Effective and efficient ways to measure impurities in flour used in bread making

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Ladies and Gentlemen,

Today, I would like to introduce a new concept for measuring the quality of flour. This new concept involves a new measurement which is normally treated as an impurity, but could also be a very important ingredient for bakers.

The present methods for measuring impurities in flour, as it is known in the industry, is the lengthy ASH test, the cumbersome and sometimes unreliable method of colour grader and finally in some countries in the world, the Peckar test.

	Branscan	Ash Yield	Grade colour
Measurement Principle	Image Analysis	Combustion	Light Reflection
Entity Detected	Colour Bran	Mineral Content	Batter 'Colour'
Relation to Purity	Direct	Indirect	Indirect
Detection of Visable Impurities	Yes	Indirect	Indirect
Standard Error Estimate	Yes	No	No
Non-destructive	Yes	No	No
Suitable for on-line use?	Yes	Yes	No

Fig 1 The table comparing ash, colour grader, Fluoroscan

In all these tests, the emphasis has been the detection of minerals. It is assumed that the impurities that are harmful or not useful to baking are associated with the mineral containing constituents of the flour. These are the parts that are loosely grouped as Bran (pericarp) and Aleurone. Some of the minerals reside in the endosperm, but this is usually a small part of the mineral content in the wheat.

The main emphasis of these quality tests has been to see if the millers have really delivered what the baker classes as quality and useable flour.

The question here is; what are the effects of these components, and what can we measure now, and how do they relate to the baking performance.

The issue that has always confused the milling and baking community is the answer to the simple question 'constituent effects on baking performance?' To put it simply, since the bakers want sell a lot of water and air with minimum amount of flour packaged as bread, there is no other constraint to the usefulness of these flour constituents. One secret constituent has a special effect.

The secret constituent that enables the baker to basically make water stand up on its own is protein, this forms the Gluten net on to which baker can hang the water and trap the air.

What we are suggesting here is that the baking performance is totally related to the protein level of the flour and how that converts to gluten net, which is a very simplistic definition but serves our purpose .We are trying to relate the baking quality to milling.

The description I gave above is a crude way of saying that the main aim is to measure and also determine where the protein is and in what form we can preserve it. That is what millers try to do while they are milling the wheat, i.e. to preserve as much as possible the protein available in wheat.

So, how does this relate to what we are discussing?

One of the main constituents of wheat that contains protein is the aleurone, which is the collective name for the layers between the pericarp (Bran) and endosperm.

In traditional milling, the miller grinds and mills most of this constituent out with the Bran. That is, we give this constituent to our animals as feed.

The aleurone layer contains protein and minerals which can be useful to;

a- Baking quality of bread

b- nutritional quality of bread

Now, having realised one of the main sources of protein which is the most important ingredient for bread making, how do we treat this magical layer.

As we said in most milling operations , this layer is usually thrown away This is because it tends to include the most minerals and hence increases

the ASH values and also effects the colour In addition we do not have(or did not have) any way of measuring this constituent.

So, if we accept that aleurone is important, then we can use the milling techniques that are available to preserve this ingredient, one of these techniques is DEBRANNING of wheat in milling which reduce the destruction of the aleurone, in fact it can be said it preserves the aleurone.

Also, you can also use the new instrument (Fluoroscan) from Branscan to measure how much aleurone you preserved after debranned milling.

Instrument;

FLUOROSCAN was launched to accurately calculate ash and for this purpose it uses

Aleurone and Bran amounts in flour to accurately estimate ASH (much more accurate than

any other indirect method including NIR).The result is that there is now a simple method to

determine how much of the aleurone is left in the flour after processing.

It should be noted that initially Fluoroscan was not designed to produce a way to measure the Aleurone, and it was also not designed to look at the effects of the flour ingredients on baking performance. It was an instrument produced to fill the gap where the NIR measurements failed.

It was purely a commercial decision to extend the capability of the original Branscan instrument, used by some millers and bakers worldwide, to check more constituents of flour and their effect on baking quality.

Fig 7. What is Fluoroscan?

The work I will mention briefly below is only the start of researching the way the flour ingredients affect the baking performance.

So, how do the new instrument measure aleurone, it uses image analysis as the main method of analysing the flour. That is the measurement is non destructive (unlike furnace method) and repeatable.

The method;

The utilisation of image analysis technique is not new; we could even say it is the oldest technique for checking the quality of flour.

The obvious advantage of the method in the past was that it has always been performed by the best implementer in the world, which is the MILLER, i.e. the miller/baker uses his eyes to analyse the flour. The main basis using an instrument to do the measurement is to make the measurement objective reducing the subjective nature of human interaction.

The human method of image analysis has been the main method for the millers/bakers to decide if the miller was doing his job properly and delivering the goods needed to make bread consistently .To this end, the baker promptly looked at the flour and judged with his eye and gave a grade to the flour. The main issue in this measurement was the fact it was very subjective and depended on the baker.

In later years this technique was further institutionalised . by people like the Hungarian Mr. Pekar who had the major visual test named after him because he categorised the images of different grades of flour in what is now called the Pekar tablets.

How does it help?

So, back to the story of Aleurone measurement. The application of image analysis to measure this special constituent, will start a totally new area in assessment of baking performance.

The study we have done so far shows that the instrument Fluoroscan can successfully distinguish different levels of aleurone in flour and hence indicate the effect of different milling techniques to the level of aleurone available in flour.

The next step will be to measure the type and size of aleurone particles resulting from different milling techniques. This point is currently been studied.

The last step will be to relate the amount and the type of aleurone to baking quality.

Conclusion;

Simply put, an instrument was used, Fluoroscan, to look at the impurities in flour, giving us a different perspective on the impurity content of flour.

The studies had originally started with the Bran, but now we are capable of looking at aleurone and hopefully soon we will distinguish between the types and sizes of aleurone particles.

All of these lead us to one position, that is the effects of what you take out of flour and what you leave in the flour is going to be more transparent.

The effect of the magical improvers, the so-called friendly enzymes and acids should be more predictable, since we will know what is left in the flour better than before.

Also;

The baker can now ask for, a more comprehensive measurement that identifies the constituents of impurity and hence can start to question the effect of these on the improvers he is using and hence even question the fact if he needs them at all?

Lastly, the main question that still needs to be answered fully is;

Are we taking more out of the flour which needs to be replaced by these additives and improvers?

And,

What is the real effect of aleurone in the baking quality?

The short report today shows the progresses in technology will help the baker to determine their future more clearly, the work is continuing and we hope to report on the findings as more data becomes available.

Thank you for the opportunity to share some of our work with you.

Question - Kevin Hodge, Glenbervie

What would the effects of debranning on flour be from a nutritional claim point of view, if bran is removed from flour to that degree ?

Answer - My understanding to that is by doing that you are actually keeping more aleurone, putting aleurone back into bread. From what I can see debranning will increase the nutritional of the bread because bran does not really affect anything and debranning will keep more nutritional value.