CHOPIN TECHNOLOGIES

a KPM ANALYTICS brand

Solutions for Cakes Manufacturers

Tools for measuring the primary criteria affecting final Cakes quality:

- Water absorption of flours
- Quantity and quality of proteins
- Consistency and viscosity of the dough
- Damage and gelatinization of the starch
- Structure and texture
- Color

INDUSTRY CHALLENGES

Cake can be defined as a sweet, usually finely texturized food product, baked in various forms that differ in size and configuration. It generally contains such ingredients as soft wheat flour, milk or other liquids, sugar, eggs, chemical leaveners, flavour extracts and spices as well as others that may or may not include shortening. Cake varieties cover a wide range from pound cake to yellow and white layer cakes, cakes containing chocolate and coca products, sponge cakes, angel food cake, fruit cakes and foam-type cakes, donuts and many others.

There are many different types of cakes and great variation in manufacturing processes. Two families of cakes can be distinguished: low ratio cake (more flour than sugar in the recipe) and high ratio cake (more sugar than flour). The first step in the manufacturing process is the mixing of the different ingredients: mainly water, flour, sugar, fat, eggs, emulsifiers and leavening agent. A very aerated emulsion is achieved through the use of a very high mixing intensity. A semi-liquid paste (batter in English) is then formed. This is then injected into molds, which are placed directly in an oven for the baking phase. Varying periods of rest 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. These proteins also contribute to the structure of the finished product. The cakes will also have to have a **color** adapted to the preferences of the consumers. Cakes are typically made from specifically treated flours, by a process of chlorination or heat treatment (the most common). This specifically allows denaturation of the proteins so that the gluten network does not develop during manufacture. This also makes it possible to modify the starch granules so that they swell more during baking, and thus contribute to the light, airy texture of the finished product.

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 cakes, this hydration is about 55%. The formed dough is liquid, however, due to the addition of a large amount of sugar and fat. The amount of water that any flour can absorb decreases with low levels of protein, damaged starch (particle size) or pentosans. 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. In the case of cakes, it is also highly influenced by the other components present in the formulation (mainly sugars, eggs, fat). 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 cakes are two important parameters impacting sensory perception and consumer satisfaction.Structure and texture are influenced by the behavior of the different ingredients during the mixing process (creation of an emulsion, incorporation of air bubbles into the dough) and during baking (swelling of the starch granules during gelatinization in particular). The **Mixolab 2** directly measures the properties related to starch (gelatinization, stability, viscosity and retrogradation). The phenomenon of gelatinization is also influenced by the level of starch damage (**SDmatic**).

As mentioned above, the structure and texture of cakes are influenced by protein quality (**Mixolab 2**, **Alveolab**) and protein quantity (**NIR**).

Color:

Cakes are judged more or less appetizing by consumers according to their color. This parameter is essentially governed by the Maillard reaction, occurring during baking, which relates to the action of sugars on proteins. The more free sugars, the darker the cake will be. The amount of simple sugars available is directly influenced by the activity of the amylases present in or added to the flour.

These degrade a portion of the starch into simple sugars.

Amylase enzyme activity is measured with the **Amylab FN**. In addition, the damaged starch (**SDmatic**) is more easily attacked by the amylases and thus promotes the browning of the products. The preferred flours for the manufacture of cakes therefore show low amylase enzyme activity and low starch damage.

Solutions / Key Point	NIR	AMYLAB FN	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
Structure and Texture	X		X		X	X
Color		X	X			

X : mesure directe. (X) : mesure indirecte

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 structure and texture of final products. The **Spectralab** is an infrared analyzer that operates based on reflectance. With a wider measurement spectrum, it also determines moisture and protein.

Measuring amylase enzyme activity

Amylab FN measures the amylase enzyme activity of flours, based on the Hagberg falling number principle, the global reference method in the cereal industry. It boats innovative technology (induction heating, aluminum tube) allowing it to be simpler and safer to use than conventional devices. Also, the **Amylab FN** can be used in a rapid test mode, called the Testogram, which allows it to provide a result in 90 seconds, regardless of the sample. Amylase enzyme activity impacts the **volume** and the **color** of finished product.

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**, **stickiness**, **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, as well as the **structure** and **texture** of the finished product.

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:

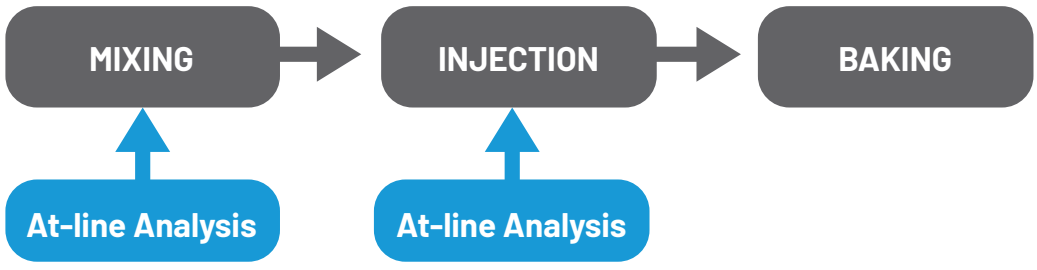
- **Firmness** (the resistance of the dough to deformation, its consistency)
- **Extensibility** (the ability to stretch the gluten network)
- **Elasticity** (the tendency of the dough to return to its original position after stress)
- **Force** (the work required to deform the dough)

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** as well as the **structure** and **texture** of the finished product.

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, as well as 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*

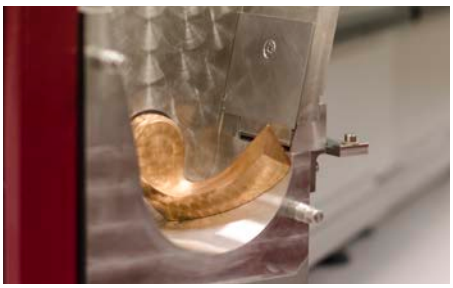


*A typical example; other processes and control points can be imagined.
Depending on the technical constraints encountered, it is possible to adapt the analysis protocols.

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)*

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