Objective Bread Analysis for Solving Quality Issues

How do you determine the overall quality and consistency of baked goods? Bread quality analysis takes into account factors such as taste, appearance, texture, and mouthfeel to provide a quantifiable score for quality. Consistent monitoring of product quality is vital for manufacturing a desirable product. Two methods the food industry uses are subjective and objective analysis.

Subjective Analysis

The subjective analysis employs methods of untrained perception for evaluating bread quality. When an employee who is not trained in sensory analysis picks up a slice of bread and starts analyzing it, they provide subjective feedback. To change this subjectivity to objective feedback, employees would need to be trained in sensory analysis.

Objective Analysis

Descriptive sensory analysis is expensive and time-consuming, but it provides objective feedback on the texture and aroma of food products.[1] Other forms of analysis use instruments, as well as physical and chemical techniques. The results obtained using objective analysis are easily replicable, efficient, and inexpensive. These objective methods can evaluate multiple parameters at a time or in complementary ways to understand better the quality of products coming off the line.

C-Cell Baking Quality Analyzer is an objective analyzer used for baked products. Key features relating to the raw material quality, processing conditions are easily quantified using this equipment. The most common stakeholders include:

- Wheat breeders examine new varieties to validate bread-making potential at the earliest possible generation.
- Flour millers check the quality of the flour to meet the consistent quality.
- Bakers practice as a quality check tool rendering real-time data, allowing changes to optimize recipes and process conditions.
- Ingredient suppliers utilize C-Cell's ability to produce significant data to fast-track new developments.
- Bakery equipment manufacturers show precisely how equipment design changes impact the cellular structure of baked products.
- Academic research groups experimenting with ingredient and process treatments in cereal science.

Objective Measurement of Quality Parameters

C-Cell is used over a wide range of products like flat-bread, pizza bases, paninis, cake sponges, baguettes, and more. It can measure 48 to 60 different product quality attributes. Some of the most common objective bread analyses include:

Color

Average crumb color, exterior crust color, and crumb brightness can be measured using C-Cell. These results are in L*a*b format, a common trend throughout food industries. This is great for analyzing ingredient and flour variations in the baking process.

Dimensions

Multiple measurements of each slice for slice area, height, width, and packaging help understand the product's physical and visual qualities.

Shape

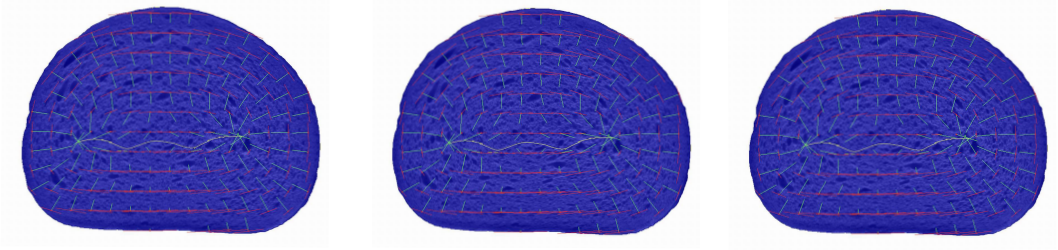
Shape analysis helps to quantify the visual quality. This measurement aids in achieving precision over concavity, oven spring, top shoulder, and bottom roundness.

Cell Size

The number of cells, size, and distribution throughout the crumb structure are essential to achieve the desired texture. Holes, wall thickness, cell areas, and volume quantification helps the baker understand the product's texture, mouthfeel, and visual quality. Additionally, process or ingredient alteration can have a direct effect on the bread cells.

Elongation

For a detailed result, C-Cell can also monitor molding performance through crumb cell elongation measurement.



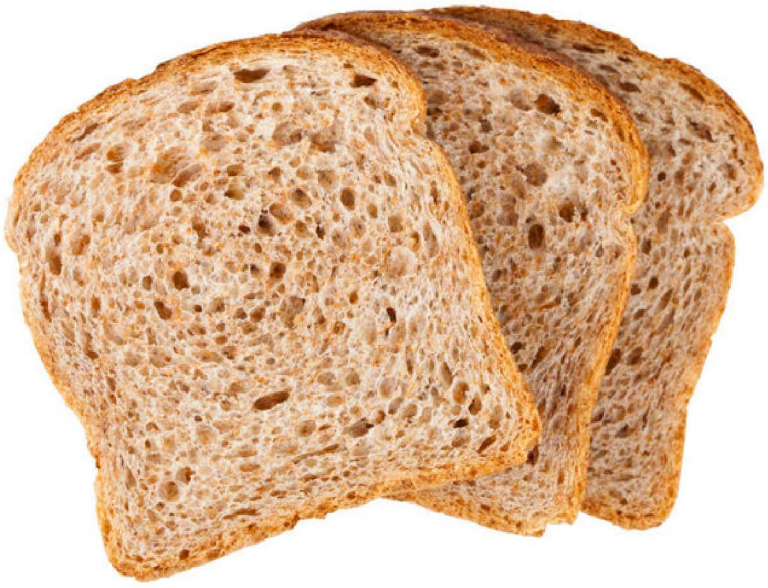
OTHER PARAMERTERS

Additionally, one can measure other sensory-related properties for bread and other bakery products such as:

- Texture
- Crumb
- Weigh
- Specific Volume
- Height or other dimensions
- Number of slices

Common problems found in crumb quality

- **Water absorption:** higher water absorption results in larger cells.
- **Yeast activity:** a high yeast activity ends in a larger quantity of cells.
- **Dough pumps:** an increase in the number of dough pumps used for transportation generates smaller cells.
- **Dough conditioners:** an increase in the use of oxidants results in more uniform cells. On the contrary, an increase in reducing agents results in more open cells.
- **Proofing:** proofing at higher temperatures opens up the crumb. Additionally, large and small cells form in a mixture.
- **Baking:** oven-spring and late yeast kill cause irregular crumb formation.



Why are there bigger holes near the top of my bread slices? What can I do to improve crumb uniformity?

This is a processing issue which stems from the speed of your line. There are two things to address. First, cooler dough temperatures. Target a final mixing temperature of 25-28°C (76-82°F). This can be obtained through reducing the mixing times. A sponge and dough can significantly reduce mixing times by 40%. If this is not an option, use reducing agents like L-cysteine or inactivated yeast to reduce the mixing times.

Second, slow the proofer down to obtain a proofing temperature of 33°C (90°F). Many times, when proofers are the bottlenecks, operators increase proofer temperatures in order to increase output. While this can be tolerated with oxidizing agents like potassium bromate and ADA, clean label dough conditioners were not designed for these conditions.

Clean label dough conditioners produce a more delicate dough that cannot prevent dough cells from coalescing. Therefore, the hotter it gets on the top of the dough, the more cells coalesce and the bigger the cells become on the top of the bread compared to the heel. The real solution is to reduce the proofer temperature or slow down the proofer. If this is not feasible, you would need to change out the dough conditioning blend.

How do I stop my buns from wrinkling?

The wrinkling is likely due to over-proofing a delicate dough or because of too much oven spring. If the dough size to weight ratio is too large, it will result in inadequate infrastructure. This causes the bun to collapse, forming wrinkles. The best remedy would be to increase the weight of the dough. It would also be helpful to ensure that the bun experiences an early yeast kill of less than 50%.

Why does my bread slice look like a mushroom?

This is common with breads that have a high level of vital wheat gluten and oxidizing agents added to its formulation, such as multigrain, wheat, sourdough or bread with inclusions. The expansion of the loaf in the oven spring stage of the baking creates an 'atomic cloud' event that causes the bread to collapse in on itself during cooling. Here are a few ways to deal with it:

- Thermal profile your baking step to make sure that yeast kill is less than 50%. This will stop fermentation effectively and reduce oven spring significantly, preventing that 'atomic cloud' event.
- Reduce your vital wheat gluten and oxidizing agents to a point that they don't affect the final volume.
- Depan the bread loafs as soon as it leaves the oven. When bread is left in the pans to cool, the pans continue to cook the bread, causing the bottom of the bread to shrivel.

Why are the blotches of white spots on the top of my buns?

The blotches are from over oxidation and dry proofing of the dough. Here are four ways to deal with it:

1. A reduction in oxidizing agents will help immediately.
2. Decrease your dough temperature by 2°C (5°F).
3. Increase the relative humidity of your proofer.
4. Take a look at your flour COA, and you may see a spike in protein quality.
5. Have a discussion with your miller on keeping the flour quality consistent.

References & Further Reading

1. Singham, P., Birwal, P., & Yadav, B. K. (2015). Importance of objective and subjective measurement of food quality and their inter-relationship. J Food Process Technol, 6(9), 1-7.
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