palm kernel oil, coconut oil, or combinations thereof.

The shortening may be composed of monounsaturated fatty acids, polyunsaturated fatty acids, and/or trans fatty acids. In some embodiments, the total saturated fatty acids in the shortening is 35-53%, with the total monounsaturated fatty acids being 15-48%, the total polyunsaturated acids being 8-35%, and the total trans fatty acids being 0.5-2%. In other embodiments, the total saturated fatty acids in the shortening is about 35%, with the total monounsaturated fatty acids being about 48%, the total polyunsaturated acids being about 16%, and the total trans fatty acids being about 1%. In yet other embodiments, a suitable fat may have the following profile: total saturated fatty acids being 7-11%, the total monounsaturated fatty acids being 2-6%, the total polyunsaturated acids being 1-4%, and the total trans fatty acids being less than 0.1%, (e.g., 0.05-0.1%). In other embodiments, the total saturated fatty acids is 7-9%,
the total monounsaturated fatty acids is 5-6%, the total polyunsaturated acids is 2-3%, and the total trans fatty acids is 0.07-0.1%.

Fat selection should include both mobile and crystalline fat at room temperature, the consistency of which should be pliable.

In some embodiments, the shortening is a solid or a semi-solid shortening, having a solid fat index (SFI) of 31-35 at 50 °F, 23.5-26.5 at 70 °F, 22-25 at 80 °F, 17-20 at 92 °F and 11.5-13.5 at 104 °F.

Examples of suitable sweeteners include sucrose (cane or beet sugar), both liquid and crystalline fructose (e.g., regular and high fructose corn syrup), dextrose, maltose, and reduced or zero calorie sweeteners such as saccharide, sucralose and stevia extracts. In some embodiments, powdered sugar (sucrose) is used.

It has been found that a particular blend of sweeteners, particularly, a combination of powdered sugar, corn syrup, and fructose (e.g., crystalline fructose) provides acceptable shelf-life for brownie 10. In some embodiments, the ratio of powdered sugar to corn syrup to crystalline fructose is 2.5-3.5 to 0.5-1.5 to 0.05-0.15, for example, 3 to 1 to 0.1 (or, 3/1/0.1). In other embodiments, the percentages powdered sugar to corn syrup to crystalline fructose is 70-80% to 20-30% to 0.5-5%, for example, 72-74% to 34-35% to 1-3%, for example, about 73% to about 24% to about 2%.

In other embodiments, blends of other sweeteners could be used, the blended sweeteners being at the same, similar or different relative levels as the powdered sugar, corn syrup, and fructose. Such blends should have similar sweetness characteristics (e.g., sweetness level, bitterness level, crystallization characteristics, etc.) as the blend of powdered sugar, corn syrup, and fructose.

Brownie 10 also includes an amount of egg protein, which may be obtained by adding whole eggs or egg whites (for example, as albumin). Egg protein provides long term cohesion to brownie 10, yet too much can result in an off-flavor of the product and too little can result in an undesirably dry product. In some embodiments, liquid eggs or egg protein is preferred over dried or powdered eggs.

The leavening agent may be a chemical leavening agent or a yeast-based leavening agent; for brownies, a chemical leavening agent is typically used. Examples of suitable leavening agents include basic leavening agent sodium bicarbonate and acidic leavening agents monocalcium phosphate (MCP), dicalcium phosphate (DCP), monocalcium phosphate anhydrous (AMCP), sodium acid pyrophosphate (SAPP),
sodium aluminum phosphate (SALP), dimagnesium phosphate (DMP), and sodium aluminum sulphate (SAS). Leavening agents aid to develop the structure and texture of the baked product.

Examples of moisture-retaining ingredients include humectant(s), hydrocolloid(s), gel(s) and gum(s).

Examples of suitable humectants include glycerin and sorbitol. Suitable hydrocolloids include hydrophilic polymers that can be of vegetable, animal, microbial, or synthetic origin. Hydrocolloids generally contain many hydroxyl groups and can be polyelectrolytes. Some functional properties of hydrocolloids can include water binding, thickening and gelling (thus impacting yield value), emulsion stabilization, prevention of ice recrystallization, and organoleptic properties. Many materials can be described as gums and hydrocolloids. One useful hydrocolloid is gelatin. Suitable gums could also be described as hydrocolloids (such as agar, alginate, carrageenans, carboxymethylcellulose, cellulose, gellan gum, guar gum, gum arabic, locust bean gum, and xanthan gum). Other illustrative polysaccharides that are hydrocolloids include arabinoyxylan, curdlan, gellan, β-glucan, pectin, and starch. A combination of multiple hydrocolloids or gums may be used. In some embodiments, a combination of locust bean gum and xanthan gum is preferred, for it has been found that this combination has a surprisingly high water retention capability.

For a chocolate brownie 10, the batter includes a source of cocoa. A suitable cocoa is either natural or “Dutched” chocolate from which a substantial portion of the fat or cocoa butter has been removed. Alternately, chocolate and cocoa fractions can be used and it is intended, therefore, that chocolate is to be encompassed by the term “cocoa”. When chocolate is used, it can be as chocolate chips, chocolate chunks, powdered chocolate, or chocolate syrup. It may be necessary to reduce the amount of shortening in the mix when chocolate is used because of the additional fat present as cocoa butter. It may also be necessary to add larger amounts of chocolate as compared to cocoa in order to provide an equivalent amount of flavoring and coloring. The chocolate may be “dark” or may be milk chocolate.

As indicated above, brownie 10 may include additionally ingredients such as flavorant(s) or flavoring(s), emulsifier(s), acidulant(s), or antimicrobial(s).
Examples of suitable flavorants or flavorings include spices and specific flavorings such as fruit, vanilla, butter, mint, and the like. The flavorant used for the batter for brownie 10 can be a liquid or solid.

Emulsifiers include nonionic, anionic, and/or cationic surfactants that can be used to influence the texture and homogeneity of a mixture, increase stability, improve eating quality, and prolong palatability. Emulsifiers include compounds such lecithin, mono- and diglycerides of fatty acids, propylene glycol mono- and diesters of fatty acids, glyceryl-lacto esters of fatty acids, ethoxylated mono- and diglycerides and the like.

Examples of suitable acidulants are glucono delta-lactone, citric acid, ascorbic acid, and malic acid.

Examples of suitable antimicrobials or other preservatives or mold inhibitors include sodium salts of propionic or sorbic acids, potassium sorbate, sodium diacetate, vinegar, monocalcium phosphate, lactic acid, sodium benzoate, and mixtures thereof.

Additional components may be present in the batter of brownie 10 to facilitate processing, or to improve the taste, texture, or hydration behavior product 10. Examples of such ingredients include salt (NaCl), nonfat dry milk, whey protein, and leavening agents.

The batter forming brownie 10, prior to baking, has a water activity (a_w) from 0.6-0.85, in some embodiments 0.6-0.7. Additionally or alternately, the batter, prior to baking, has a moisture content of up to 20%, and in some embodiments up to about 22%.

Table 1 provides an exemplary list of ingredients as well as exemplary formulation ranges for the batter for brownie 10.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Possible Range(s) (wt%) in Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flour(s)</td>
<td>9-20</td>
</tr>
<tr>
<td></td>
<td>11-14</td>
</tr>
<tr>
<td></td>
<td>12-13</td>
</tr>
<tr>
<td>Cocoa</td>
<td>1-6</td>
</tr>
<tr>
<td></td>
<td>2-3</td>
</tr>
<tr>
<td>Total Sweetener(s)</td>
<td>25-60</td>
</tr>
<tr>
<td></td>
<td>40-50</td>
</tr>
<tr>
<td>Sucrose</td>
<td>20-40</td>
</tr>
<tr>
<td></td>
<td>29-34</td>
</tr>
<tr>
<td>Fructose</td>
<td>1-5</td>
</tr>
<tr>
<td></td>
<td>2-4</td>
</tr>
<tr>
<td>Ingredient</td>
<td>Amount</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Corn Syrup</td>
<td>5-15</td>
</tr>
<tr>
<td></td>
<td>9-11</td>
</tr>
<tr>
<td>Flour:sweetener ratio</td>
<td>1:2-1:5</td>
</tr>
<tr>
<td></td>
<td>1:3-1:4</td>
</tr>
<tr>
<td></td>
<td>1:34</td>
</tr>
<tr>
<td>Shortening</td>
<td>10-30</td>
</tr>
<tr>
<td></td>
<td>16-17</td>
</tr>
<tr>
<td></td>
<td>16.5</td>
</tr>
<tr>
<td>Liquid Shortening</td>
<td>1-17</td>
</tr>
<tr>
<td></td>
<td>2-4</td>
</tr>
<tr>
<td>Solid Shortening</td>
<td>2-20</td>
</tr>
<tr>
<td></td>
<td>13-15</td>
</tr>
<tr>
<td>Egg</td>
<td>10-20</td>
</tr>
<tr>
<td></td>
<td>14.5-16.5</td>
</tr>
<tr>
<td>Egg Protein</td>
<td>13-18</td>
</tr>
<tr>
<td></td>
<td>14-16</td>
</tr>
<tr>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Water</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>0.5-1.5</td>
</tr>
<tr>
<td>Humectant</td>
<td>0-8</td>
</tr>
<tr>
<td></td>
<td>1-4</td>
</tr>
<tr>
<td>Gum(s)</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>0.1-0.2</td>
</tr>
<tr>
<td>Flavoring(s)</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>1-1.5</td>
</tr>
<tr>
<td>Salt</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>0.05-1</td>
</tr>
<tr>
<td></td>
<td>0.1-0.3</td>
</tr>
<tr>
<td>Antimicrobial(s)</td>
<td>0-1.5</td>
</tr>
<tr>
<td></td>
<td>0.1-0.2</td>
</tr>
<tr>
<td>Leavening agent(s)</td>
<td>0-1</td>
</tr>
<tr>
<td></td>
<td>0.1-0.3</td>
</tr>
</tbody>
</table>

FIG. 2 illustrates an embodiment of packaged brownie product as retail product 20. Product 20 has a packaging or overwrap 22 with an internal volume 23 for receiving a product. In this embodiment, brownie 10 according to the present disclosure and as described above is enveloped in packaging 22. Packaging or overwrap 22 may be any conventional packaging and include materials such as paper, polymeric material (including metallized polymeric material), metal foil, paperboard, cardboard, and the like, and may be air-tight or include a moisture barrier. The packaging may be flexible (as is polymeric film) and/or rigid (as is a paperboard container). In some embodiments, the packaging is a metallized flexible laminate package. In this embodiment, packaging 22 includes a paperboard layer 25 on which brownie 10 is seated.
In the packaged retail state, brownie 10, and other products according to this
disclosure, have a moisture content of 15-18%, in some embodiments 15-17% (e.g.,
16%), a water activity (a_w) from 0.6-0.7 (e.g., about 0.65-0.7), and a baked pH of 5.5-6.8
in a 10% dilution.

The brownie has been described above when in a ready-to-be-sold or ready-to-be-
consumed state. The overall moisture within the brownie, when packaged or otherwise
stored in a sealed film package, does not significantly change over time (i.e., from the
time of production to at least 1 month later, in some embodiments at least 3 months
later), and also the distribution of moisture within the product also does not significantly
change.

The brownie, in its ready-to-consume state, has a moist and chewy texture with
no grittiness or crystallization, all which are highly desirable organoleptic properties with
a desirable flavor profile (i.e., it has minimal off flavor development over its shelf life).
These desirable properties remain at least 1 month, usually at least 3 months, sometimes
at least 6 months after packaging, and sometimes up to 9 months after packaging,
without staling of the flavor(s) of the brownie. Additionally, the product avoids mold
growth thereon and therein for at least one month, usually at least 3 months, sometimes
at least 6 months, and sometimes up to 9 months.

Moisture Management

As described above, the shelf life of the brownies of this disclosure is based on
the management of moisture level and inhibition of sugar crystallization within the
product. The brownies of this disclosure are designed to have little, if any, moisture
migration that would degrade the sweetener by recrystallizing the sugar back to its pre-
baked state. In prior art products, the high level of moisture in the product results in
short shelf-life, often due to mold growing on the surface, due to off-flavors and
rancidity reactions caused by the high level of moisture combined with sugar and fat, or
due to the texture changes from crystallization of sugar, fat or starch. The food products
of this disclosure have a low moisture level and water activity.

Brownie 10, and other brownie products of this disclosure, has a finished product
water activity (a_w) of about 0.5-0.7, in some embodiments about 0.55-0.65, when the
product is in a ready-to-eat form. For embodiments having a filling component, the
water activity of the filling should be no more than 0.1 a_w different than the water
activity of the crumb. Additionally or alternately, the finished product has a moisture level of 15-18%, in some embodiments about 16%. The water activity and moisture level remain fairly constant throughout the shelf life of the packaged product. When measured 1 month after having been packaged, these values have changed less than 10%, in some embodiments less than 5%, from the values of the product 48 hours after being baked.

Exemplary Methods of Making the Brownie and Brownie Products

As described above in respect to FIGS. 1 and 2, brownie 10 (and other products according to this disclosure), can be made by the following process.

First, the ingredients are thoroughly mixed together at step 30. In some embodiments, the dry or solid ingredients (e.g., flour, sugar, fructose, etc.) are mixed together, and the liquid ingredients (e.g., eggs, water) are mixed together, after which the two are combined to form a batter. In other embodiments, any solid shortening may be added to the mixed solid ingredients, and the mixture is then creamed prior to adding the liquid ingredients.

In step 40, the batter is formed into its desired shape, for example, by pouring into a pan or by extruding onto a conveyor, which can be done if the batter is sufficiently viscous. As an example process, the batter may be co-extruded with caramel to provide a final brownie product having a caramel filling.

The batter is baked at step 50 (e.g., 350°F for 12-16 minutes) to form a baked product.

The baked product may be cooled prior to step 60, or may be immediate processes into final form. The final product may be formed by cutting with an ultrasonic slitter or a guillotine.

The resulting finishing product can then be packaged in step 70 to provide a saleable brownie. Typically, packaging is done within 30 to 60 minutes of post processing step 60.

Of course, the brownie of this disclosure may be made by alternate methods.
Exemplary Brownies

In one particular example, an Example and three comparative examples (Comparatives A, B, C), were formed from the ingredients listed in Table 2 using the process of FIG. 3, described above.

Table 2 provides the amount of flour and sweetener in the batter, and provides the relationship of solids and liquids.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Example</th>
<th>Comp. A</th>
<th>Comp. B</th>
<th>Comp. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sucrose (powdered sugar)</td>
<td>30</td>
<td>33</td>
<td>33.746</td>
<td>33.101</td>
</tr>
<tr>
<td>Corn syrup (42 DE)</td>
<td>10.128</td>
<td>--</td>
<td>10.226</td>
<td>10.128</td>
</tr>
<tr>
<td>Corn syrup (63 DE)</td>
<td>--</td>
<td>10</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Fructose (crystalline)</td>
<td>3.102</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Whole eggs (liquid, pasteurized)</td>
<td>15.06</td>
<td>18</td>
<td>15.032</td>
<td>15.06</td>
</tr>
<tr>
<td>Shortening (palm – canola oil)</td>
<td>13.983</td>
<td>--</td>
<td>14.061</td>
<td>13.983</td>
</tr>
<tr>
<td>Shortening (partially hydrogenated soybean oil)</td>
<td>--</td>
<td>13.75</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Flour (soft red winter blend)</td>
<td>12.705</td>
<td>--</td>
<td>--</td>
<td>12.705</td>
</tr>
<tr>
<td>Flour (mennel-dry, O ½)</td>
<td>--</td>
<td>12.5</td>
<td>12.782</td>
<td>--</td>
</tr>
<tr>
<td>Cocoa (dark Dutched)</td>
<td>6.617</td>
<td>6.5</td>
<td>6.647</td>
<td>6.617</td>
</tr>
<tr>
<td>Glycerin</td>
<td>3.084</td>
<td>2</td>
<td>3.068</td>
<td>3.084</td>
</tr>
<tr>
<td>Canola oil (high oleic)</td>
<td>2.427</td>
<td>2.5</td>
<td>2.556</td>
<td>2.427</td>
</tr>
<tr>
<td>Water</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>Vanilla powder</td>
<td>0.771</td>
<td>0.6</td>
<td>0.767</td>
<td>0.771</td>
</tr>
<tr>
<td>Salt</td>
<td>0.617</td>
<td>0.75</td>
<td>0.614</td>
<td>0.617</td>
</tr>
<tr>
<td>Gellan gum</td>
<td>0.185</td>
<td>0.09</td>
<td>0.184</td>
<td>0.185</td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
<td>0.185</td>
<td>0.18</td>
<td>0.184</td>
<td>0.185</td>
</tr>
<tr>
<td>Potassium sorbate</td>
<td>0.134</td>
<td>0.13</td>
<td>0.133</td>
<td>0.134</td>
</tr>
</tbody>
</table>
Table 3: Brownie Batter Ingredients Grouped

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Example Wt%</th>
<th>Comp. A Wt%</th>
<th>Comp. B Wt%</th>
<th>Comp. C Wt%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flour</td>
<td>12.705</td>
<td>12.5</td>
<td>12.782</td>
<td>12.705</td>
</tr>
<tr>
<td>Sweetener</td>
<td>43.230</td>
<td>43</td>
<td>43.972</td>
<td>43.229</td>
</tr>
<tr>
<td>Solids</td>
<td>68.299</td>
<td>67.5</td>
<td>69.118</td>
<td>68.298</td>
</tr>
<tr>
<td>Liquids</td>
<td>21.571</td>
<td>22.5</td>
<td>20.656</td>
<td>21.571</td>
</tr>
</tbody>
</table>

The ingredient group “Sweetener” included solid and liquid sweeteners, including sucrose, corn syrup, and fructose.

The ingredient group “Solids” included flour, sugar, cocoa, vanilla, salt, gum, dicalcium phosphate, and potassium sorbate.

The ingredient group “Liquids” included the eggs, glycerin, oil, and water.

Shelf-Life Testing

Food product samples, prepared as above, were stored for 16 weeks under the following conditions to simulate warehouse distribution and to test accelerated shelf life.

1. 90 °F with 15% RH - to simulate hot dry stress
2. Weather room conditions (cycling through a temperature of 90 °F for 12 hours followed by 70 °F for 12 hours, 65% RH) – to simulate hot humid stress
3. Ambient storage (70 °F with 38% RH) – to simulate room temperature storage

The food product samples were pulled from the ‘hot dry’ and ‘hot humid’ storage conditions every two weeks to evaluate organoleptic properties including: texture, flavor, and overall acceptability. The ambient samples were pulled at 12, 16, 24 and 36 weeks to evaluate organoleptic properties including: texture, flavor, and overall acceptability. All evaluations were performed after allowing the samples to equilibrate at room temperature for at least 24 hours.

A five point evaluation scale was used to grade samples. Score of 4 or above was deemed as shelf life failure.

1 = Like fresh product.
2 = Like fresh until compared to 0°F sensory reference. There maybe a flavor loss or slight change in texture.
3 = Product is not “like fresh” but has no clearly objectionable characteristics. The difference should be apparent even without going back to the sensory reference.

4 = There are some off notes detected or the texture is marginal.

5 = Product is objectionable and should clearly not be available to the consumer.

Kinetic modeling, based on flavor loss and texture degradation, was used to predict an equivalent shelf life of the products under each of the storage conditions.

The Comparative A product failed after 6 months due to sugar recrystallization, which detrimentally affected the texture, and oxidation that produced an undesirable musty flavor with high egg notes.

The Comparative B product failed after 7 months due to sugar recrystallization, which detrimentally affected the texture, dryness of the product, and oxidation that produced an undesirable off-flavor.

The Comparative C product failed after 9 months due to sugar recrystallization, which detrimentally affected the texture, and oxidation that produced an undesirable off-flavor.

The Example, after 12 months, maintained cohesive properties, and no objectionable flavor or texture degradation was observed during the storage period. The formulation of the Example retarded sugar recrystallization and stabilized water activity of the product.

Although various embodiments of the present disclosure have been disclosed here for purposes of illustration, it should be understood that a variety of changes, modifications and substitutions may be incorporated without departing from either the spirit or scope of the present disclosure.
CLAIMS

1. A shelf stable, baked, brownie formed from a batter comprising:
   11-14 wt% flour;
   40-50% sweetener comprising sucrose, corn syrup and fructose, present in a ratio of 2.5-3.5/0.5-1.5/0.05-0.15;
   14.5-16.5% whole egg; and
   shortening,
   the baked brownie having a moisture level of about 16%.

2. The brownie of claim 1 wherein the corn syrup has a DE of 42.

3. The brownie of claim 1 or 2, wherein the sucrose is powdered sugar.

4. The brownie of any of claims 1-3, wherein the fructose is crystalline fructose.

5. The brownie of any of claims 1-4, wherein the sucrose, corn syrup and fructose are present in a ratio of 3/1/0.1.

6. The brownie of any of claims 1-4, wherein the sucrose, corn syrup and fructose are present as 70-80%, 20-30% and 0.5-5%, respectively, of the sweetener.

7. The brownie of any of claims 1-6, wherein the batter further comprises cocoa.

8. The brownie of any of claims 1-7, wherein the batter comprises about 15% whole egg.

9. The brownie of any of claims 1-8, wherein the egg comprises liquid albumin.

10. The brownie of any of claims 1-9, wherein the shortening comprises mobile and crystalline fat at room temperature, and the consistency of while is pliable at room temperature.
11. The brownie of any of claims 1-10, wherein the batter further comprises a moisture-retaining ingredient comprising humectant(s), hydrocolloid(s), gel(s) and/or gum(s).

12. The brownie of claim 11, wherein the moisture-retaining ingredient is gellan gum.

13. The brownie of any of claims 1-12, wherein the baked brownie has a density of about 1 gram/cc.

14. The brownie of any of claims 1-13 having a shelf life of at least 1 month.

15. The brownie of any of claims 1-13 having a shelf life of at least 3 months.

16. The brownie of any of claims 1-13 having a shelf life of at least 6 months.

17. The brownie of any of claims 1-13, the batter comprising:
   12-13 wt% flour;
   43-44% sweetener comprising sucrose, corn syrup and crystalline fructose, present in a ratio of 2.5-3.5/0.5-1.5/0.05-0.15;
   14-16% egg protein; and
   shortening,
the baked brownie having a moisture level of about 16%.

18. A brownie batter comprising:
   11-14 wt% flour;
   40-50% sweetener comprising powdered sucrose, corn syrup and crystalline fructose, present in a ratio of 2.5-3.5/0.5-1.5/0.05-0.15; and
   14.5-16.5% whole egg.

19. The batter of claim 18 further comprising cocoa.

20. The batter of claim 18 or 19, wherein the powdered sucrose, corn syrup and crystalline fructose are present in a ratio of 3/1/0.1.

21. The batter of any of claims 18-20 comprising about 15% whole egg.
22. The batter of any of claims 18-21, wherein the egg comprises liquid albumin.

23. The batter of any of claims 18-22 further comprising a moisture-retaining ingredient comprising humectant(s), hydrocolloid(s), gel(s) and/or gum(s).

24. The batter of claim 23, wherein the moisture-retaining ingredient is gellan gum.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(8)- A21D 13/08 (2013.01)

USPC - 426/556

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - A21D 1000, 1004, 1300, 1308 (2013.01)

USPC - 426/531, 549, 551, 552, 556, 558

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

CPC - A21D 10/00, 10/04, 13/00, 13/08 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Orbit, Google Patents, Google Scholar

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>

* Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent but published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed
  - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  - "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  - "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  - "&" document member of the same patent family

Date of the actual completion of the international search

25 October 2013

Date of mailing of the international search report

13 NOV 2013

Name and mailing address of the ISA/US

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Form PCT/ISA/210 (second sheet) (July 2009)
INTERNATIONAL SEARCH REPORT

Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ✗ Claims Nos.: 4-17, 21-24
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest ☐ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.
☐ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.
☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)