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Technical Paper

No. 18

STALING - CHANGES IN BAKED PRODUCTS POST-BAKING

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The quality of all bakery products changes post-baking and they lose their 'just-baked' characteristics. The changes which occur vary with the different bakery product groups, and sometimes within product groups. In broad terms the product characters that change are covered by the term 'staling'. While this term has is often seen as synonymous with the firming of bread crumb in the absence of moisture loss, it is equally applicable to other quality losses in the generic sense, and may include:

- Moisture evaporation (dehydration)
- Crumb firming in the absence of moisture loss
- Loss of crust crispness
- Product softening though absorption of moisture
- Increased crumb fragility (crumbliness)
- Loss of flavour
- Loss of aroma

Product spoilage as the result microbial activity and the development of off-odours and taints may occur, but they are not considered in any detail in this Technical Paper.

Before considering the changes in product character that occur during storage, it will be helpful to examine the contribution that water makes to the underlying characters of bakery foods. Water in baked products plays a major 'lubricating' role when the product is eaten, and because of this the product moisture content has a profound effect on the perception of quality, whether the product has been freshly made or stored.

Bread and other fermented goods fall into the intermediate moisture range of foods and have the highest water levels and water activities of all baked products. They are characterised by a relatively high crumb moisture content and a lower moisture crust. The moisture content of bread crumb is a major contributor to the perception of product freshness and generally the higher the moisture content, the fresher the bread will be perceived by the consumer.

The baked moisture content of cakes is somewhat lower than that of breads, but cake products still fall within the intermediate moisture range of foods. The crust formed on cakes during baking is usually considerably thinner than that of breads and the moisture content of the crumb has a major impact on the perception of freshness in cake products. As with bread, as the moisture content of the cake increases so does the sensory rating of freshness as shown by the data in the illustration below for a unit cake.

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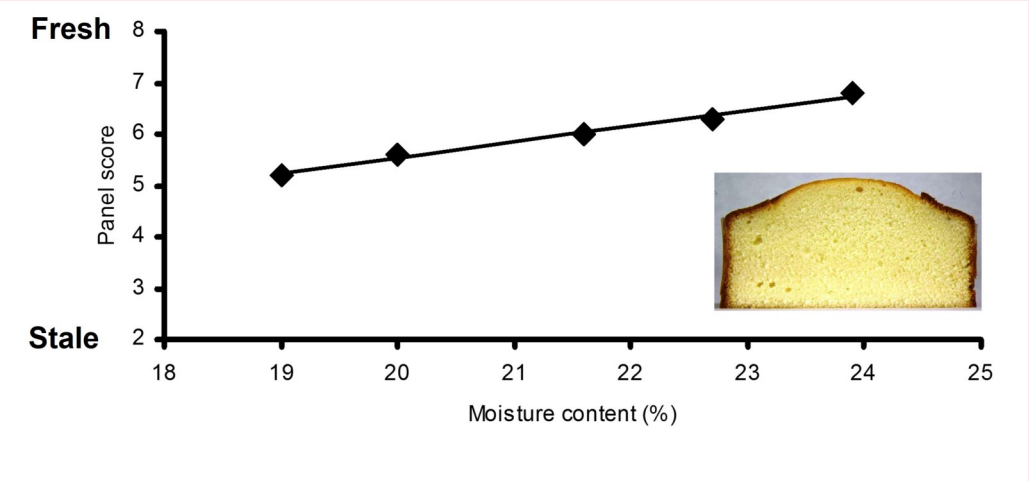

Biscuits, cookies and laminated products have much lower moisture contents than bread or cakes. This means that the eating qualities of such products are characterised largely by their hardness or crispness, and the sensory perception of freshness is the opposite of bread and cakes in that higher moisture levels would be associated with lack of freshness.

Sensory and Microbial Shelf-lives of Bakery Products

The loss of freshly-baked characteristics of bakery products is one key determinant of their different sensory shelf-lives, that is, the point when consumers would consider products to be stale and as such would be discarded. The other major determinant is related to the visible spoilage associated with the unwelcome development of mould colonies on product surfaces. There may other less visible microbial spoilage, such as fermentation caused by contamination with wild yeasts, and the development of off-odours (some of which are considered below).

The relationships between the relative timescales associated with staling and microbial spoilage vary, mainly according to the product water activity (related to but not the same as moisture content). Bread products usually have the highest water activities and tend to exhibit mould growth before or around the same time, as the products reach their limiting value for staling. Though cakes have lower water activities than bread, they tend to exhibit mould growth before they reach their limiting value of staling.