Shortening Requirements for Baked Products

By C. B. MORISON

SHORTENING has been used in baking and cooking for centuries, yet until recently the effects of these fatty ingredients in baked products were not regarded as of significant research interest either by producers or consumers. The influence of shortening on changes in taste and flavor of baked products on keeping, had not received serious attention from chemists and no attempts had been made to measure comparative "shortening" effects by physical methods.

Bakers used butter, lard and sometimes beef fat, the latter for special purposes. When other fats and oils later came on the market, the question of their use was largely an economic one. At first these new shortenings were regarded by the baking trade as substitutes for the real thing; and for some years they met with strong consumer resistance, not to mention the opposition of food officials. However, a development period was under way, and oil chemists were producing new shortenings claimed to possess superior properties for use in baking. "Hydrogenation" soon won its battle and revolutionized the shortening industry.

In the meantime commercial baking was progressing and getting into mass production. The chemist had worked his way into the flour mills, and soon afterwards founds his place in the bakery. There he was confronted with the problems of ingredients, processes and products and among them was a need for a better understanding of shortening.

On the other side oil chemists were coming into contact with bakers' ideas about shortening through conversation with the company's sales force. The salesman assuming that chemists are supposed to know everything, put the oil chemists "on the spot." "Just what kind of shortening do the bakers want?" "If you can make what they want—do so." Oil chemists are always broadminded so they brought some practical bakers into their organization and set up facilities for baking in their own laboratories. Some of our oil chemist friends even attended baking schools and actually went to work in the bakery. They were trying to learn what the customers wanted, which is "horse sense" and provocative of good chemistry.

Therefore we can say that at the present time conditions are most favorable for a much better mutual understanding of the shortening problem by both producers and consumers than ever before. Tests are being made now, not only at the bakeries where shortenings are used but also at the source where they are manufactured. There are also indications of an active research interest especially in the problem of stability or rancidity, from which important knowledge is being obtained.

Shortening Power

Various writers have proposed definitions for the term shortening. Davis and Platt and Fleming[1] state that "Shortening is any fat or fixed oil used as an ingredient in baked products. That material has the greatest shortening power, which when baked in a dough under standard conditions gives to the product a minimum breaking strength and a minimum crushing strength."

A definition of this kind has at least the merit of brevity and clarity. It also may be referred back to numerical values obtained by the use of "shortometers," or instruments such as those developed by Davis, Platt, Bailey, Luckow and others for the determination of the breaking and crushing strength of a suitable test sample of baked product. Standard test conditions are recognized in practice.

Physical measurements of this kind are useful, and if sufficient data is accumulated and statistically analyzed, important information may be obtained on the comparative shortening power of different fats and oils as they are used in baked products. Nevertheless methods of this kind have their limitations, not only due to the inherent variables in the physical structure of the test samples themselves but also the kind or type of baked products tested. The amount and characteristics of the flour proteins and the method and time of mixing conditions are other factors that may be contributory to the shortening effect as indicated by breaking or crushing. Control of the room temperature and humidity when determinations are made appears to be highly important[2] if trustworthy data are expected.

Stability, Resistance to Rancidity

Wesson[3] the dean of American oil chemists has stated that "the ideal shortening material for long keeping is one that will keep indefinitely without making its presence known except by its shortening effect." Here is an ideal shortening for oil chemists to produce which recalls familiar adages about stars and chariots.

There are several angles to this problem that may be mentioned here. Fundamentally it belongs to the oil chemist, but as it now seems to be connected not only with the chemical characteristics of the fat but also to the conditions or environmental influences of the baking process it becomes a research field of highly important mutual interest to both fat and cereal chemistry.

This problem also possesses relative importance according to the kind of baked product in which the shortening is to be used. Bread for example has a very rapid sales turnover. People want fresh bread. The rancidity possibilities as the result of keeping bread are practically nil, although old bread develops oxidation rancidity in time. The fact that ground bread crumb, in the form of coarse particles speedily becomes rancid, if stored without suitable precautions to remove oxygen from the container is well known to any one who has ever tried to develop a stable product of this kind for culinary purposes. Practically, however, bread reaches the home as fresh as possible, and the keeping quality of bread from the development of rancidity standpoint is of slight immediate interest under the usual rate of bread consumption.

If, however, some future chemical genius should solve the problem of the growing stale of bread, he would very probably have to deal with flavor and taste changes on keeping, in which the shortening would be involved. This side of the stale bread problem has received little attention.

The various kinds of cakes require large amounts of shortening as compared to that of bread. Like bread, cakes generally have a rapid sales turnover, though some types of cake (fruit cake), are held in storage for a considerable length of time. If cakes are to be of high quality, the shortening used must possess not only the proper characteristics for satisfactory results, but also should be of high stability.

The cereal chemist in baking must establish suitable methods which not only will give reliable information on the rancidity resistance of the shortening but also on its effects in whatever baked product it is used. At present this practical viewpoint is recognized generally by both oil and cereal chemists. Tests have been developed in the last few years that are helpful, but no one would contend that these are not without limitations for a satisfactory interpretation of the observed data. This has been brought out recently in connection with studies of the rancidity problem in the biscuit and cracker industry. The shortening problem in this industry is of the highest importance, especially in relation to keeping quality.

The investigations of Triebold[4] and associates in this field are of great interest to oil and cereal chemists. Triebold's papers have been published in Cereal Chemistry, and oil chemists working in the shortening field who do not read this comparatively new journal will find it worth their time and attention to do so.

In a recent paper, Triebold[4] has called attention to certain anomalies in the results obtained from tests that indicate the influence of the baking process on the development of rancidity of crackers in storage. Certain lards of very inferior keeping quality were found to produce crackers of good keeping quality. This anomaly appeared to be due to the "reduction of the active oxygen content of the lards in the baking process and thereby the removal of pro-oxygenic catalysts formed in the preliminary auto-oxidation of the lard."

However, it seems that in some cases keeping tests of shortening by storage tests or length of induction period of oxygen absorption may not always be a true index of keeping quality of the crackers in which the shortening is used. There is still much to be done on this subject.

Another development of interest lies in that modern touchstone of chemical industry, the catalyst. Results so far are promising and perhaps the oil chemist has an anti-oxygen even now on the laboratory shelf.

Consistency

The consistency of a shortening is of much interest to the trade. Indeed this property "may make or break" a shortening in the estimation of the baker. Most shortening users test consistency by the "finger indentation and feel method" which to say the least is not exactly a controlled procedure. This test may be supplemented by the "mouth softening method," familiar also to oil chemists as a trade criterion.

Some form of penetrometer used under controlled temperature and time conditions will give comparative results for hardness. Since the plastic flow of a solid fat like shortening depends upon the temperature, this may be established within the usual working temperature range of 70-80° F. So-called "creaming tests" for volume may also be used to provide further information on this property, with due attention to control of temperature and time.

The oil chemist's problem of producing a shortening of proper consistency to meet climatic or seasonal variation in temperature will probably remain as it is until proper storage conditions by consumers are more generally adopted. Complaints are frequent that the shortening is either too hard or too soft. Some of these complaints are due to composition of the shortening, but others may be traced to wide variations in temperature of storage and use.

Other factors of significance in a consideration of shortening requirements are, color and flavor. The baker is critical of color especially in a solid shortening agent. While a chemist observes the color of the melted fat, this point is not appreciated by consumers generally. Color in the baked product is of more significance, and if the shortening is a contributor to color, this may be investigated readily.

The flavor of a shortening is of the highest importance for the production of a quality product. This is such an obvious factor in quality that it requires little discussion. Given a satisfactory flavor in the shortening, its influence on the bread, cake or other baked product should also be investigated. Here again the baking process has an influence and may not be disregarded.

The shortening problem from the control side has been greatly clarified in the last few years. A highly competitive industry, that has now reached a high technical development must have consumer confidence in its statements and claims. The oil chemist has gone forward in the right direction, by making actual baking tests on the effects of shortenings in the various kinds of baked products, and this should be an important aspect of his control work.

Competition has made this necessary, and claims should be checked and substantiated at the source of production. The uniformity bugbear may be satisfactorily checked in laboratories having baking facilities.

It seems to many of us that the time has now come for chemists in the edible oil industry, and chemists in the baking industry to cooperate in working out a schedule of tests for shortening that would be of material value to both industries. This would not only include established analytical methods but also what might be called process and product tests on the effects of shortening under baking conditions.

Experience has shown that work of this kind is apt to become complicated by obsessions as to highly refined standardization of test baking procedures. This is to be deplored, but if these problems are approached with a proper understanding of objectives it is probable that a comparatively simple framework of conditions might be established that will give the information required.

Such work cannot be initiated easily, since it requires not only public spirited cooperation, but time. It is an objective that is not too remote from the routine laboratory work, and obviously should not be allowed to assume the magnitude of a major research problem. It is quite probable that some chemists become so interested in working out the details and conditions for a method, that they lose sight of the practical purpose for which it is intended. Of course we all know that chemists in the oil and baking industries have never been known to have fallen into the bogs of theory.

If this is so, cannot we look forward to the time when there will be available for all those interested an up to date and well founded system of tests on shortening that will have practical value to both producer and consumer in the determination of shortening requirements for baked products.

References

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