Quality Measures in Baking

Assessment of the quality of baked products requires a selection of measurements covering a range of physical and chemical characteristics, textural properties, and attributes related to food safety and nutrition. In the case of food safety and nutrition, a major contribution to final product qualities is made by the raw materials and formulation used. There are few baked products in which the nutritional attributes change significantly as a result of baking. The exception is moisture content; baking losses that arise as a result of the transition from raw dough or batter to baked product have to be taken into account to accurately declare the nutrition data on the product packaging. Obtaining typical weight loss data for a particular product is not a complicated process, which makes the calculation of final moisture content and other chemical data postbaking a relatively simple task. Calculated data should be checked at some stage against measured values using appropriate approved methods to maintain confidence in the declared information and meet the requirements of the relevant regulatory authorities.

Physical and Sensory Qualities

When it comes to the physical and sensory qualities of baked products, the responsibility lies directly in the hands of the baker. I would argue that it is the baker who knows what final product characteristics are required, what process will be used, and, therefore, what raw materials should be specified. When working with bakers on new or existing products, I am always surprised by how many default to their ingredient and even equipment suppliers. I have nothing against bakery ingredient and equipment suppliers, but it often seems to be a case of “the tail wagging the dog” (as we say in the United Kingdom). I constantly visit bakeries where ingredient after ingredient is thrown at a product or a new piece of equipment is considered (or even purchased) to solve a process problem. What has this got to do with quality measures? Well, process settings are as much a part of product quality as the formula or ingredients used. My philosophy is best summed up as “What are you trying to make (product quality)? How are you trying to make it (process)? What formula and ingredients should you use to achieve the desired product quality?”

Food Safety

In the case of food safety, the main concerns are associated with the presence or absence of contaminants, which requires careful screening of raw materials. This may be performed by the baker, but these days the responsibility more often lies with the primary producer, processor, and supplier. The number of substances that are screened for in raw materials is large, and the list is growing almost daily. Because each contaminant that must be screened for requires specialized measurement techniques, it is often beyond the means of the average baker to equip themselves with the sophisticated instruments needed for these assessments. If the baker is not able to carry out the analysis, they may turn to specialized, accredited laboratories for the necessary skills and resources.

Communication between the supplier and baker often takes the form of certificates of analysis for a specified range of substances. Today, the retailer often plays a major role in deciding which substances should be checked by the baker. Major retailers are sensitive to consumer opinions and tend to be ultracautious when it comes to specifying what contaminants should be included on the list. This caution may result in the baker having to check for materials that are highly unlikely to be found in bakery products to reassure the retailer who fears consumer backlash stemming from sensational media reports; the concept of “likelihood” seldom gets a sympathetic hearing. While the notion of “risk” is universally recognized, the concept of likelihood is often ignored. A good risk assessment should always include an assessment of likelihood, and this is especially true when quality measures are put in place to reduce the likelihood of contaminants being carried through to the consumer.

Fig. 1. Blemishes on the crust of a hamburger bun.
you experience one of those rare occasions when a single change delivers the goods but more to illustrate that process settings are as much a part of achieving the desired product quality as the choice of ingredients and formula.

Some bakeries don’t gather process data, while others do; mind you, many of those that gather data often don’t appreciate its value and don’t do anything with it. The example I gave above confirms my assertions perfectly in that when questioned in his office the bakery manager gave me a value for the machine setting I later changed. In the plant, the machine was set on a different value, and the mixer operator had recorded yet another value that did not agree with the other two. All three settings were wrong, as my tale indicates. How do bakers get into such a muddle? Commonly, it is because they do not pay enough attention to process data and its contribution to ultimate product quality. We are all used to the concept of measuring product quality at the end of the line and accepting or rejecting a product accordingly. However, this is far too late in the process. Rejection is costly, and as a result, products that do not have the right physical qualities often leave the bakery without enough thought as to whether the customer will be happy.

Measuring Bread Quality

The rise of the sandwich industry in the United Kingdom has had a major impact on how bakers view bread quality (2). The U.K. sandwich is based on two slices from a rectangular loaf baked with a lid to keep the top flat. Once made up as a sandwich, the sandwich is cut along the diagonal to provide two triangular sandwiches that are placed in a triangular package (Fig. 2). Sandwich assemblers work with very low margins, and only small tolerances for differences in the size and shape of the bread slices are permitted. Because assembly is often done by hand, each bread slice is effectively subjected to quality control. If the slice is too big, it will not fit in the packaging; if it is too small, it will not look like a good value for the money; if the sides are not straight, the filling will spill over; if the crumb has large holes, the filling will fall out; and if the slice has a coarse structure, the assembler will use too much spread.

Traditional postbaking quality assessment is performed by the baker, perhaps using imaging technology such as C-Cell (Calibre Control International Ltd.), which provides data on slice dimensions, shape (Fig. 3), and crumb characteristics (1); such data may well be included as part of the product specifications between baker and sandwich assembler. It is all very well to collect samples from the line and perform quality checks, but how can a baker guarantee that all loaves meet the required standard? The answer is, of course, that they cannot because they would have to handle every slice, which is totally impractical.

The key to maintaining quality is to develop an intimate knowledge of the complex factors that control the ingredient, formula, and process interactions. This requires good quality ingredient, process, and product data and lots of it. When things go wrong, we commonly collect a lot of data to analyze and determine what went wrong. When things are going right, we tend not to worry too much about collecting data. My contention is that it is when things are going right that we should pay the closest attention to the process data, because it is this data that tells us the most about how to achieve the final product quality we are seeking. A lot of modern equipment is capable of collecting and storing process data as part of its operation.

However, few bakeries collate the data to build a process pattern for their plants, and even fewer store the data for future use. In this digital age, bakers have a wealth of information about what controls their product quality; few have adequate knowledge of how to use it, however. I say that it is time for a change. Data and knowledge are as much bakery tools as mixers and ovens, so don’t just think about using them—do it!

References