Looking at Long Life Bread

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Nothing appeals more to consumers than the belief that bread is really fresh but what constitutes fresh bread? The concept of freshness in bread depends to a large extent on the product which one is making and the marketplace in which one is operating. Increasingly as bakers we are seeking to extend the shelf life of our breads and yet at the same time try to keep the properties which make it fresh. This presentation will review the underlying mechanisms by which the qualities of bread freshness are lost and consider other factors which limit the shelf life of breads. At the same time I will evaluate some of the ingredients and processing techniques which can be used to influence the perception of freshness of bread by the consumer and deliver longer shelf life.

After leaving the oven, bread is hot and will remain so for some while after depanning. While bread is still warm we all, bakers and consumers alike, have no difficulty in describing the products as fresh. However, the major portion of manufactured bread is consumed when fully cold and lacking the association between the warmth of the product and time after baking we have to find other means of convincing our consumer that the product is fresh.

Shortly after being freshly baked, bread and all fermented products undergo a series of chemical and physical changes which we collectively refer to as staling and spoilage. Understanding the nature of these changes and the rate at which they occur is very important to bakers who wish to supply customers with longer shelf-life products in the best possible condition. Some of the most important of the changes which take place in bread post-baking are listed below:

Crust crispiness

Crumb and crust moisture

Crumb firmness

Crumbliness

Taste

Aroma

The relative importance of each of these changes in bread character will depend on the type of product we are making so that we will be less concerned with loss of crust crispness in pan breads than in hearth breads or baguette. The two most commonly recognised changes in bread quality which are associated with staling arise from loss or movement of moisture and the intrinsic firming of the bread crumb which arises from changes in the starch component in the loaf.

The rate at which and the extent to which the bread characteristics listed will change depends on a number of factors including those listed below:

Product formulation

Crust and crumb moisture contents

Storage temperature

Storage time

Types of packaging

Microbial growth

I have also added the term acceptability to our thinking because there are microbiological changes which have a profound effect on consumer acceptability. And here I am referring to such issues as mould or rope growth not the acceptability in terms of labelling and ingredients, though I will return to that issue towards the end of my presentation.

The main product that we shall concern ourselves with today is the so-called long life breads which have now become an accepted part of the modern baking scene. I would like to consider how we might achieve the requirements placed on such products.

In the first instance let's look at the issues of microbial growth. We are all familiar with the problems, namely that with such a high water activity bread is always at risk from microbial growth. The two main problems come from rope and mould growth.

Rope occurs through the Bacillus subtilis spores that are ever present in our ingredients and the atmosphere surrounding us. We have become accustomed to using as a mould inhibitors in our bread formulations. There effect of bread pH is small but every little helps and we are happy to benefit from it. In the past we turned our back of the use of calcium propionate in our effort to pursue clean labels on our wrappers. Now that longer shelf life is required from the bread we have welcomed it back into the fold so to speak because of its useful anti-rope properties.

When bread leaves the oven its surface is largely sterile but very quickly it can become contaminated with mould spores from the atmosphere. We all work hard at keeping the atmosphere as clean as possible but we know that contamination does occur.

One way of helping to reduce the problem from surface contamination is to spray the surface with a suitable mould inhibitor. Long life bread uses potassium sorbate surface sprays even though it is usually considered more of a mould inhibitor for cake than bread.

The use of sorbate works well in cakes because generally they have lower water activities than bread and the effectiveness of potassium sorbate increases as the water activity falls. We do not think of bread having a lower water activity but indeed the crust, being lower in moisture than the bread crumb, does have a lower water activity when it leaves the oven. This gives the opportunity for the sorbate spray to have an increased effect while the moisture content of the crust is still rising as is absorbs moisture movement from the crumb.

A potentially important reason for having a suite of mould inhibitors present in long life bread lies with the nature of the micro-organisms themselves. As long ago as the early 1960ís David Seiler working at Chorleywood showed that specific micro-organisms grew at different rates on the same bakery product and that inhibitors have different degrees of effectiveness on different micro-organisms. Thus, it was clear that in order to provide defence against a broad spectrum of micro-organisms a broad spectrum approach to mould inhibitors was also required. And that is what we now see.

Let's now turn our attention to the packaging of the product. We have known for a good many years that we need to restrict moisture losses from the bread in order to preserve an element of perceived freshness. In principle any packaging which is moisture impermeable can do the trick. For many years we used wax wrapper and provided the seals were good it achieved our aims. Later the polyethylene bag became more convenient and whole sectors of the industry moved over to that technology. So what does the new foil bag offer us over our previous technologies. Well it looks different and jazzy but does it offer any special anti-microbial role?

So much for the mould inhibitors and the packaging, so what about the ingredients and the processing methods, what do they have to offer for shelf life extension? The progressive firming of the crumb is the one which most of us associate with bread staling. It occurs through two mechanisms; the gradual loss of moisture and changes in the crystalline nature of the starch present in the crumb, commonly called retrogradation. Without suitable additives bread staling reaches its limiting value after about 8 days, a time somewhat after which bread commonly went mouldy. Since the product was mouldy the consumer rejected it and so longer term staling was not a key issue but as soon as we extended the mould-free life of the product progressive crumb firming becomes a more critical issue.

First a quick refresher on what starch staling means. During baking the starch present in the dough undergoes the transformation we know as gelatinisation. This is a complex process but essentially involves a transition from an ordered (crystalline) to a disordered state. In the unbaked starch it is the amylopectin which contains ordered regions and is embedded in the non-crystalline matrix of the amylose, the other main constituent of wheat starch. The disordered starch state created during baking gradually begins to re-order, or retrograde, with storage time and contributes to the firming of the bread crumb which typically occurs. If we reheat old bread we can once again disorder the starch structure and create a soft bread crumb. However, when we subsequently store the same bread we will notice that the rate at which the crumb firms has now increased.

There are some ingredients which can directly affect bread staling by changing starch retrogradation. They fall into two main groups; the emulsifiers and the enzymes. Other ingredients may be sold as preventing staling but these are mainly based on changing crumb softness rather than inhibition of starch retrogradation. I'll return to them later.

Once again it has been known for quite some time that additions of Glycerol mono-stearate (GMS) slow down the rate of starch retrogradation because of the formation of a complex with the starch during the gelatinisation stages of baking. GMS has been used extensively in the past as a bread improver and when I joined the industry some 35 years ago it was already known as a crumb softener. Its use in standard breads has largely been limited by price considerations but it plays a very useful role in long-life breads.

GMS may come in a number of forms and with varying monoglyceride contents and is at its most effective against bread staling when used as a hydrate where it should be in the alpha gel form. This condition is achieved over a limited range of GMS concentrations and preparation temperatures and careful preparation is required to ensure most effective use of this emulsifier. Powdered forms have been used but they tend not to have the same full improving effect of the gel.

Other emulsifiers which may be included for their anti-staling properties are DATA esters, CSL or SSL. They too have the ability