Dough Processing & Bread Faults

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Good morning ladies and gentlemen. It's not often I get a round of applause at the end never mind the beginning.

Introduction

This presentation is concerned with dough processing and how we can identify how the dough moves and what if any problem can occur in the loaf crumb structure.

We'll look at how we can identify where 'streaking' or 'cores' have manifested themselves and then go onto a new technique developed at CCFRA using non-destructive method of viewing dough movement during final proof. My colleagues Dr. Martin Whitworth & Mr Juan Alava developed this method.

The style of bread we want to make will dictate how we mix, process (mould) and bake the product. We wouldn't want to be producing French Baguettes with a close crumb structure, and of course we wouldn't want to be producing a 800g 4-piece loaf with an open crumb structure like a Baguette.

First let's look at how the dough moves during final moulding. During final moulding we change the shape of the dough. Whether we are making 4-piece or single piece bread, our aim is to achieve the desired shape without bursting any of the bubbles we have carefully developed during the mixing stage. 90% of our quality is achieved during mixing so it is important to make sure we improve on this not make matters worse.

After mixing the dough goes through a number of processing stages, these change the shape of the dough and re-orientate the bubbles. From dividing the dough piece generally passes through a 'rounding' stage such as a conical 10 moulder. It later moves to a sheeting stage, passes under a curling chain, then the pressure board and guide bars may well determine the length of the dough piece coming from the end of the final moulder.

Faults to crumb structure

Faults in loaf crumb structure, such as discoloured, coarse patches, streaks and variation in softness are not uncommon in modern breadmaking. Many combinations of raw materials and dough processing stages can influence the occurrence of such faults but they have a common origin. They are the direct result of instability in the structure formed during mixing and/or subsequent damage to the bubble structure during moulding.

It is important to remember that dough is more likely to be damaged during final moulding if the dough bubble structure is vulnerable in the first place.

Areas that certainly need to be investigated if dough stability is being questioned are:

- Flour protein levels and quality of flour l Damaged starch levels
- Grade colour (bran contamination) l Dough development
- Oxidation
- Fat failure
- Tight doughs
- Cold doughs.

All of the above can influence how stable the dough is during processing and how much pressure is required to change the shape of the dough at the final moulder stage.

Research at the CCFRA (FMBRA) has identified many of the potential causes of coarse structure and streaks. If the bread is made using the CBP, it is likely that ascorbic acid (AA) will be the sole oxidising improver used. Doughs oxidised with AA are more difficult to process during moulding, due to increased resistance to deformation, and the bubble structure is more vulnerable to damage."Tight" first moulding, too short a first proof, severe sheeting and heavy pressure have also been shown to cause damage to the dough bubble structure.

The pattern of streaks in bread crumb was studied, at the CCFRA, using red coloured dough. Dough sheets formed during final moulding were sampled and their density and rheological properties measured. Evidence of loss of bubble structure and changed rheological properties were found to coincide with the damage patterns identified using the coloured dough. As a result of these studies it is now possible to trace areas of damage back to where they occurred during final moulding. We have also found that the problems are affected by the direction of dough feed into the dough moulders.

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Damage to the outer surface

This area of damage can be viewed as random streaks running through the loaf; the damage can appear as horizontal streaks in the crumb or as a 'frame' around the slice. As it is the surface which is affected, then in 4 pieced bread damage will be seen as horizontal lines and in single piece loaves it will appear around the moulding line. This damage has usually occurred before the final moulder, possibly on the conical moulder.

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Damage to the tail end of the sheet

This illustration shows the damage that may be caused by excessive pressure to the trailing edge of the dough piece as it goes through the rollers during final moulding. It is possibly caused by presenting the dough incorrectly to the rollers on the final moulder, the dough being too tight or the rollers set to close together. It will

appear as dense areas of damage at the sides or base of the slices throughout the loaves.

Damage to the ends of the dough piece (guide bars)

This can be caused by one of two things, either the guide bars are too close or the pressure board is to low. Either way what is happening is the dough is being dragged along the guide bars and bursts the gas bubbles in the dough. The damage will only be visible on the end section of the loaf and will appear as very dense areas on one side of the slice.

The coloured dough work was a very good way of identifying where streaks manifested themselves. We then needed to develop a method where we could view the bubbles moving during final proof and then view the same loaf of bread.

This work started with myself, Bill Collins and Stan Cauvain popping off to the local hospital, waiting for the patients to go so we could put frozen dough piece through the CT scanner, an X- ray machine. This gave us an excellent insight into how the dough was shected and moulded. It showed differences in dough density with the whiter area on the X-ray showing a denser dough. The problem with this is that we could not follow the dough through the remaining processing, final proof and baking.

CCFRA then hired a portable CT scanner to visit our site at Chipping Campden where we could prepare fresh dough and fully prove the dough while it was located in the scanner. By doing this we could record a sequence of images and so identify changes that occur during final proof. As we could also bake the dough at end of proof we were also able to identify changes that occur during baking.

The images have highlighted:

l After final moulding large air pockets may be incorporated in the dough, this is due to shape of the sheeted dough and how it 11 is curled during final moulding. These large air pockets do not always remain in the baked loaf.

l During final proof bubbles change shape and size and can even disappear!

l Dough that is in contact with the bread tin is restricted in movement. This is shown clearly in the single piece images, after final moulding it can be seen the centre, of the mould line is in the centre of the dough. At the end of final proof the centre of this moulding line is now in the top 1 / 3 of the dough.

l Bubbles that are still visible at the end of final proof may collapse during baking, this may be one reason for coring (dense patches) in the crumb structure.

Conclusion

Understanding how dough moves during processing is very important, it can allow us as bakers to achieve the best quality possible to offer to our customers. We can do a lot of damage to the bubble structure of dough after we have completed the mixing stage, knowing where the damage occurs and how we can handle the dough better gives us greater control over the final baked loaf.

Sessional Chairman

If that is the quality of paper we can get at 24 hours notice perhaps we should try that approach more often. Well if there are any questions for Kim, we have some time, and we will take them now please.

Question Albert Wood, Bingley. Thanks Kim that was very useful. The logical outcome of this would it be to introduce a different type of bread moulder to evaluate.

Answer.. It's certainly possible. We are looking at really ways of handling the dough correctly. Correctly is probably not the right word, but looking at ways of manipulating the dough so that we get the best out of it. We certainly know of a process in Camden. We divide the dough, have a conical moulder and then process it off in the medium proof and final moulder. WeÍre certainly looking at different shapes going through the final moulder, which do not necessarily have to be round. So that certainly could be one of the outcomes, yes. Any more questions?

Question. Neill Hastie. Newcastle upon Tyne. A long long time ago there was a bread process called the Wallace Tiernan "Do-maker" process, which was a continuous mixer, which automatically divided into the tins. Before Oaks and before anything else, this is when I was a bakery student, and that helped produce bread which was, the definition of the time, Madeira cake type texture, which was very very very uniform. And at the time was banned, certainly from Newcastle bakery competition, because there was a Newcastle Co-op where it was installed, because it was too perfect. And that would seem to acknowledge the fact that the moulder and the rounder is giving some sort of form, some sort of source to the problems you've got there. If you we went back to Wallace Tiernan, you can have everything. Everything was perfectly even, it was divided straight into the tin.

Answer. But you actually need some form of different densities within the crumb to actually get the characteristics like you associate with bread. If the crumb structure was all the way through then you would not get that softness, that compression, so different bubble sizes are beneficial. We are more looking at getting rid of holes, or identifying where, if you have problems with holes around the moulding line, that kind of thing, and certainly streaks, nobody wants to see streaks in crumb structure, because apart from visual it also affects the eating quality as well, and the keeping quality of the products. So that is the area we are looking for.

Question. Neill Hastie. I think one of the underestimated, from retail point of view, areas of bread which we just ignore is "bite-ability". It is all right looking the same but if people want to have a range of products, you go to European countries where they usually have a range of different breads, so when you bite and when you are eating it, it gives you a different feeling. I think in England we virtually ignore that.

Answer Yes. I think that's it, it's really going back to the first slide, of the different varieties of bread that we had. It is like identifying the variety that you are producing and actually achieving the characteristics for that. You don't want to be buying the French stick that has a very soft crust and a very close crumb structure, you want it opened and a shell like crust, nice and crisp. So it's identifying the characteristics and how actually to achieve them. And hopefully work like this is going to help us.

Question. Adams, Northampton. Kim, we were just discussing how many sets of reduction rollers do you have in your final moulder, because with more sets of rollers you might even out the crumb structure, have you tried that?

Answer. No, we've actually got three sets in our final moulding, we haven't yet maybe looked at putting them through twice, so that gives us the thickness of the sheet that we actually need to roll the units. We have looked at different thicknesses of the sheets but we haven't actually looked at different lengths of rollers yet. Thank you very much indeed for that Kim.