



Technical Paper

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OPTIMISING CAKE QUALITY

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Cake quality is determined by a number of complex interactions arising from the choice of raw materials, their ratios in the recipe and the processing conditions employed. While cake batter processing is significantly less complex than is the case with breadmaking (essentially it comprises depositing of the individual units and there are no shaping or proving stages), it still has a role to play in delivering the required final product quality. The same is true for baking in the oven where the input of heat determines the rates and extent of the many chemical and physical changes which characterise the conversion of batters to cakes.

Traditional cake quality optimisation approaches have focussed on the structure of the recipe and the 'balancing' of the ratios of the different raw material inputs. These rule of 'recipe balance' remain important but it is equally important to recognise the role that mixing, batter processing and baking can make, not least because changes in these elements of cakemaking offer reformulation opportunities for product innovation.

The definition of cake varies in different parts of the world (e.g., sometimes they are called 'fine bakery wares'). However, most cake recipes are based on wheat flour, sugar and whole eggs and milk or water, commonly with the addition of fat or oil. The level of added liquids is such that a relatively low viscosity 'batter' rather than a dough is formed. Modern cakes are characterised by being relatively low-density products, typically 0.4–0.7 mg^{-3} , with a tender-eating, friable crumb and sweet taste.

Cakes may be classified into six arbitrary categories:

Low-fat sponges containing less than 5% fat.

High-fat sponges containing more than 5% fat.

Low-ratio cakes in which the level of sugar and liquids in the recipe are individually less than the flour weight.

High-ratio cakes in which the level of sugar and liquids in the recipe are individually greater than the flour weight. Commonly the flour used in the manufacture of high-ratio cakes will have been subjected to some post-milling treatment such as dry heat treatment or chlorination may have been used.

Fruited cakes which have a proportion of dried vine fruits, fresh fruit, nuts or other particulate materials in the recipe.

Chocolate cakes containing a proportion of cocoa solids.

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General Approaches to Mixing Cake Batters

The primary functions of mixing are:

- To blend all of the recipe ingredients uniformly.
- To hydrate the wheat flour components.
- To dissolve the soluble ingredients (e.g., sugar).
- To incorporate air for the formation of the cake structure.

In practice a number of different, commonly multistage mixing procedures have evolved to form cake batters. Some of the procedures still in practice are traditional and evolved when ingredient qualities were less consistent, and often they aimed to improve the mechanical aeration of the batter (see below) or 'inhibit' the formation of gluten during mixing. It is debatable as to whether the latter would have occurred to any significant degree in cakemaking as the low viscosity of the batter limits the potential for the energy transfer required for significant gluten formation. Traditional tasks may refer to avoid 'toughening' the batter but this may more likely refer to the loss of cake volume from insufficient mechanical aeration and the loss of carbon dioxide from premature baking powder reaction than the formation of gluten (as in the context of breadmaking).

Mixing procedures which may be encountered include:

- The 'sugar-batter' process in which the initial mixing step is the creaming together of the fat and sugar with the intention of incorporating air before the addition of other ingredients.
- The 'flour-batter' process in which part of the flour and the fat are creamed together to aid air incorporation and limit gluten formation.
- The 'egg-separated' method in which the egg white is separated and whisked with the sugar to incorporate air (c.f., meringue production) before being blended with the other ingredients.
- The delayed addition of oil (or melted fat) until after the cake or sponge batter has been fully mixed. The addition of oil should be carried out in such a manner so as not to de-aerate the mixed batter.
- The 'all-in' mixing method in which all of the ingredients are placed into the mixing bowl at the start of the process with blending the ingredients and batter aeration being carried out in one stage. The inclusion of an emulsifier in cake and sponge recipe has greatly facilitated the move to the all-in mixing method because of its ability to ensure adequate mechanical aeration, even in the presence of oil or fat.