New challenges of flour quality fluctuations and enzymatic flour standardization.

IAOM 2017 – Ho Chi Minh

Norizad - Application Technologist Baking Enzymes

HISTORY

1907
Röhm and Haas founded. Invention of OroponTM for the leather industry.

1934
Invention of the first enzyme for the food industry: ROHAPECT®

1958
First enzyme for the milling and baking industry launched: VERON®

1999
ABF acquires Röhm Enzyme which is renamed to AB Enzymes

2005
AB Enzymes restructures to achieve a global leadership position

2007
Global distribution arrangement for feed with ABF sister company AB Vista

2008
Completion of the VERON®, ECOSTONE®, ROHAPECT® and ROHALASE® product ranges

2009
Capacity expansion at manufacturing site in Finland

2010
Further expansion of the BIOTOUCH® product range, and launch of Veron® xTender

2012
Enzymatic Wheat Tempering launched under VERON®

VERON®

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PROCEEDINGS

Flour samples collected from different continents to ensure real quality differences:

- US and Canadian wheat
- Australian wheat
- Black sea (Romania, Bulgaria, Russia)
- Czech wheat

The aim was to determine the influences of enzymes on standard rheological dough characteristics from different wheat flours.

BASIC CONCLUSION

The influence of enzymes on the rheology of the flours, the analysis of the falling times, the farino- and extensographical measurements, the features of the gelatinization with the micro visco-amylo-graph were measured.

No surprise:

The results are that the origin of the flours had a decisive influence of the final result. That is because of the climate and environmental influences, which has an effect on the ingredients, and also causes a change of the components (lipid-, protein contents, quality of gluten).

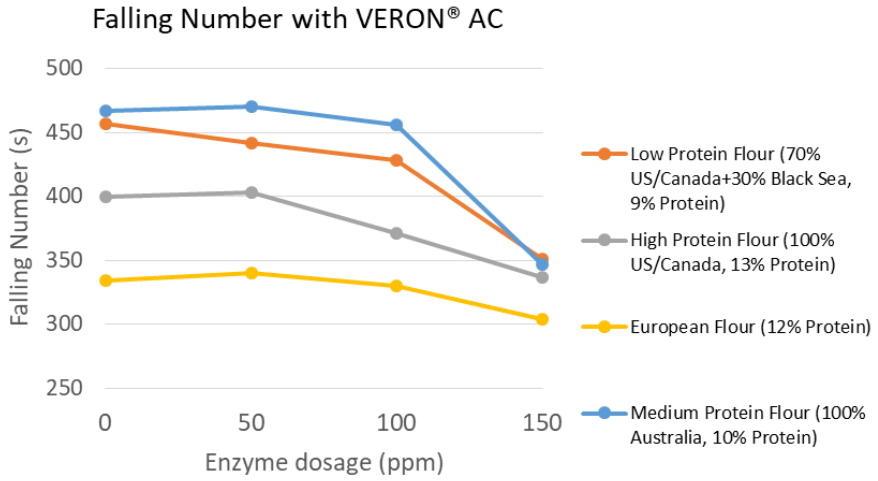
Not every enzyme lead to the same effect on the flours.

RHEOLOGY – FALLING NUMBER

Alpha-amylases effect on Falling number (FN)

Bacterial amylase VERON® AC both reduces the FN and improves baking quality. Fungal amylase VERON® M4 improves baking quality but is inactivated in the FN test.

Because FN is measured at 70°C, FN and baking performance are not always directly comparable.



Alpha-amylase enzymes for falling number adjustment

ENZYME PRODUCT	FEATURES	BENEFITS
VERON® AC	Thermostable bacterial alpha-amylase for Falling Number adjustment.	✓ Direct decrease in falling number
VERON® 1000	Thermostable bacterial alpha-amylase for Falling Number adjustment.	✓ Direct decrease in falling number
VERON® M4	Fungal alpha-amylase for improving flour baking quality. **Note:** Except at very high dosages, the Falling Number is not influenced by VERON® M4 because the fungal alpha-amylase is not thermostable. An alternative test method such as temperature-adjusted FN is recommended.	✓ Dosage-tolerant

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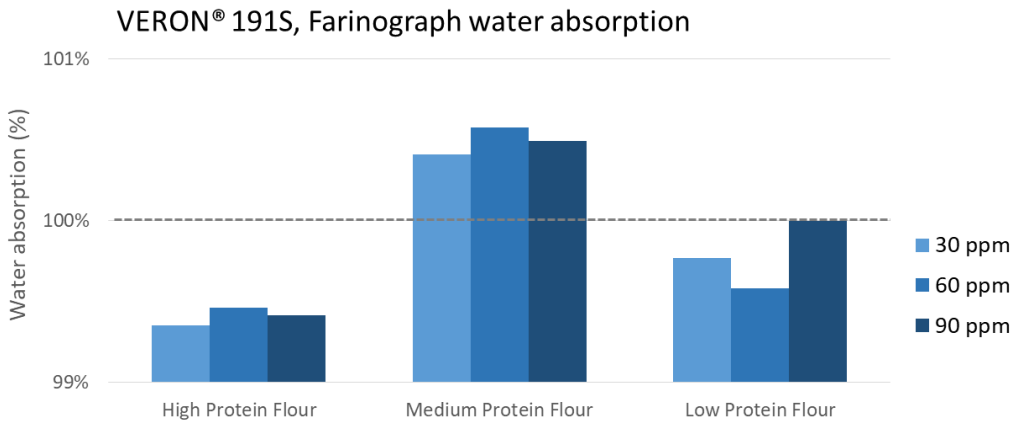
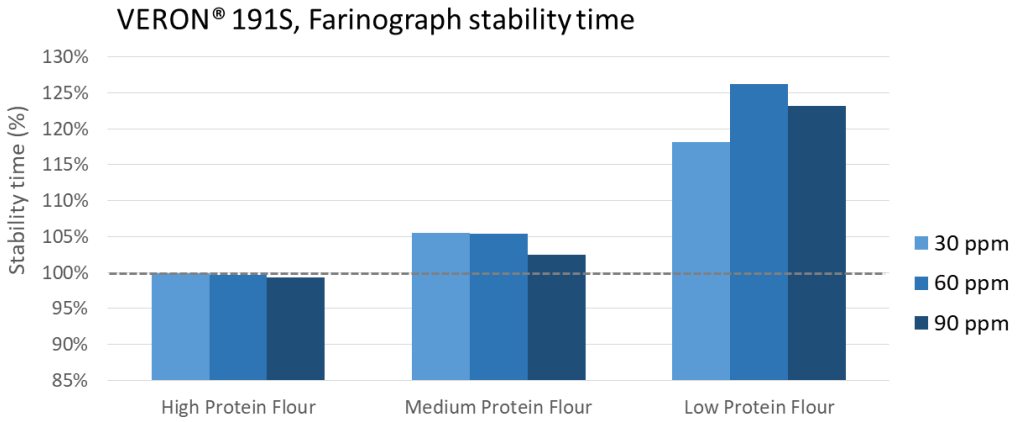
Source: AACC Method 56-81B

RHEOLOGY – FARINOGRAPH

Xylanase can be used to increase water absorption and stability time in Farinograph.

Optimum dosage and application is highly dependent on starting quality of the flour. Baking quality should be verified by baking trials.





Source: AACC Method 56-81B

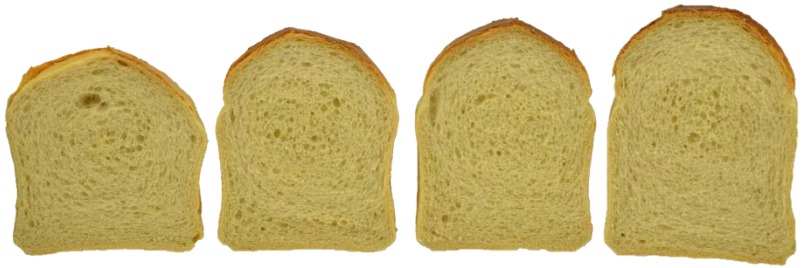
XYLANASE BAKING QUALITY

Baking quality of flour can be improved by adding xylanase, in combination with alpha-amylase and ascorbic acid.

The resistance of the gluten network is decreased, allowing better oven spring.

Volume increase with xylanase – pan sandwich bread

The increased elasticity and oven spring can be shown with a standard dosage range test of fungal xylanase.



control	50 ppm VERON® 191S	100 ppm VERON® 191S	150 ppm VERON® 191S

Example 1 – Pan sandwich bread

Additives for all breads:
50 ppm Ascorbic Acid

Volume increase with xylanase/amylase – free-standing

control	10 ppm VERON® M4	10 ppm VERON® M4 50 ppm VERON® 191S	10 ppm VERON® M4 50 ppm VERON® RL

Example 2 – Turkish style bread

Additives for all breads:
50 ppm Ascorbic Acid

QUALITY CONTROL

Rheological measurements function as quality control measurements to communicate between buyer and seller.

Composition of a flour is determined from the growing, harvesting and processing. The basic composition parameters are ash content, protein content, moisture, wet gluten.

Main rheological quality control tests

TEST	DEVICE	MEASUREMENT
Mixing properties of flour	Farinograph	Water uptake and mechanical resistance during mixing/kneading Most popular and accepted method to determine flour quality
	Mixolab	Combination of flour, dough and starch measurement in one run
Rheological dough properties	Extensograph	Dough extensibility and resistance by unaxial extension (stretching in one direction)
	Kieffer-rig	Dough extensibility and resistance by unaxial extension
	Alveograph	Dough extensibility and tenacity by biaxial extension (stretching in two directions)
Starch gelatinization	Amylograph	Pasting properties of starch
	Falling Number	Alpha-amylase activity

FUNCTIONALIZING THE FLOUR

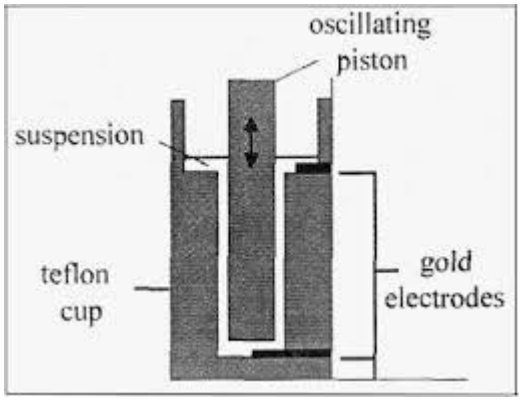
Enzymes optimize and functionalize the flour.

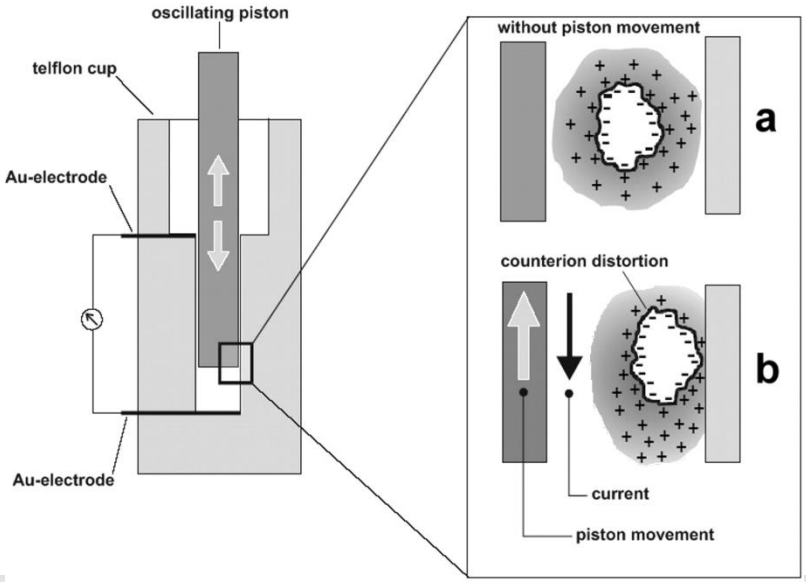
- Improving baking quality
- Compensation of harvest and raw material fluctuations
- Adjustment to specifications
- Replacement of chemicals

PARTICLE CHARGE DETECTOR (PCD) METHOD

- Could this be used to predict flour quality, because flour could be seen as an “electrolytic interacting system”?
- Could PCD be applied next to traditional measurements?
- At AB Enzymes we have tried to get new insights by applying the particle charge detector (PCD) method on the effect and variability of enzymatic flour treatment.

PARTICLE CHARGE DETECTOR (PCD) METHOD



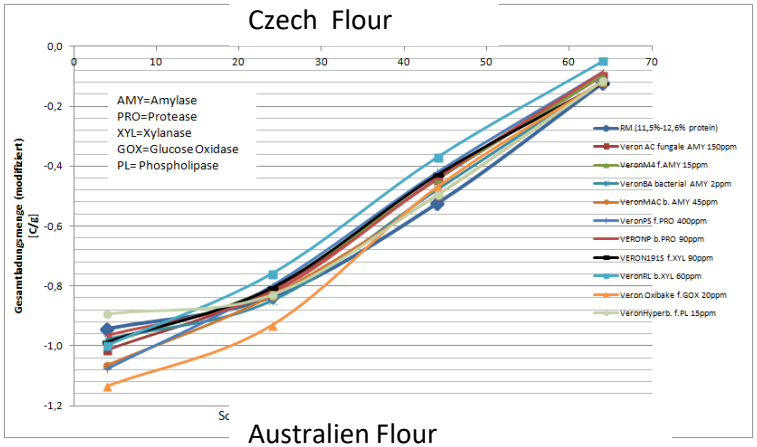


- The particle charge detector (PCD) measures the total charge of an aqueous suspension by inducing a streaming potential.
- At the beginning, the flours shows all an anionic charge. The charging amounts are though very specific, and partly very different.

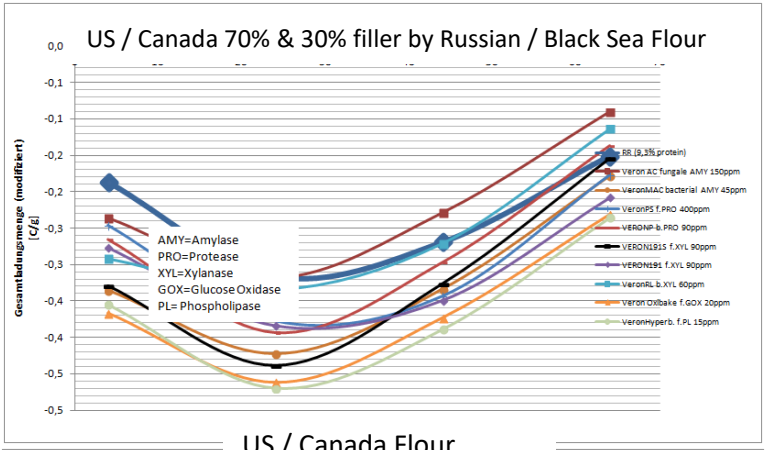
DETERMINATION OF PARTICLE CHARGE OF DIFFERENT WHEAT FLOUR

The particle charge detector measures the total charge of an aqueous suspension by inducing a streaming potential. An electrical field is built up. The charge of the sample can be determined by titration. The streaming potential has its's point of zero charge at 0 mV.

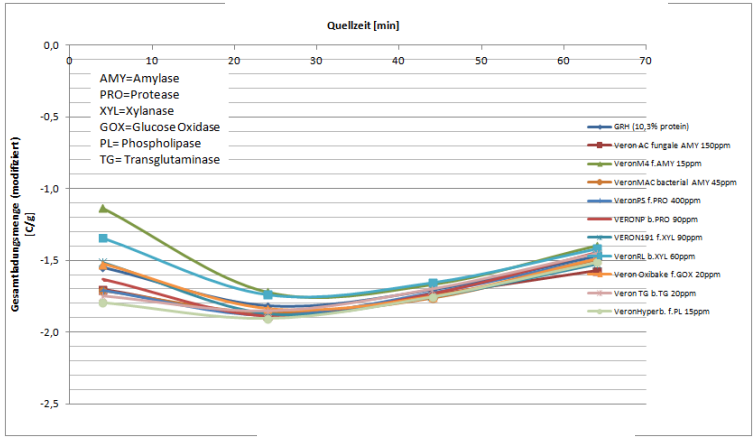
Czech Flour



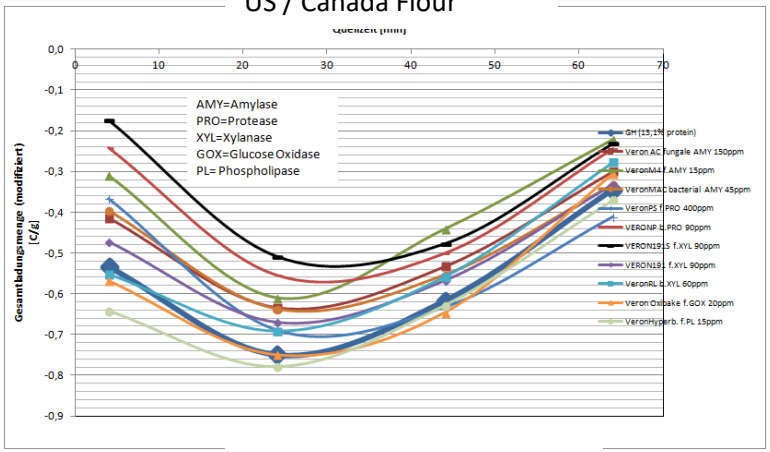
US / Canada 70% & 30% filler by Russian / Black Sea Flour



Australien Flour



US / Canada Flour



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CONCLUSION

- The standard measurements are still valid and do provide us with a lot of important quality information's.
- Next to the established measurements we should continuously screen and apply different methods to further create insights to predict and steer the flour quality to our advantage.
- PCD could help to see possible relationships between standard measurement and PCD data e.g. a high gluten index ensures for fewer anionic values.
- This assumption is based on a consideration in the literature which says that the glue in the wheat flour must have a cationic charge (Schick & Lösche, 2010)
- We can for sure determine the difference, as shown in the results, between basic qualities!

TAKE AWAYS

Enzymes – A tool to increase your milling value

- ✓ **Enzymes optimize and functionalize the flour.**
- ✓ **Wheat and flour tests are standardized testing procedures commonly used for quality control purposes.**
- ✓ **PCD does indicate quality differences.**
- ✓ **We just start to understand flour as an electrolytic interacting system and looking for partners to further develop this methodology. Visit us!**

THE ART OF ENZYMES

The combination of science and craftsmanship is powerful - we call this 'The Art of Enzymes'

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THANK YOU VERY MUCH FOR YOUR ATTENTION!

OUTLOOK

- There are still lot of questions and PCD should further be investigated.
- Are there correlations between PCD and standard rheological measurements?
- How could PCD be applied to define grain quality of imported wheat?
- Further work is ongoing!