CHOPIN TECHNOLOGIES

a KPM ANALYTICS brand

Solutions for Wafers manufacturers

Tools measuring the primary criteria affecting final Wafers quality:

- Water absorption of flours
- Quantity and quality of proteins
- Dough viscosity
- Damaged starch
- Starch gelantinization

INDUSTRY CHALLENGES

Wheat flour for production of thin, flat wafers in industrial wafer ovens should preferably contain 25-27% wet gluten, corresponding to about 10% protein in the flour. Fineness of flour is critical; 70% of flour should have a particle size of 40-70 microns with the remainder between 90-120 micron.

Wafer batters are thin and contain a lot of water; fat must be melted to ensure homogeneous distribution. Fat should contain a high liquid fraction but should not be too liquid in the cold state, and resistance to oxidation is important. Rising agents ($NaHCO_3$ or equal parts of $NaHCO_3$ and NH_4HCO_3) give improved flow of the mass, better browning of wafers and a "delicate" bite. To avoid wafer breakage, the recipe should contain 35- 37% DM.

It is recommended that the flour for use in wafer manufacture should contain 14.5-15% moisture, 0.55-0.58% ash, 9.5-10.0% protein, and should have a wet gluten content of approx. 26%. Flour used for wafer production must have good starch properties, but the quality and amount of gluten are of secondary importance. The Hagberg viscosity should be 230-310, with absorption of the alkali solution limited to 60-67%.

There are many different types of wafers and great variation in manufacturing processes. However, one process that could be considered representative consists of mixing flour, water, sugar (0 to 30% depending on the type) and a little fat, to form a liquid, homogeneous batter. The batter is then injected or pressed into a thin layer. It is then baked between plates or in a mold for about 2 min at 180 ° C. The product then is cooled so that other ingredients can then be added (cream, chocolate, etc.). The last step is to cut the product to the desired size. Varying periods of rest of the dough are common.

Because the recipe is relatively simple, the quality of the finished product depends greatly on the properties of the flour. In particular, **water absorption** is very important for the formation of a liquid and homogeneous batter. The batter is most often injected using a dosing pump. At this stage, the **consistency** and the **viscosity** must be optimal.

During the baking phase, the product goes from a liquid stage to a solid stage in a few minutes. In order to obtain a product with a uniform **structure** and **texture**, the properties related to the **quality** and gelatinization of starch are very important. Similarly, the quantity and quality of the proteins are crucial because the bonds they form with the water molecules influence evaporation, a key step in the manufacturing process as the product has to go from a water content at close to 70% down to less than 2% in a few minutes. Wafers are traditionally made from wheat flour, but they can also be made from maize, rice or rye flours.

Identifiying the key elements that affect the final quality of the product is essential in order to implement effective quality control. There is a common knowledge base that can be applied; however, the influence of the mechanisms involved differs for each production line. A more modern approach is for a company to objectively measure what works on its lines, and to focus its quality control on the most important elements.

Master the Key Points of the Process

Water absorption:

This is the quantity of water that can be added to the flour to give it the necessary plasticity (firmness, extensibility, elasticity). If you do not put in enough water, the dough is dry, hard and brittle; if you put in too much, it becomes soft and sticky. For wafers, the required level of hydration is high (100 - 150%). The formed dough is liquid. The amount of water that any flour can absorb decreases with low levels of protein, damaged starch (particle size) or pentosans. These flour characteristics are particularly important in the manufacture of wafers because, as the water content of the finished products is very low (<2%), most of the water absorbed in the mixing process must be evaporated during the baking, an expensive process. It is very simple to measure water absorption directly using the **Mixolab 2**, the **Alveolab**, and the **SRC-CHOPIN**. A good estimate can be obtained by measuring starch damage (**SDmatic**, **SRC-CHOPIN**), protein levels (**NIR**: **Infraneo**, **Spectralab**), and pentosans (**SRC-CHOPIN**).

Consistency and viscosity of the dough:

Dough consistency depends on the amount of water added and the ability of the flour to absorb this water. For any given level of hydration, the consistency of the dough represents its tenacity, its hardness. This depends, on the quantity and quality of the proteins, the starch damage, and the pentosans. Mixing consistency may be measured by either the **Mixolab 2** or, after shaping by the **Alveolab**. It is also possible to individually measure the factors responsible for consistency: proteins (**NIR**, **SRC-CHOPIN**), damaged starch (**SDmatic**, **SRC-CHOPIN**) and pentosans (**SRC-CHOPIN**).

Structure and texture:

The structure and texture of wafers are two important parameters impacting sensory perception and consumer satisfaction. These characteristics are directly influenced by the properties related to starch (gelatinization, stability, viscosity and retrogradation). They are measured by the **Mixolab 2**.

Process of baking and evaporation of water:

The wafer baking process is very fast (about 2 min at 180 ° C). During baking, the majority of the water contained in the liquid dough must be evaporated. The main molecules present in the flour (proteins, starch, pentosans) create more or less strong bonds with the water molecules. The stronger these links are, the more energy is needed to break them (during baking). The greater the strengths of these bonds, the more expensive will be the manufacturing process. It is possible to measure the contribution of each of these molecules to water absorption with **SRC-CHOPIN**.

Flours with weak proteins (**NIR** or **Alveolab**) will be favored for the manufacture of wafers. Similarly, low starch damage (**SDmatic**) flours will be chosen because higher damage results in greater gelatinization (**Mixolab 2**) of the starch during cooking and higher water absorption.

Solutions / Key Point	NIR	SDMATIC	SRC-CHOPIN	ALVEOLAB	MIXOLAB 2
Water absorption	X	X	X	X	X
Dough consistency	(X)	(X)	(X)	X	X
Viscosity	(X)	(X)	(X)	X	X
Process of baking and evaporation of water	X		X	X	X
Structure and texture		(X)			X

X : direct measurement. (X) : indirect measurement

CHOPIN TECHNOLOGIES' SOLUTIONS IDENTIFY THE KEY ELEMENTS AFFECTING THE QUALITY OF YOUR BAKING PRODUCTS

Measuring moisture and protein levels by near-infrared analysis (NIR)

The **Infraneo** is a near-infrared (**NIR**) analyzer that works on both whole and powdered grains. It uses transmittance and monochromator technology. Simple, reliable, and precise, it can rapidly measure many parameters such as humidity and protein content, that affect the **absorption of water**, **stickiness**, **consistency** as well as the **evaporation** of water during **baking**. The **Spectralab** is an infrared analyzer that operates based on reflectance. With a wider measurement spectrum, it also determines moisture and protein.

Measuring starch damage

The **SDmatic** allows for simple, fast, safe analysis of starch damage. Based on the measurement of iodine absorption, it works on 1 gram of flour and provides results in only 10 minutes. The reliability of the **SDmatic** has been confirmed in international collaborative studies. It is a standardized method recognized by AACC, ICC, ISO, CEN Afnor, Gost, etc. Starch damage affects **water absorption**, **consistency**, **viscosity**, and the **structure** and **texture** of the finished product.

Measuring flour functionality

The **SRC-CHOPIN** is a means of measuring hydration based on the increased swelling capacity of the various flour polymers when they are in contact with particular solvents.

It performs 4 measurements in one automated test:

- **Water absorption** (Solvent: distilled water)
- **Glutenins** (Solvent: Lactic Acid)
- **Damaged starch** (Solvent: Sodium carbonate)
- **Pentosans** (Solvent: Sucrose)

The **SRC-CHOPIN** is a method recognized by the AACC. It allows one to measure **water absorption** and factors influencing the **stickiness** and **consistency** of dough, and process of **evaporation of water** during **baking**.

CHOPIN TECHNOLOGIES' SOLUTIONS IDENTIFY THE KEY ELEMENTS AFFECTING THE QUALITY OF YOUR BAKING PRODUCTS

Measuring firmness, extensibility, and elasticity

The **Alveolab** has been an internationally recognized method (AACC, ICC, ISO, CEN, Afnor, Gost, and others) for many years; it measures the characteristics of dough during the swelling of a bubble.

Completely adaptable, the Alveolab directly measures:

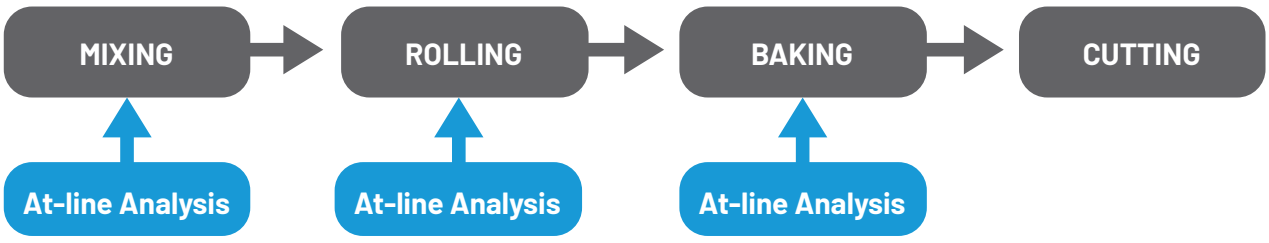
- **Firmness** (the resistance of the dough to deformation, its consistency)
- **Extensibility** (the ability to stretch the gluten network)
- **Elasticity** (the tendency of the dough to return to its original position after stress)
- **Force** (the work required to deform the dough)

The **Alveolab** allows one to work with both constant hydration and adapted hydration. It measures **water absorption** and characteristics of the dough such as **extensibility**, **elasticity**, and **consistency**. Protein quality also influences the process of **evaporation of water** during baking.

Measuring the characteristics of the dough during mixing and baking

The **Mixolab 2** is the only internationally standardized device (AACC, ICC, ISO, CEN, Afnor, Gost, etc.) that can perform a complete analysis of dough that is subjected to temperature increase. It measures **dough hydration**, mixing behavior (**consistency**, development time, stability, and so on). It is the only device that allows you to observe the changes in the dough at the beginning of heating as well as during gelatinization and starch retrogradation, a phenomenon that impacts the **viscosity** of the dough and the **structure** and **texture** of the finished product. By working on representative doughs, the **Mixolab 2** allows one to get as close as possible to the actual conditions of use of the flours.

"AT-LINE" CONTROL *

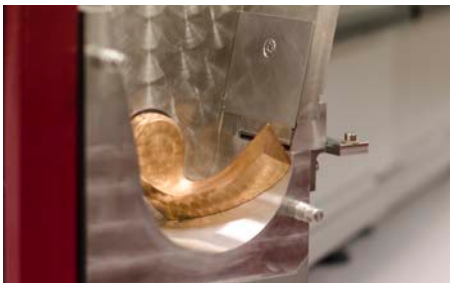


*A typical example; other processes and control points can be imagined.
Depending on the technical constraints encountered, it is possible to adapt the analysis protocols.

THE TOOLS:

Mixolab 2 Dough sample kit

The dough sample kit makes it possible to introduce, and to analyze simply, samples of about 100 grams of dough directly taken from the line.



Alveolab Kneader

The Alveolab kneader is suitable for receiving and extruding samples of approximately 300 grams of dough.

OUR TEAM IS HERE FOR YOU. CONTACT US!

Every manufacturing process, every factory, is different.

We'll help you:

- Define acceptance characteristics for the finished product.
- Define the key steps in the manufacturing process that influence the success of the finished product.
- Put in place effective quality control for these key steps (at-line control).
- Characterize your raw materials and assist you in setting up specifications based on what genuinely has an impact on your production.

HOW SHOULD I PROCEED?

Make a request on our website (*www.chopin.fr)*, and a technician will contact you to define the scope of your request.

Following this initial contact, an appointment (physical or virtual) will be scheduled which may lead to the establishment of a contract, possibly involving the provision of equipment* and the presence of an on-site technician* to assist you.

(Subject to availability)*

CHOPIN TECHNOLOGIES

a KPM ANALYTICS brand

20 Avenue Marcellin Berthelot,
92390 Villeneuve-la-Garenne, FRANCE
Tel: 01.41.47.50.00 *Sales@kpmanalytics.com*