Recent Developments in Rheological Instruments

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...where quality is measured.
Situation in the laboratory today

- Many analysis necessary
- Classification of raw materials more and more difficult
- For different materials the current methods are not sufficient
- Little time available
- Sometimes not well-trained laboratory technicians
- Complex test procedures

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Recent Developments in Rheological Instruments

Introduction

Solution in the laboratory for the future

- High rate of automation
- New developments of instruments and methods
- Self-controlled working and test processes
- Easy handling of instruments
- Automatic evaluations and statistics

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Recent Developments in Rheological Instruments

Farinograph®-AT

Rapid Moisture Tester MT-C

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Brabender® Farinograph®-AT

The 4th Farinograph® generation

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Features

- Automatic water dosing system
- Extended software applications
- Better reproducibility (because of technical innovations)
- Variable speed (0-200 min⁻¹)
- Higher torque (20 Nm)
- Actual temperatures are shown and recorded when needed (mixing bowl, dough and water)
- Calculates mixing energy
- Accuracy water dosing system < 0,1 % of added water

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Brabender® Farinograph®-AT – working tools

**Sigma mixer S 300**
- Standard test according ICC/AACC e.g.
- 300 g flour
- For mixing the Extensograph dough
- Removable blades

**Sigma mixer S 50**
- Standard test according ICC/AACC e.g.
- 50 g flour
- Removable blades

**Sigma mixer S 10**
- For small samples
- 10 g flour
- For breeders and research work
- To mix dry gluten

**Resistograph mixer R 100**
- Flat blades
- Narrow bowl
- Intensive/high speed mixing
- High shearing force

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Hardness and Structure Tester

- Measures hardness of grain (wheat, barley, malt)
- Torque and time during milling with a cone mill is recorded.
- Gives information about the need of conditioning of grain
- Adjustable fineness
- Special software

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Brabender® Farinograph®-AT – working tools

Planetary mixer P600

- Soft dough (e.g. rye doughs)
- Sponges (e.g. sponge batters)
- Foames (e.g. egg white)
- Cold swelling raw materials
- Container volume: 2500 ml
- Temperature controlled: approx. minus 5 → 150°C

Farinograph®-E with P600

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Software options

1. Standard software to run standard test like ICC or AACC

2. Additional software for different applications beside the standard Farinograph® test
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Brabender® Farinograph®-AT – software options

Software to run standard test like ICC, AACC

Information about
➢ Wheat quality
➢ Water absorption
➢ Mixing behaviour
  ▪ Development time
  ▪ Stability
  ▪ Degree of softening

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Automatic correlation of different curves

- to compare different curves
- to get statistical evaluation

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Brabender® Farinograph®-AT – software options

**Variable speed**
- Internal method
- Shorten or extend the test time
- Show the influence of intensive mixing
- Considered special product characteristics

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Different kneading intensities

Standard speed 63 min⁻¹
- Both flours have nearly the same quality
- Problems in the production of bread, rolls, toast…,
  ⇒ But why?

Intensive mixing 100 min⁻¹
- More energy into the dough
- More stress for the gluten
- The gluten of the blue sample crashed after a certain time

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Programming of automatic speed profiles

For the simulation of the production processes

- 1 minute 63 min$^{-1}$
- 5 minutes 90 min$^{-1}$
- 4 minutes 125 min$^{-1}$

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Special applications

- Wholemeal flour
- Water absorption of rye
- Sponge dough/batters
- Adaption to production process
- Special test profiles (e.g. temperature setting)
- …
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Brabender® Farinograph®-AT – special applications

Results with same dough consistency (500 FU)

Wholemeal flour fine

<table>
<thead>
<tr>
<th>Water absorption [%]</th>
<th>Consistency [FU]</th>
<th>Dough development time [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>65,4</td>
<td>501</td>
<td>8,1</td>
</tr>
</tbody>
</table>

Wholemeal flour coarse

<table>
<thead>
<tr>
<th>Water absorption [%]</th>
<th>Consistency [FU]</th>
<th>Dough development time [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>63,0</td>
<td>498</td>
<td>16,8</td>
</tr>
</tbody>
</table>

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Rheological analysis of sponge batters

- 0.5 slow only for mixing
- 9.5 min. fast whipping

The temperatures were increased step by step by 5°C

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Adaption of Farinograph® results
to the process mixer and the production line

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Brabender® Farinograph®-AT – special applications

Mixing with different speed and all parts of the production recipe (yeast, sugar, fat,..)

- Slow speed (10 min.)
- High speed (product dependent)
- Measuring of energy input
- Verification

→ Transfer into daily work

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Benefits for the daily practice

With consideration of

- used raw materials (complete recipe)
- machines in the production
- baking product (rolls, bread, puff pastry, …)

- **Optimization** of water absorption → more water
- **Adaptation** of the kneading process on raw materials and production facilities → perfect dough
- **High quality** baking products → satisfied customers
- **Less loss** through non-sellable products

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Programming and automatic evaluation of complex test profiles

Since 40 years used in research and development with the Brabender® Plastograph® / Farinograph®

First published in 1969:

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Brabender® Rapid Moisture Tester MT-C

Brabender® Rapid Moisture Tester MT-C

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Features

- Rapid oven drying method
- 10 samples at the same time
- Sample weight 9-11 g
- Automatic reweighing after the test time
- Automatic calibration of the integrated balance
- Accuracy better 0.1 %

No incorrect operation possible = 100% correct results

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Why rapid analyzer MT-C?

**MT-C (155 °C / 20 min)**
- One test = 20 min.
- Two tests = 22 min.
- Ten tests = approx. 40 min.
- 20 tests = approx. 85 min.

**Drying balance (10 min)**
- One test = 10 min.
- Two tests = 22 min.
- Ten tests = approx. 120 min.
- 20 tests = approx. 240 min.

**Parameter flour**
- Standard: 130 °C / 60 min
- Rapid: 155 °C / 20 min

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Advantages compared to other instruments (NIR, drying balances):

- Fundamental method (Drying oven method)
- No calibration necessary
- Careful drying, no overheating of the material
- Accuracy better 0.1 %
- Up to 10 samples at a time
- High automation rate makes user mistakes impossible

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Micro Visco-Amylo-Graph® (MVAG)

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Measures and checks

➢ Gelatinization properties of flour and starch
➢ Enzyme activity of flour (to find sprout damage)
➢ Adjustment of the diastatic activity of flour by adding enzymes (e.g. malt)
➢ Pasting properties of native and modified starch
➢ Extruded products and the influence of extrusion conditions

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Advantages

- Small sample size
  - Not to small (weighing mistakes have slight influence)
- High heating and cooling rates
  - Up to real 10°C/minute
  - Short test time
- Measuring of the temperature in the sample
  - Real temperature
- Evaluation in BU, cmg, or mPas

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Measuring system

Stirrer/paddle

Cooling Probe:
Sample directly cooled in the cup

Temperature Sensor:
In the sample

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Measuring of temperature

Red line: reference  Green line: actual

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The new generation of Brabender® equipments

⇒ meet international standards (AACC, ICC, ISO)
⇒ provide more opportunities for special application
⇒ set new standards in accuracy
⇒ show a lot of automation
⇒ make the work easier

⇒ with the best benefit for our customers

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Meet us at booth B16 to get
- more information
- the presentation
- special solutions for your needs

Thank you very much for your attention