Shortening for the Cake Baker*

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Abstract

A discussion of shortening requirements based on the problems of commercial cake baking. The author attempts to briefly indicate what properties are sought for by the baker in his effort to produce superior results. The influence of shortening on finished products and the suitability of types of shortening to meet shop practices are reviewed.

IT has been suggested that I say a few words to you concerning the problem of the bakers' needs in the matter of shortening for cake and sweet goods. Until one has been brought into rather direct contact with production in the bakery there is often a lack of knowledge of what the baker requires in making the great variety of products which normal operations demand. As one employed in the bakery field, I shall speak to you in the baker's terms and will avoid the phases of the problem that are more properly the concern of the shortening producer.

The field of baking is broad and includes several general varieties of products which we must here group in rather general classes.

Let us first consider shortening cakes such as loaf cake, layers, pound cake, etc. Such products are made from a relatively limited number of essential ingredients by methods that differ in almost limitless ways.

We may ignore for the moment the consideration of ingredient percentages and in so doing restrict our discussion to procedures. By so doing we will simplify the approach to the problem of shortening influence.

For our purpose we will classify processes for mixing into the two most distinctive procedures, namely, that of beginning the cake mix by incorporating shortening with sugar and on the other hand the procedure of first blending the shortening with the flour.

The first method is the older and is the method long used by the housewife and until recent years used likewise by commercial bakers. Old recipes, as you find them in cook books before the turn of the Century, usually called for butter as the shortening agent, later cottonseed compounds were sometimes partially substituted. These recipes all call for blending, or, as the baker terms it, creaming the sugar and shortening. Creaming involves making an intimate mixture of the two ingredients in which condition the mixture has a plastic or creamy consistency, the measure of creaminess being dependent upon the amount of agitation and the incidental air inclusion which results.

After this first step, the next stage is the incorporation of eggs, milk, etc. A good cream will quickly take on the moist ingredients without separation of the fat, in other words, an emulsion is formed that carries such ingredients in a finely divided state. With such blend of ingredients, the necessary flour may be added and complete incorporation accomplished without any separation of fat from the liquid phase. Incidentally, the act of mixing the ingredients together incorporates air into the batter in a finely divided state.

Whole eggs and yolks yield a better emulsion than whites alone, when butter is used. Oils, such as cottonseed and corn oil, for instance, will not make a fine grained cake even with yolks. It is necessary that the shortening have a measure of "fat" characteristics.

The development of the hydrogenating process was a solution to the problem of preparing cottonseed oil and fat compounds.

Today hydrogenated oils are used to a greater extent than butter because the industry has developed plastic hydrogenated oil preparations that have better water-carrying properties than butter has at temperatures above 75° F.

In recent years the shortening companies have developed whole series of shortenings to meet special conditions. Some of these conditions may then be briefly considered but we will not endeavor to consider them in the order of importance.

Color — or I might better say whiteness — has come to be of great importance. Extremely white cake is now possible by virtue of the color properties of shortening and bleached flour. Therefore, a shortening that is very white and bright in the plastic stage and nearly water white in the melted state has distinct advantages that a baker may lay much store upon.

Plasticity is important; a shortening that is too firm at 70° F. or too soft at 80° F. has very definite limitations for the commercial baker in his problem of creaming his mix. Then, too, he finds that there are great differences in the shortenings in their moisture-holding properties at a given temperature, say 75° F. He finds it to his advantage to select the shortening that creams readily to a good volume and with good body at his average shop temperature which may be 75° F. Where shop temperatures vary considerably, a baker appreciates a shortening that has a wide temperature tolerance; such a product will permit more uniform baking results under extreme shop temperature conditions.

I have described several of the factors that influence the baker's preference in shortenings for cake. There is then left the point that further distinguishes the baker's choice: that is the style of mixing procedure that he prefers. If he seeks to pursue the fat-shortening creaming method in which the flour or part of the flour is incorporated with the shortening, he may be anxious to make a cake with a high percentage of sugar. There are a number of shortenings on the market to which emulsifying agents have been added: the shortenings are designed to increase the emulsion-forming power of the fat which in turn permits the incorporation of large amounts of water and sugar into the fat without separation of the fat. In this procedure the flour or part of the flour is creamed into the fat and the eggs and liquid added gradually to form a rather thin batter after which the final flour is added.

The baker desires in his modified shortening all of the qualities that I have previously mentioned and in addition he looks for a greater burden-carrying capacity. Normally the baker has no means of determining his preference as between brands except as shop tests may indicate. These may be influenced by the type of flour he has and to a less extent by other factors.

It is my observation that cakes made by the shortening-flour creaming procedure do not vary greatly in composition from well-made sugar-shortening types. With

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the introduction of the modified type of shortening there were some revolutionary methods recommended and claims made for their use which persuaded many bakers that these shortenings had many qualities not characteristic of the ordinary hydrogenated shortening. We observed that cake made with the modified shortening tends to have somewhat different characteristics in that it is relatively easy to obtain extremely fine grain in the cake and unusual uniformity. Characteristic of this type of cake is the more or less round formation of the cell structure as distinct from the more elongated cell structure of the sugar-shortening method which yields a more feathery type of cake crumb.

I believe that the preference of the baker may in many cases be determined by the keeping qualities of the cake that he makes for his tests. It is quite possible that the melting point of the fats used will influence the amount of "setting up" that the cake structure evidences during the course of 36 hours. For other bakers, especially those who have some technical advantages, the nature of the shortening as is evidenced by plasticity tests will influence their choice. It may be presumed that the matters of crystal size, softening points and degree of hydrogenation are important factors in determining the suitability of shortenings, but it is not in the province of the baker to determine these factors; he relies on his shop tests to determine the properties that govern his choice.

Let us consider another shortening problem of the baker, namely, cream icings and fat cream fillings. Here the value of a shortening is determined very largely by its capacity to form a fat-water emulsion in which the water may be approximately 20%. Usually some sugar is used and sometimes egg as well. The shortening that will whip up into a firm, smooth, plastic mass is desired. In addition, it is quite essential that the cream have the quality of remaining homogenous for a considerable time. Under commercial conditions, especially in the case of wholesale bakers, it is desirable that such a cream should hold its moisture for as much as six days. A cream that sweats out droplets of water is quite undesirable.

It is of particular interest to the baker that experience should prove that very often the shortening that will produce the best cake will not yield the best cream. For determining his choice of brands, the baker may make creams of several brands, using ample water and noting which yields maximum volume and least tendency to sweat. Of those brands that do not sweat under the conditions of the test, the one that yields the greatest volume will be chosen, other factors being equal. The other points are whiteness and freedom from taste; it being quite desirable here, as in cake making, that blandness of taste be a characteristic.

It so happens that some shortenings will whip to a light, smooth, creamy-textured mass that will support itself in a rather sharp angle cone. Others tend to lack smoothness at consistencies where they are sufficiently firm to support themselves, there being a tendency for the product to lack a completely homogenous structure. On the other hand, some products will absorb a large quantity of water in the creaming, make a smooth cream of good consistency but will bleed out moisture and shrink on standing.

It has been my experience that the best cream is often obtained from those fats which do not carry the added emulsifying agent. The reasons for the behavior of fats in this test are probably much more clear to you than to me.

Where the shortening is used in icing such as is known as "butter cream," the choice of shortening may be conditioned upon the percentage used and upon temperature conditions prevailing. Under some conditions and with low fat icings it may be desirable to use a shortening that has a lower per cent of high melting fat. Under other conditions it is desirable to have a more firm fat. An experience which is always unpleasant is that of having an icing become streaky due to separation of fat and sugar in the finished product. The baker will choose the fat which has the least tendency to exhibit this fault.

There are quite a number of other uses for shortening which one has to consider in cataloging the baker's requirements but for lack of time I will not dwell upon them. Suffice to mention several briefly.

For enrobing purposes the baker must resort to shortenings that are quite hard at room temperature. Here it is essential that the fat be quite firm at 90° F. but at the same time soft enough so that it will melt at body temperature. Further, such a fat must have a high sweat point or the finished product will not tolerate temperature variations. In this type of work heat is generally used and the setting properties are of considerable importance. A fat that sets unevenly will be dull and unattractive and if used in dark stock it may give rise to streaks and grayness.

Rolled-in pastry is another field where the baker seeks a shortening of specific properties. Butter is probably best from the standpoint of flavor, and flavor is vital, nevertheless other preparations find favor. In the preparation of such products it is essential that the shortening be quite firm and characterized by a definite toughness. If too firm it is undesirable because it will not spread in the pinning. If too soft it will run together between the sheets and will run out when rolled. Here is desired a butter or other shortening that at cool temperatures will be firm but not hard, tough but plastic. Such shortenings are worked at somewhat lower temperatures than cake work calls for; they should be of a nature that they will soften completely below body temperature.

Another place where the baker must select his shortening to fit special conditions is in preparing pie crust. Much pie crust is made using lard but hydrogenated shortening is quite commonly used. Where a mealy, rather dry crust is desired a firm hydrogenated product may be selected. Such a shortening should not have a high melting point nor should it become excessively hard on chilling. The vegetable shortenings yield crust that does not grease-soak containers as readily as lard will. This is sometimes a consideration while on the other hand crust made with good lard has a characteristic flavor preferred by many bakers. In selecing a shortening for pie crust the nature of the fat selected may be conditioned by the character of the flour used. With a given flour one may select a relatively firm shortening to get much the same effect that would be obtained by using a very plastic shortening with a flour of different nature.

As you are all probably aware, pie crust attains its character as much by reason of the manner of assembling the ingredients as it does from the kind and proportion of materials. The nature of shortening called for will, therefore, be

conditioned upon the procedure chosen by the operator. There are consumer as well as baker preferences for types of pie crust that vary from greasy, flaky, rather dark colored crust to the friable, mealy and dry crust that many prefer. To satisfy the requirements of such a range, there must be available a variety of shortening preparations that range from lard through rather soft hydrogenated vegetable fats to those that are quite firm.

In these comments I have sought to point out the characteristics that govern the baker's choice of shortening. We must bear in mind that baking is fundamentally an art as well as a craft. Just as there are whole groups of consumers that prefer a flaky pie crust to a mealy one, likewise there are numbers of bakers who strive for a feathery, flaky cake crumb while others work to attain extremely fine grain and uniformity of cell structure. Recipes and procedure in mixing are as varied as human personalities, so it is quite natural that no particular ingredient, such as shortening, will be universally preferred and by the same token there is no one set of ingredient characteristics which will fit all requirements of many bakers. It may be added that the baker has no definite information supplied to him by shortening manufacturers which will aid him in developing an understanding of shortening. Unlike flour, which he buys on a basis of analytical specifications, his shortening is bought on sample or by brand name. My comments here are evidence of the unsatisfactory relation of buyer and seller; to use brand names here is unwise but in all probability I might convey to you my thoughts in a more illuminating manner if I could use brand names. You then, knowing the characteristic differences between brands, would derive real information which I am unable to explain through my limited knowledge of the intricacies of shortening manufacture. In closing I should like to leave with you a plea to strive toward the development of terms and descriptions that will better classify the commercial shortening preparations submitted to the baker so that he will have a more thorough understanding of what he is using. The baker will then be in a much better position to cooperate with you in solving some of the problems which beset him.

ABSTRACTS

Oils and Fats

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SHORTENING. P. Pelshenke. *Fette u. Seifen 46,* 5-8 (1939). The author discusses the interchangeability of fat for bakeries. The 1937 statistics of Berlin yielded the following ratio of fats used: margarine 44, oil 21, tallow 13, butter 9, compound fat 3½, and other 6%.

SEPARATION EMULSIONS. A. Häussler. *Fette u. Seifen 46* 3-5 (1939). The author recommends the use and discusses "trennemulsions" which is a 25% fat emulsion for use in the baking industry. Use of this product assists in the fat economy program.

COLLOID CHEMISTRY ASPECTS OF THE STRUCTURE OF OIL SEEDS. M. Singer. *Seifensieder-Ztg 65,* 882-3 (1938) Review.

QUANTITATIVELY DETERMINING THE STEARIC ACID IN FATS. A. Heiduschka and W. Bohme. *Z. Untersuch. Lebensm. 77,* 33-8 (1938). App. comprising thermostat, filter and extg. equipment is described. About 0.5 g. fat acids are weighed in a 200 Edenmeyer flask, 100 cc. of stearic acid soln. (4.5 acid to 1000 cc. alc.) are added, the soln. is warmed to dissolve all fat and stirred and placed in a bath of 0°. After 6 hrs. filter. The stearic acid is extd. from the filter paper, dried and weighed. The error in the analysis amts. to ± 2%. Fat from various parts of beef and pork were analyzed.

LOSS OF FAT DURING BUTTER MAKING AND PREVENTION OF THIS LOSS. J. S. Francisco. *Agr. Live-stock India 8,* 262-8 (1938). When the concn. of fat in the cream was maintained at 30% a min. amt. of fat was lost in the buttermilk. The optimum temp. of aging was 48-52° F. and that of churning the cream 54-56° F. Loss of fat in the buttermilk was reduced from 0.15% to 0.1%, when cream with 30% fat was churned, by adding 100 cc. of a 0.2% soln. of either citric acid or Na citrate per 100 lb. cream; the flavor, aroma and keeping quality of the butter were improved. *(Chem. Abs.)*

COMPOSITION OF DRYING RATES OF SOYBEAN OILS. H. R. Kraybill, A. W. Kleinsmith, & M. H. Thornton. *Ind. & Eng. Chem. 31,* 218-22 (1939). Analyses of the oils were made as follows: per cent of foots, per cent of break (Gardner method, per cent of phosphatides, acid number, iodine number, refractive index, and drying time before and after removal of the phosphatides and associated compounds. There was a close correlation between the Gardner break and the percentage of phosphatides of the crude oils as calculated from the phosphorus content of the oils.

A STUDY OF THE PASSAGE OF FATTY ACIDS OF FOOD INTO LIPINS AND GLYCERIDES OF THE BODY USING DEUTERIUM AS AN INDICATOR. B. Cavanagh & H. S. Raper *Biochem. J. 33,* 17-21 (1939). Rats were fed with a fat containing 4-5 atoms % deuterium and the distribution of the "deutero-fatty acids" in "lipin" and "glyceride" fractions of liver, kidney, brain and blood determined 6, 10, & 24 hr. after. After 6 hr. D. was present in considerable amount in plasma glycerides, liver glycerides and liver lipins. There was much less in the lipoid fractions of the kidney and plasma and the D was only present in traces in adipose tissue. The D in the liver glycerides decreased more rapidly in 24 hr. than that of the liver lipins. In the lipoid fractions of kidney and brain there were no notable changes in % D between 6 & 24 hr. The results suggest that liver lipins may play a very active part in fat metabolism.

THE BIOLOGICAL VALUE OF CAROTENE IN VARIOUS FATS. E. J. Lease, J. G. Lease, H. Steenbock and C. A. Baumann. *J. Nutr. 17,* 91-102 (1939). When excessive amts. of carotene or vitamin A were fed in lard, soy bean oil, cottonseed oil, devitaminized butterfat and a hydrogenated vegetable fat, no marked differences in storage were obtained. Approx. equal growth responses were obtained when 1 microgram of carotene