Flour Quality

Baking quality
Protein & starch analysis
**Baking Quality.**

In order to obtain a good bread volume, the dough structure (gluten) should be able to hold back the carbon dioxide (CO₂) produced by the yeast during fermentation.

The best baking quality is obtained if:

- The quality of the dough structure and the carbon dioxide production are well balanced.
- Both factors reach their best properties at the same time.

![Diagram showing good gas production, gas production and retention well balanced, and poor gas production and good gas retention.](image)

- Good gas production but poor gas retention
- Gas production and gas retention well balanced
- Poor gas production and good gas retention
Baking quality

Gas retention

Gluten quantity

Gluten quality

Enzymes

Gas production

Pre-existing sugar

Starch decomposition

Enzymes

Starch damage

Gluten quantity:
- Gluten washing
- Protein

Gluten quality:
- Farinograph
- Extensograph
- Alveograph
- Gluten index
- Sedimentation test (Zeleny)

Gas production:
- Falling Number
- Amylograph
- Damaged starch
- Maltose Test

Ultimate test in gas retention and gas production: → Baking test
Production of gas.

Gas production

- Maltose test: Testing the maltose (sugar) content of the flour
- Damaged starch: Degree of damaged starch in the flour
- Falling number: Instant information on α-amylase activity
- Amylograph: Testing the α-amylase activity during the baking process
Starch

- Schematic structure of a starch kernel with amylopectin and amylose more or less equally distributed within the starch granule
Each starch granule consists of 2 different glucose chain formations. They are called amylopectin and amylose. The difference is mainly in the chemical structure where amylopectin has branched arms compared to amylose that is arranged in a twisted string formation.
Decomposition of starch.

<table>
<thead>
<tr>
<th>Product</th>
<th>Enzyme</th>
<th>Presence of Enzyme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch</td>
<td>α-amylase</td>
<td>in flour</td>
</tr>
<tr>
<td></td>
<td>β-amylase</td>
<td></td>
</tr>
<tr>
<td>Maltose</td>
<td>Maltase</td>
<td>in yeast</td>
</tr>
<tr>
<td>Glucose</td>
<td>Zymase</td>
<td>in yeast</td>
</tr>
<tr>
<td>Alcohol+CO₂</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Decomposition of starch.**

- During the decomposition of starch the 2 enzymes (α-amylase and β-amylase) are cutting the glucose chain as follows:
  - ☢ = α-amylase (cutting big chunks)
  - ☢ = β-amylase (cutting glucose into Maltose molecules)
Falling number.

- Measuring the α-amylase activity in wheat or flour.
**Falling number.**
Indicator for α-amylase activity

- The falling number determines the activity of α-amylase.

- If the grain was subject to sprouting the amylases are very active and the falling number is very low (FN 62)

- Too high falling number (>350) means that the enzymes are not very active

- Neither too high, nor too low falling number is ideal for an ideal bread development.

- A certain amount of enzymes is needed to provide sufficient food for the yeast for cell division and to produce the sufficient amount of CO₂ for production of a light, fluffy bread.
Gluten Quality / Gas retention

- Gluten index: Instant test on extensibility of gluten
- Sedimentation: Information about gluten quality and quantity
- Farinograph: Testing the resistance against mechanical stress
- Extensograph: Information about any change of the gluten quality during the fermentation
Gluten / Protein.

- Gluten is a complex protein formed of two protein structures, Gliadin and Glutenin (Gli+Glu).
- Due to the water and energy impact (kneading) Gli+Glu get connected to form the GLUTEN. The connection points are so called disulphide bridges.
- Yeasts consume sugar and produces carbon dioxide via fermentation. The CO$_2$ becomes trapped in this molecular mesh structure of gluten, causing bread to “rise.”
- Gluten is one kind of protein but not all protein is gluten → approx. 85% of the wheat protein consists of Gli + Glu.
Gluten in bread.

- The amount of gluten contained in the bread has a significant influence on the baking volume of the bread.
Gluten Analysis: FARINOGRAPH.
Farinograph: Kneading unit.

Measurement of the dough resistance to kneading by specified kneaders.
FARINOGRAPH Evaluation.
Weak Flour

Stability

Degree of Softening

FQN

Development Time

12 min
FARINOGRAPH Evaluation.
Strong Flour

Stability

FQN

Degree of Softening

Development Time

12 min
EXTENSOGRAVPH.

Gives information on:

- Wheat quality
- Stretching behaviour
  - Extensibility
  - Resistance to extension
- Effect of additives e.g.
  - Ascorbic acid
  - Enzymes
  - Emulsifiers
EXTENSOGRAPH
Dough Homogenizer – Sample Molding
EXTENSOGRAPH.
Stretching of the dough
EXTENSOGRAPH Evaluation.
EXTENSOGRAPH Evaluation.

- Strong flour
- Extensible, elastic dough
- Suited for long fermentation processes, large proving tolerance

- Light, voluminous baking products with a good volume

- Rigid, tough dough structure
- Poor extensibility
- Dough hardly rises during proving

- Results in small pieces of dough with poor spring

- Flour producing a wet, plastic dough
- Soft dough

- Narrow fermentation tolerance, dough tends to spread
- Small baking volume

- Flour not suitable for normal baking products
Flour Quality Tests.
Physical Dough Tests - Alveograph

Electrovalve
AIR FLOW
Flour Quality Tests.
Physical Dough Tests - Alveogram