Cake Quality and Evaluation

One of the world's most famous and commonly consumed baked goods is cakes, with production representing a USD 86.15 billion market. This is expected to grow around 4.58% between 2026-2034. The continuing growth of this market is associated with the growing love for sweet bakery treats and is accompanied by a change in the market dynamic associated with the growing healthy baking trend.[1]

This has also caused a need to reformulate or create new lines for trends such as gluten-free, clean label, organic, low sugar, egg-free, etc.

Global cake consumption has showcased that its biggest market includes North America and Europe, with dessert cakes as the leading type in worldwide consumption.

Companies now rely on the development of specialty products with a special interest in increasing the offer of healthier product alternatives.

Emulsifiers in Cake

Made with flour, sugar, butter, eggs, and milk, cake is recognized by its fluff,y soft texture, and rich buttery flavor. A wide variety of cakes is produced worldwide, the most popular being the yellow vanilla cake. Each type of cake has its own particular flavor profile and inclusions to provide its special and unique characteristics.[2]

Cakes can be classified into two main groups:[2]

- **Foam-style cakes (e.g., sponge cake, angel food cake, chiffon cake):** foam-like appearance produced from the aeration of eggs.
- **Batter cakes (e.g., pound cake, yellow cake, white cake, chocolate cake):** crumb structure resulting from the fat-water emulsion created during batter mixing.

Cakes Ingredients and Functions

Ingredient	Type	Function
Sugar	Granulated sugar	Provides sweetness.Tenderizes by actively participating in aeration process. Absorbs moisture.Improves shelf life.Participates in Maillard browning reaction.
Flour	Low protein flour (cake or chlorinated flour)	• Provides crumb-setting for product structure. • Absorbs liquids.
Fat	Butter or baking margarine	• Imparts tenderness. • Batter lubricant. • Tenderizes by interfering with gluten network formation. • Tenderizes by actively participating in aeration process.
Eggs	Whole egg	• Provide structure and flavor. • Provides volume. • Moisturizer. • Imparts color. • Nutrition profile enhancer.
Baking powder	-	Chemical leavening essential for product texture and volume.
Vanilla	Extract	Provides a characteristic sweet flavor.
Salt	Granulated	Flavor and taste enhancer.

CAKE QUALITY PARAMETERS

pH: influences the rate of reaction for the chemical leavening agents. Texture and gluten behavior are also influenced by batter pH. A higher pH tends to favor the browning Maillard reaction. Final pH affects the microbial stability of the product (e.g., mold growth); the typical pH of a classic cake lies between 6.0 and 7.0.

Moisture content: it's the water content of the product. It affects the shelf life and sensorial acceptability of finished products. Moisture content is commonly measured by a direct method of evaporation (e.g., convection oven, vacuum, microwave ovens) or by indirect methods (e.g, spectroscopy or thermogravimetry).

Water activity: it determines the microbial and chemical stability of the product and impacts the staling rate of the cake.

Texture: a wide variety of subparameters define cake texture; among the most relevant are hardness, cohesiveness, springiness, and resilience. Texture can be measured with a trained sensory panel or by instrumental methods like texture profile analysis (TPA).

Cake volume: associated with the lightness and fluffiness of the cake. It can be measured through instrumental methods like C-Cell.

Cell structure: considering the number of cells, cell diameters, cell volume, and cell elongations, among others. It can be measured through instrumental methods like C-Cell.

Color: produced during the baking process due to the browning reactions, affects the acceptability of the product. It can be measured through instrumental methods like C-Cell or by trained sensory panels.

Inclusions: (such as fruit or chocolate chips) can be quantified to provide information about the evenness of distribution within the slice.

Typical Ranges for Cake Varieties

Quality parameters	Carrot cake	Yellow cake	Fruited cake	Celebration cake (e.g Heavenly fruited cakes)
Moisture	18 - 28%			
Water activity	0.90 - 0.95	0.80 - 0.89	0.70 - 0.79	0.60 - 0.69

J&K Ingredients

Extending Cake Shelf Life

Enhancing the product's shelf life is essential for bakers and manufacturers looking to preserve product quality and reduce waste. Here are a few key ingredients and processing strategies:

1

Anti mold

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2

Clean Label

Natural ingredients such as vinegar can be used to adjust pH, and extracts such as citrus or rosemary can help reduce microbial load. However, be cautioned that these ingredients may affect the taste of the product. It has been shown that ingredients such as sorbic acid can reduce microbial loads and prevent mold growth, but it lacks the solubility required to have the greatest effect. SOR-Mate from J&K Ingredients is a natural preservative designed to replace synthetic additives, such as synthetic potassium sorbate and sorbic acid, in cake formulations. For special applications, it is also available in a gluten-free formulation.

3

Humectants

Glycerin, sorbitol, and honey help retain moisture in the cake, averting it from becoming dry and
crumbly.

4

Emulsifiers

Ingredients such as lecithin, mono- and diglycerides, and sodium stearoyl lactylate help distribute fats and oils evenly throughout the batter, resulting in a smoother texture and more consistent product.

J&K Ingredients

Processing Conditions

When looking at the processing conditions, a few steps must be taken to ensure a long product shelf life. Overbaking a cake leads to a dry, crumbly texture, a higher rate of staling and shorter shelf life, while underbaking can result in a more moist and dense cake that may spoil quickly due to access to available water for mold growth. Therefore, finding the right balance and ensuring that the cake is baked for the appropriate time and temperature is vital.

Finally, sanitation and storage conditions can also affect the cake's shelf life. Cakes should be stored in a cool, dry place away from direct sunlight and moisture. Moisture can lead to mold growth, while heat can cause the cake to spoil more quickly.

Ideal Cake Texture and Volume

Ideal cake texture and volume depends on the type of cake to be produced. In general, cakes should have a tender texture characterized by a tight grain and crumbly properties. Cake crumb should have a uniform distribution of cells and a uniform cell size. The cell size of cake crumb is definitely smaller than bread.

Volume fully depends on the type of cake produced, mixing method, baking powder amount, aeration extent and overall formulation. Higher volumes are preferred to lower volumes, indicating that higher aeration during mixing is ideal as long as crumb grain is acceptable or within limits. Tools that can help evaluate the quality of cake texture include the C-Cell Texture Analyzer. For measuring water activity, use a water activity analyzer.

Troubleshooting Cake Emulsifiers

What preservatives should I use to make my cake last for at least 1-3 months and uphold the texture?

When preserving a cake for an extended period, it's essential to use a combination of strategies. Preservatives like potassium sorbate, sodium propionate, and calcium propionate can prevent mold and yeast growth. SOR-Mate is another natural preservative with effective mold growth for replacing potassium sorbate or synthetic sorbic acid inhibition properties that can be used. The recommended proportion for using SOR-Mate as a replacement for potassium sorbate or synthetic sorbic acid in a formulation is 3 to 4 parts SOR-Mate per 1 part of the former. SOR-Mate is labeled as "Rowanberry Fruit Extract, Tapioca Flour."

In addition to preservatives, a good humectant and emulsifier are critical to prevent staling, which can cause the cake to become dry and crumbly. Proper storage conditions are also crucial, as the cake should be protected from heat, sunlight, and moisture. By using a combination of preservatives, humectants, emulsifiers, and proper storage techniques, bakers can extend the shelf life of their cakes without compromising on texture or taste.

What are the main characteristics of a good sponge cake?

Sponge cakes are a type of foam cake. They are characterized by their formulation, which consists of egg yolks, granulated sugar, egg whites, and flour, and by their mixing method. Sponge cakes are characterized by their rich flavor and by their soft, resilient,t and fluffy texture. Their characteristic texture is associated with their specific gravity. A cake's specific gravity is the ratio of the mass of cake batter in a known volume compared to the mass of water in said volume.

Typical values of specific gravity for sponge-type cakes are 0.30-0.50. Lower volumes of specific gravity indicate a high amount of air has been incorporated into the batter.

J&K Ingredients

What effect does damaged starch in flour have on cake texture and shelf life?

Damaged starch is starch that has undergone a change in its shape due to the milling process. This starch absorbs a greater amount of water at a faster rate than non-damaged starch. Increase of water absorption aids in starch gelatinization, and thus contributes to the structure building of the cake. A high amount of damaged starch (values above 3%) may cause the collapse of the cake during oven spring. [8]

How can I determine the moisture content of my cake?

Several techniques can be employed to determine the moisture content of the cake. One option is a moisture meter, which estimates water content through an electric current. Another strategy is to dry the cake in an oven and weigh it before and after drying, allowing for a more accurate measurement. A third method is to use a moisture analyzer, which is similar to the oven method, but takes smaller samples and is faster. These methods can help bakers make necessary recipe adjustments to improve cake quality.

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