



**FILIERE**  
*Gourmande*  
Magazine

The taste of know-how in Baking, Biscuit making, Viennoiserie pastries, Pasty and Soufflé

in collaboration  
with Lesaffre

COLLECTION

The Filière Expert Notebook

# The Taste of Bread

A combination of Art and Science

Thanks to the recent development of tools for the measurement of taste, such as sensory analysis and olfactometry, bakers can now discover how much influence their technical skills and their use of "taste ingredients" have on the character of their bread. Filière Gourmande magazine has drawn on the expertise of the Lesaffre group to bring you the first volume of these "Cahiers Experts" [Expert Notebooks].

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# About the word « taste »

*How much simpler it would be for bakers if consumers unanimously agreed that their bread had a really good taste. Unfortunately, individuals judge for themselves what is good and what is bad. It is enough to see the diversity of bread throughout the world to realise that appreciation criteria vary from one culture to another and according to individual tastes! How can one explain the taste of bread? What mechanisms are at work in the consumer's brain?*

*Our discussions with semiologist Laurent Aron give some useful keys towards understanding this word which is present in everyone's mouth.*



## Social and cultural values

The brain keeps a personal record of products we consume, together with the level of pleasure that we experience from them. For example, some clients will think a baguette with pointed ends is better than the same baguette without pointed ends. Appearance influences our senses, as does the packaging of the product. Isn't it a real pleasure to go into a bakery where the décor, the smell and the layout of the bread stir all the senses and make customers dream? It awakens childhood memories and represents the epitome of a healthy, well-made, traditional product. Sensory panels try to understand this phenomenon by starting with the simple statement « *I like it* » or « *I don't like it* » and then trying to interpret the reasons that lead to this feeling. This is where individual choice is important. Ideas evolve and sometimes we can help to change values. Twenty years ago white bread was highly thought of, but these days it is rejected if it is too white. The reason for this lies in the cultural associations of the product. In the period from the fifties to the seventies white bread required manual sifting of the flour. As technology has gradually replaced manpower, we now tend to look for « *unrefined* » products, synonymous with authenticity, that have not been manipulated by science or machines. A similar situation exists in the sugar industry where refined white sugar now has less added value than brown sugar.

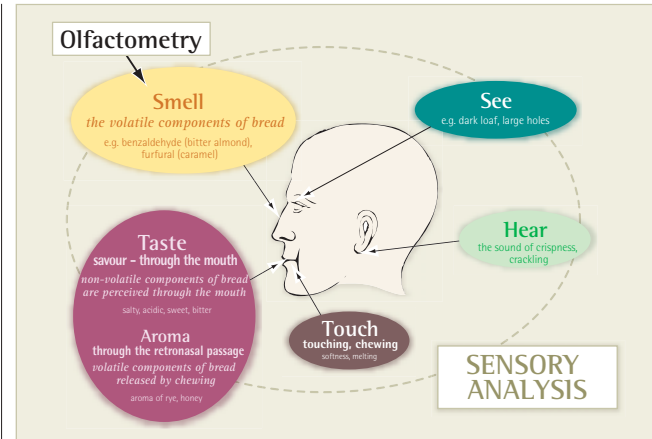
## The limitations of the language of bread

It is difficult to find a word for every sensory perception. It is perhaps impossible, as individuals have their own words, own vocabulary and above all, their own way of seeing things. Words are enriched by experience, exactly like colours. When we are young we discover primary colours like blue, then as we grow older we fill in the palette by adding shades with names like ultramarine and indigo. We use a standard shade card as a tool to agree definitions of colour, but it is a matter of interpretative understanding rather than of absolutes. Likewise, in the language of bread there is no supreme taste or absolute palate. Interpretation often translates into a profusion of words as a means of expressing ourselves and of having the pleasure of speaking about something and sharing our experiences with

The brain, in a way, is the real seat of taste because it concentrates the various sensory experiences. But how do they get there? Try an experiment: put a piece of bread on your tongue and your tongue and nose go into action immediately. Both these oral-nasal organs are receptors of sensory information. Firstly, the taste buds spread all over the tongue recognise a series of flavours: sugar, salt, acidity and bitterness among many others. At the same time, the nose sends complementary information to the brain as the aromas are exhaled through the mouth and penetrate the retronasal passage. This combination of tastes and aromas is called « *flavour* ».

The consumer can also experience a food differently according to various aesthetic sensations. For example, a food eaten hot does not have the same taste eaten cold. A melting vanilla ice cream tastes sweeter than if it is eaten very cold. Finally, there are physical perceptions, such as whether a food is crispy or soft. When talking about chocolate, one often mentions its crunchiness as a taste criteria. Taste is so complex that it makes use of all five senses: smell, touch, sight and sound as well as taste itself. This restrictive classification goes back over 2500 years to Aristotle, who gave himself the task of arranging everything – men, flora and fauna – into a precise register with tangible reference points. But does this arrangement really help to explain the mechanics of taste as it is understood today? Haven't some senses – such as the sense of balance – been left out of this classification?...

others, even if individual opinions differ. The language used to describe the taste of bread is often constructed by borrowing pseudo descriptions from different imaginary universes. In the bread world these descriptions can refer to places, or more often to processes and actual ingredients such as flour, or supposed ingredients such as nuts. The taste of bread is a culture in progress to which words are freely added. The vocabulary grows, enriched by experience. In contrast, the lexicon of sensory analysis is created through a process where words to identify tastes are selected from a palette of terms agreed by all. We move voluntarily from a language that is rich and abundant to one that is restrained. Camille Dupuy, who is in charge of sensory analysis, explains: « *At Lesaffre we have established a precise lexicon for the sensory analysis of several clearly defined types of breads.* » A clear distinction can be made between different textures, such as sticky, spongy, aerated or crumbly. ■



Taste is a complex mechanism based on the five senses

## From fermentation to the cultivation of taste



The world of the bakery should give pleasure to the customer and make him receptive to new sensations

The process of fermentation lies at the heart of complex food products. Through the mastery of fermentation by human genius, the three major types of fermented foods - bread, wine and cheese - (to which can be added most types of uncooked salami-type meat products) create a magic alliance which gives pleasure while satisfying our fundamental need for food.

Fermentation is very useful: it conserves foodstuffs, makes them more digestible and decreases their glycaemic index while increasing the availability of micronutrients. At the same time, it leads to the production of aromatic molecules, such as those that everyone recognises in wine-making or in the maturing process of cheese. These are also present in breadmaking and the characteristic flavour that develops is olfactory proof of a good fermentation well carried out. Over time, these typical flavours have become identified with the very products from which they arise, which is why for most consumers taste is synonymous with a well-made product. The taste of a good bread reflects the quality of its manufacture. However, a number of factors come into the definition of sensory components. In order to make good quality bread the baker must choose his ingredients - yeast, flour and other ingredients - and must fully master the control of the production process - kneading, fermentation and baking.

### A universal dimension

When customers advocate a return to tradition and authenticity the baker knows that he has a card to play in making them aware of the quality and diversity of his products. Customers are the judges of whether a product is satisfactory, so it is important to pay attention to their perceptions. Taste has a cultural dimension based on the client's imaginary vision of what is « *best* » that he hopes to satisfy. He wants to find a tasty product that will make his mouth water. And what do you say to describe something new? We no longer think of bread just as « *something to mop up the sauce with* » or as an implement for picking up food. Knowledge and innovation have enabled bakers to improve what they have to offer and to adapt to the needs of a demanding market. Productivity can finally keep up with taste.

Bread has become a food in its own right. It complements the foods that it accompanies and adds to appreciation of them, thus becoming a « *taste enhancer* ». From simply being « *bread to eat* » it has become part of the « *pleasure of eating* ». We eat bread as part of a balanced diet in order to stay healthy. Not that it is quasi-medicinal, but it does contribute to energy levels and nutritional needs as much as all the other parts of a meal.

### Continual evolution

Today's consumer buys bread according to selection criteria based on appearance, taste and freshness. Taste is a complex mechanism which uses all five senses: sight, touch, taste, smell and sound. The layout, the ambiance of the bakery and the customer's feelings influence his purchase and confirm his definition of taste. A good bread is judged through a combination of perceptions, relating to tradition, health and food safety. The image that the product reflects must, therefore, conform to that of typical breads and their flavours.

But tastes evolve in the course of discussion, so there is no profile of an ideal bread! Faced with such a variety of eating habits it is important to identify and describe the interactions which give rise to sensory perceptions. For a yeast producer like Lesaffre, the experience gained over 150 years of yeast production and international interaction gives the group a perfect understanding of the language of bread, so that through a range of technical analyses they are able to decipher the aromatic components which give different breads their typical tastes. This is truly the cultivation of taste: it starts with the cultivation of yeast, then the yeast contributes fundamentally to the aromatic development of bread; finally, there is an international cultural dimension, in order to adapt and respond to the specific breadmaking needs of different countries. ■

■ The worldwide diversity of bread

# Reference terms from here and elsewhere

*The diversity of breads throughout the world has not come about by accident. It is difficult to classify breads according to type, because this truly worldwide heritage is the result of numerous factors such as geography, climate, culture...*



## PITTA BREAD

Pitta bread, also known as Arabic bread, has its origins in a valley between the Euphrates and the Tigris. This area is one of the cradles of civilisation, of agriculture – and of bread. Its flat shape arises from being baked on a stone by means of heat conduction or directly

in the embers. Pitta bread is soft and very lightly salted. It should not be torn. These days pitta bread is used throughout the world instead of a spoon or a plate. It is widely used to make oriental sandwiches, by filling between the two layers. It dries out rapidly and should be eaten quickly.



## BAGUETTE

The origins of the baguette are obscure. It is an emblem of France, much appreciated for its length and its slinness. Over time, it has grown in length, no doubt to increase its crustiness and perhaps to distinguish it from the large round loaves that bakers used to make and which kept

for longer. In the 19<sup>th</sup> century baguettes weighed no less than two pounds! Today they are made to be eaten the same day. They are rarely wrapped. Bakers bake them daily, preferring freshness and crustiness to long shelf-life.



## RYE BREAD

Rye is typical of Central and Northern Europe and was for a long time the dominant cereal in these regions. Then selective breeding and importation allowed cultivation to become more diversified and led to the introduction of wheat. Rye bread always requires the

use of an acidifier to prevent it becoming sticky. It is therefore often characterised by a strong acidity. Rye bread is best eaten after two days when it is beginning to dry out.



## WHITE BREAD

This is typical Anglo-Saxon bread. Although its highest production level is in the United States, the home of the famous « sliced white loaf » is actually in England. It has been widely adopted throughout Northern Europe and is often eaten toasted. In the United States it has a higher sugar and fat

content. The key factor of this bread is its softness. In English-speaking parts of Africa, such as Nigeria, white bread is preferred very sweet, strongly rolled and cooked at low temperature. More surprisingly, Japan holds the record for consumption of white bread, comprising 60% of its total bread consumption.

## Influences of geographic region

For centuries, cereal growing was governed by climatic conditions, which led to the predominance of one breadmaking method according to region. Agricultural progress in the 20<sup>th</sup> century, such as changes in wheat and rye growing areas, selection of varieties and exchanges between continents has encouraged the mixing of baking practices and has led to the enlargement of the range of bread products available.

## From traditional links...

Our « daily bread », inherited from the habits of our forefathers, is very different from one country to another and everyone has their own repertoire of tastes and sensory references. Every consumer assesses the shape, colour and crustiness of bread, as well as texture and taste according to his own experiences and judges all other breads accor-

dingly. Nevertheless, while in some countries bread is still a basic foodstuff, elsewhere it is following the tendencies of the consumer society. The higher the standard of living, the more the consumer searches for the exotic and sophisticated .

## ... to the mixing and intermingling of cultures

Today there is so much diversity that any consumer looking for new types of bread is spoilt for choice. Migratory movements and the development of exchanges between countries have contributed to an intermingling of cultures from which bread has not escaped - all the better for us! Certain breads have been exported together with their methods of manufacture and have been fully assimilated by their hosts - for example, the baguette in Japan, Turkish bread in Germany and the ciabatta, which was originally Italian but is now found throughout northern Europe. ■

■ Report from an artisan baker

## David Brésard: **Taste** – it's a question of personality

© David Brésard



**D**avid Brésard<sup>(1)</sup>, a baker in the heart of Lille, upholds taste, nourishes it daily and talks about it with great conviction. He recognises, of course, that technique is essential to optimise taste: he kneads little, preferring to use a fruity lactic raising agent that requires long fermentation. « As far as I'm concerned, it's the fermentation

process that controls what I do, not the other way round...I work exclusively with a liquid raising agent prepared in a tank of milk. In a way, this personalised raising agent is my signature. » But in addition to this, David Brésard does his best to leave the imprint of his own taste on each of his breads. « I can't make a bread unless I like it myself », he says. What about his customers' expectations? « I've resisted the temptation to make standard baguettes, tinned loaves or voluminous boulois. I want to meet my clients half way and lead them into a world of diversity and flavours. So three quarters of my baguettes are specials. » Like a restaurateur, he feels it is his duty to offer both a fixed menu of breads and a « bread of the day » throughout the week - a sports loaf on Monday; a bio on Tuesday; buckwheat bread on Thursday; German wheatbread on Friday; millstone bread on Saturday; and on Sunday - chef's surprise! And the cherry on the cake is the bread that he calls his « overnight inspiration », in which he lets his imagination run wild. Bread made with a flour of buckwheat/ pineapple and poppy flour, bread with cereals, apples and nuts, banana bread with soft brown sugar and sesame seeds - all these sweet combinations have met with great success. Early each morning his clients like to satisfy their curiosity and they naturally build up a rapport with the shop assistants and the baker. « But even though I've decided to individualise my bread,

I can't make just any old thing. Certain combinations of flavours must be respected. So my customers still have terms of reference in my shop and, in spite of everything, they still look for a known identity. It's one thing to lead the consumer to experiment, but we must not break the bounds of good taste... »

### Selling taste

So, how does he sell diversity when the only judge is the client? « Taste finds its own way. There are clients who arrive in my shop with heads down asking for a standard baguette. As I don't have any, I naturally give them my attention and try to find out what their tastes are and what sort of bread they like. Do they want a dense texture, a thick crust or a thin one, an acid or a fruity taste, a honeycombed appearance or a long shelf life? Then I get them to try various breads. Daring to taste is a big step forward. This client's view of bread will be changing. » Like wine and cheese, bread deserves to have its own vocabulary, its own words so that it can be discussed. Moreover, the vocabulary of bread should be taught, so that bakers and shopkeepers can fully exploit their role as advisers.

« I know that to sell my bread I have to dramatise my products, create some animation and be close to my clients. Taste is life. You can't imagine how pleased people are when they see me coming up from the bakehouse with a batch of bread. Contact and closeness are essential in my trade. » Listening to David Brésard, one realises that taste is the essence of his business, inspired by his artistic personality and environment and brought to fruition on the palates and in the souls of his clients. ■

Research by Cécile Chevreux

(1) David Brésard is a master baker who has been awarded the "Ami des Arts". At 34 he has three shops in Lille, employing 26 staff. After seven years travelling around France he went to Chicago (USA) where he was production manager in an industrial bakery for one year, then took charge of a traditional French-style bakery in Santa Barbara. Two years later he came back to France and joined the Lesaffre group, where he expanded his international experience with trips to Africa and Asia. After three and a half years he decided to set up his own business.

# Creating taste in breadmaking

*The baker is a real artist in the creation of taste, drawing on a palette of varied ingredients and using different fermentation techniques to typify and personalise his breads and pastries. As Gérard Brochoire, director of the INBP, explains, « the quality of good bread depends 75% on the baker, that's how important technique is in bread-making! » With curiosity, sensitivity, audacity and technique, these days every baker has the means of experimenting with the taste of bread*

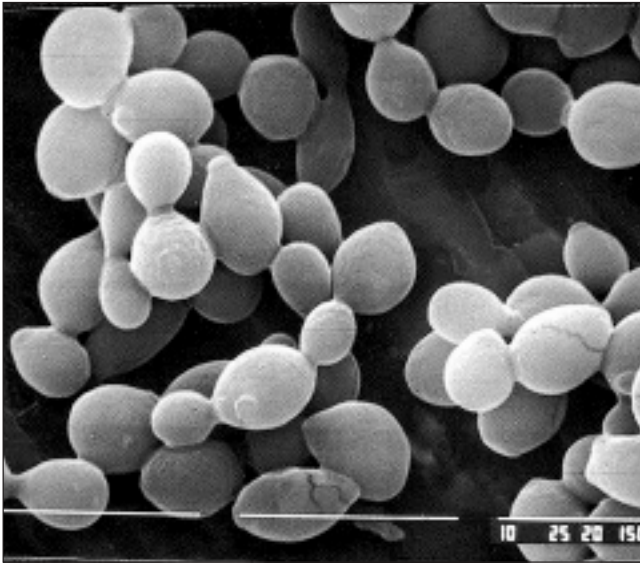
## A palette of ingredients

The most obvious way of diversifying the quality of bread is to play around with its composition and the type of cereals used. The basis of the product's identity lies in the variety of wheat. This is complemented by the addition of cereals such as rye, buckwheat, German wheat, mixed rye and wheat, maize or flax in the form of flour or seed. On a more sophisticated level, specific cereal ingredients such as wheatgerm, malt or bran can be added to reinforce certain aromatic notes. These ingredients, based on wheat or rye, undergo different degrees of fermentation before being dried. The choice of cereal, the degree of drying and the final combination of different dried fermented products allows the aromatic balance of the bread to be altered. It is thus possible to reinforce the « grilled », « roasted » or « sugary » notes, to guide one's taste towards an acid flavour or to mask other tastes. Taking things one step further, sourdough derivatives in either dried or liquid form are very simple to use because they are mixed directly into the dough. These are the source of a rich,

complex bouquet arising directly from the raising agent. In recent years the use of yeast derivatives has been greatly developed, due to their excellent qualities as sensory stimulants and taste enhancers. They can be used to increase or correct the aromatic profile of the dough.

## Fermentation, the natural way to taste

The primary function of fermenting agents such as yeasts and bacteria is to make the dough rise. By partially consuming the sugars in the flour the natural metabolism of these micro-organisms produces carbon dioxide and ethanol which cause an increase in volume during baking. The production of these components is accompanied by the release of a large number of taste molecules. The quantity produced varies according to other factors such as the flour and other ingredients, the kneading, water content, length and temperature of fermentation, etc. These reveal themselves during baking, either by releasing the cell contents following the destruction of the micro-organisms by the heat, or by the intense biochemical reactions that occur during baking. ►►



The growth of yeast, seen through an electronic scanning microscope

►►► Each type of yeast or bacteria imparts specific aromatic notes to the bread, depending on their metabolism. Finally, there are over 200 molecules that make up the taste of bread. The same ingredients can produce different aromatic profiles according to the length and temperature of the fermentation process. The combination of unique complex flavours in each type of bread, are the baker's « signature » and evidence of his skill in the breadmaking process.

#### Raising agents, a new step towards originality

The use of raising agents in breadmaking generates the richest tastes, due to their complex flora which closely combine yeasts and bacteria. However, the use of natural raising agents requires such a high level of organisation that this practice, common at the end of the 19<sup>th</sup> century, is today very limited. This situation and the positive image of raising agents has led yeast producers to develop fermentation agents which combine ease of use and diversity with traditional taste. The first generation of these products was used as a starter, but these days there is a complete range of ready to use raising agents. ■

### Lesaffre scientists at the service of raising agents

Bakers are well aware that unless raising agents are refreshed they become over acidified and their beneficial flora are destroyed. With most commercially available raising agents this usually happens within a few days. Their biomass declines, rapidly reducing their effect to simple flavouring and acidification. Sourdough bread is characterised by the active fermentation of beneficial flora during breadmaking. This means that the raising agent must have at least a minimum level of viable biomass - a fact that has now been established in law by the « *Decret pain* » [Bread Law]. By fully analysing the ageing mechanism of bread flora, Lesaffre have been able to modify the maturing process of raising agents. This new, patented maturing process has enabled the effective life of the raising agent to be prolonged. These days, a distinction must be made between ready-to-use raising agents with a variable biomass and those with a minimum guaranteed biomass. Lesaffre offers the latter as part of its « *Crème de Levain* » range of products.

# The impact of breadmaking methods

It is commonly acknowledged that bread has to taste good, but the idea of how it should taste varies from one consumer to another, or even for the same consumer at different times. In a world where there is a huge variety of foods on offer breads cannot all be expected to have the same taste.

There is a considerable number of possible techniques to choose from in breadmaking, and it is up to each individual to decide which he prefers. Like other craftsmen making food products, the baker has to get into the habit of tasting his bread, either to create new flavours, or to make any corrections that may be necessary with each batch to maintain the standards expected by his clients. Over sixty years ago, Henri Nuret, an eminent professor of flour milling, who cannot be accused of partiality because of his job, said that good bread depends: 15% on the wheat, 10% on the miller and 75% on the baker. This emphasises the importance of breadmaking technique! With this in mind, Gérard Brochoire, Director of the Institut national de la boulangerie et de la pâtisserie (INBP) [The National Institute of Bread and Pastry Making], summarises the importance of fermentation and of kneading in the taste creation process.

#### Kneading – a fair compromise

Intensive kneading was used in the fifties and sixties to produce white bread with good volume but little taste. We now know that intensive kneading produces three times as many volatile organic acids with what is perceived as an unpleasant smell as does slow kneading. However, slow kneading produces a dough with limited volume that is unsuitable for production of the small items that are most popular today, such as baguettes and rolls.

Improved kneading allows a compromise between the two preceding methods, producing a correctly developed bread with good taste and improved shelf-life. Given an equal amount of energy, speed is less important than duration. In other words, it is better to knead at a slightly higher speed for a shorter period than at a slower speed for a longer period. This better preserves the carotenoid pigments responsible for taste. The proportional length between the 1st speed and 2nd speed is variable, depending on wheat and hydration. An approximate duration can be established but the important thing is to stop kneading before the dough becomes white.

#### Duration of kneading for a fork kneading machine (oblique axis)

Slow kneading	15 minutes at speed 1
Improved kneading	4 to 5 minutes at speed 1 and 10 to 12 minutes at speed 2
Intensive kneading	4 to 5 minutes at speed 1 and 18 to 20 minutes at speed 2

The order in which the ingredients are added has some effect on the taste. The inclusion of salt right at the start of the kneading process has a positive effect, as the salt will be perfectly distributed in the dough and can effectively limit oxidation.

## Fermentation – a taste factory

Fermentation is evidence of the second major taste factor. We know that this type of alcoholic fermentation breaks down pre-existing sugars and a very small part of the starch in the flour. This alteration, while modest in quantity, completely changes the nature of the dough, by developing specific flavours and modifying its alveolar structure.

It is possible to play around with a number of parameters, such as the type and quantity of the fermenting agent, the ambient temperature, the length of fermentation and the contribution of various ingredients.

There are two main types of fermentation in baking:

- **fermentation with raising agents:** this encourages the development of yeasts and bacteria naturally present in the flour and in the atmosphere, which assist in the natural fermentation of the dough.
- **fermentation with yeast:** industrially cultivated yeast is made up of billions of cells of the same strain of *Saccharomyces cerevisiae*. Fermentation with selected strains will produce exactly the same results from one batch to the next.

Three techniques are normally used with yeast:

- **The direct method:** this is the simplest method in which the yeast is added directly into the kneading machine. To allow the development of flavours it is essential to use the correct quantity of yeast and to control the length of the fermentation programme. The minimum period of proofing is one hour. It is also possible to practise retarded proofing. At the end of the kneading process the dough is put into a tub and stored at + 10°C for 6 to 12 hours. The time, temperature and quantity of yeast must be carefully controlled to obtain optimum fermentation. This technique is similar to slow proofing, where the formed dough is stored at 10°C. However, although the fermentation times are similar for the two techniques, slow proofing often produces larger loaves with a less intense flavour.



Proofing is an important stage for successful breadmaking. During this stage flavours develop fully.



The aromatic molecules really come out in the course of baking.

- **Working with fermented dough:** this consists of adding dough from a previously kneaded batch in a quantity varying from 100 to 500 g per litre of mixture. The previously kneaded paste should be added half way through the kneading process, in order to avoid spoiling the taste by over-kneading. This technique has the advantage of reducing waiting time, while obtaining similar flavours to those from a long proofing period. It can add a slightly acid note depending on the degree of maturity of the fermented dough. However, this is not a raising agent as the fermentation is carried out entirely by the bakery's own yeast. Using a raising agent must not be confused with working with fermented dough, especially in the product description at the point of sale.
- **« Poolish »:** this method has been recognised since around 1870 when yeast was first used in French bakeries. As the yeast was of unequal quality it was safer to pre-ferment it. This method had fallen out of favour, but reappeared about twenty years ago. The poolish gives a slight acidity. It produces soft bread, somewhat like brioche, and is particularly chewy. However, when both techniques are properly used there is little difference with directly made bread. ■

### Example of production of a "half poolish"

Total quantity used	Preparation of the "poolish"	Fermentation	Kneading
Water: 10 l Flour: 15 kg Salt: 270 g Yeast: 155 g	Water: 5 l flour: 5 kg (hydration 100%) Yeast: 15 g	15 to 18 h at 20-22°C	Poolish (10 kg) Water: 5 l Flour: 10 kg Salt: 270 g Yeast: 140 g

This is called a « half poolish »: 5 litres, i.e. half of the 10 litres of water used in the above diagram is required for the « poolish », the other half is added during the final kneading of the dough. By varying the duration of kneading and the fermentation methods the baker can create bread with a multitude of tastes and textures, thus adapting to consumer demand.

■ Measuring taste

# From consumer to analytical approach

*Product development depends on the judgement of sensory analysis panels, as well as on complementary techniques of chromatography, mass spectrometry and olfactometry.*

## The relationship between the expert and the consumer

The smell, taste, flavour and texture of bread are the consumer's major quality criteria and are naturally the main concern of the bakery. As there is no measuring equipment that can precisely evaluate these criteria, tasting panels are used, whose members can judge the same sensory stimulants that will be perceived by the consumer: the smell of a brioche, the taste of rye, an acid flavour, a crispy crust. Such tasting sessions create a link between the world of consumer taste, the world of baking technology and of physico-chemical analysis. The market is influenced by innovation and fashion so the product needs to be carefully placed in the right context and with the right references for the moment. Tasters undergo regular training based on tests of new products, so that their reference notes are constantly updated.

## Complex research tools

To analyse an odour extracted from bread it is necessary to separate and then identify the different components of the aroma. In a gas chromatograph the molecules of the aroma are vaporised and then carried in a vector gas under pressure through a thin tube several metres long

## Olfactometry at Lesaffre



A member of the « nose » panel in full concentration

Lesaffre has a « nose » panel composed of about twenty people, selected for their sensory capacities and their cognitive skills (good memory of smells). First of all they develop together a common vocabulary of descriptions of pure components for reference. They are regularly trained to describe pure molecules selected from the « Field of Odours® » and to recognise them on fingers of bread. From the descriptions and from the retention times given during the olfactometry sessions it is possible to identify the molecules that play an important role in the smell of a given product. The levels of perception differ greatly from one person to another, which means that the same extract needs to be sniffed by several people (usually six to eight) to obtain a good representative result.

called a « column ». Some of the molecules partially attach themselves to the material, which slows them down. The size and the mass of the molecules will thus influence their speed of migration. Two types of detectors are used to identify them:

- the mass spectrometer, to give a name to the molecules detected
  - the human nose, to evaluate the odorous strength of these molecules
- By combining gas chromatography and mass spectrometry (GC/MS) one can identify components according to their retention time and their mass. However, the molecules identified by GC/MS are not necessarily those that influence the smell of the bread and there can be important odour molecules which remain at the bottom.

The olfactometry, or sniffing tests, carried out at the end of the « column » (see box) complete the analysis, by submitting a mixture of volatile odorous components to the human nose. It requires the perception levels of the « nose panel » to pick up odours that are lost at the bottom level which the chromatograph cannot identify. The research is refined by knowing the aromatic descriptions and the retention times corresponding to those particular molecules. Not all identified components contribute in the same way to the overall aroma of the product. By combining olfactometry and gas chromatography, mixed up molecules are separated and then individually smelled by a trained person. This identification compares and classes the various molecules among themselves.

Depending on the perception level of the molecule, a person can detect it or not and qualify it with a description. The quantitative importance of a component does not necessarily mean that it has a major role from an olfactory point of view. So the aromatic value of a component has to be considered according to the following formula:

$$C/L = \frac{\text{the concentration (C) of the molecule in the matrix (ppb)}}{\text{the level (L) at which this same molecule is perceivable(ppb)}}$$

This enables the evaluation of what a particular component contributes to a mixture, an aromatic preparation, or an aroma, called an « odour power ». For example, 2.5 dimethyl pyrazine has a direct olfaction perception level of 800 ppb, while for acetic acid it is 22,000. In the same concentration the 2.5 dimethyl pyrazine would have an aroma value 27 times higher! The higher this factor, the more the molecule is likely to contribute to the aroma of the product.

The advantage of this technique is that in many cases the human nose is more sensitive than electrochemical sensors, such as ionisation detectors or mass spectrometers.

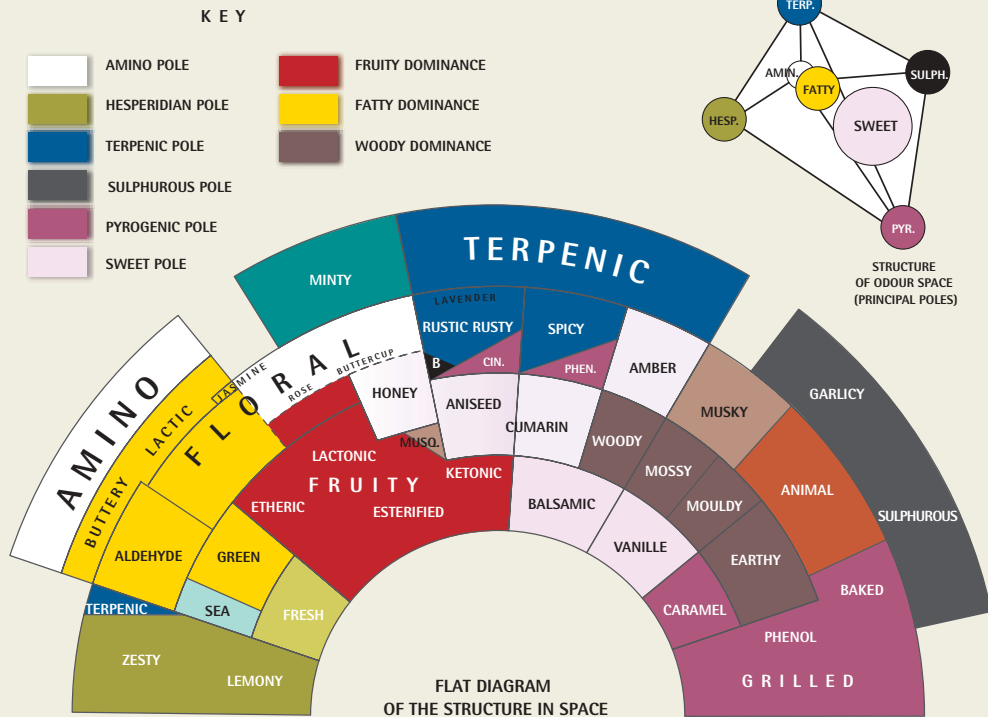
## Sensory analysis at Lesaffre

The preferences of bread consumers leading to a purchase include individual parameters such as mood and social context, the purchase environment at the point of sale, the presentation of the bread and, above all, the sensory characteristics of the bread.

But can one explain and anticipate consumers' reactions?

# THE FIELD OF ODOURS

ACCORDING TO JEAN-NOEL JAUBERT



The description of odours is a difficult exercise that many scientists have attempted to undertake in order to establish an objective classification of odour molecules. There are, therefore, many classification systems, such as Jean-Noel Jaubert's "Field of Odours®", which places each odour molecule in a category. Starting with 64 elementary descriptions nearly 1,400 basic molecules can easily be described according to the characteristics of their classified odour!

This is the objective of sensory analysis, which contributes to the development of new products through testing by tasting panels.

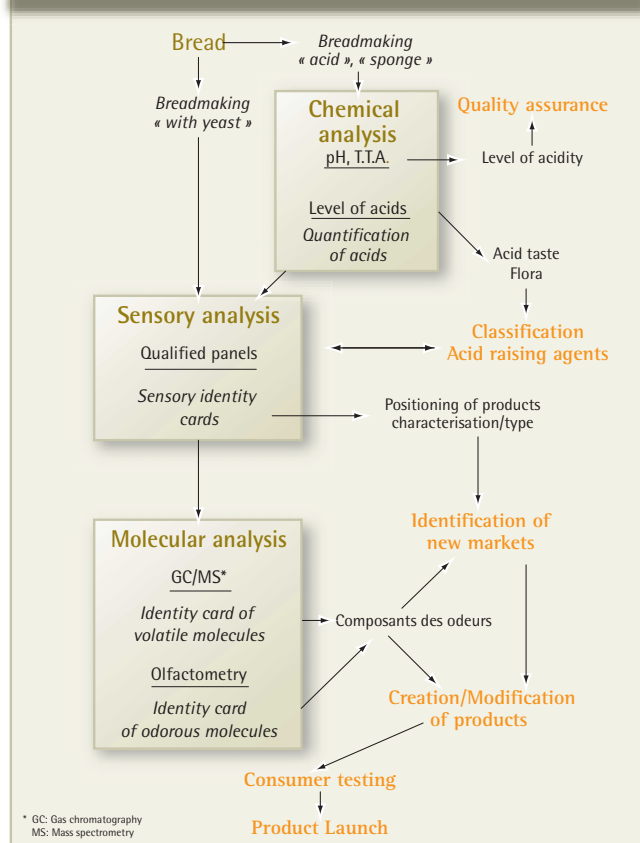
The use of pertinent and discriminative descriptions allows the precise characterisation of feelings. « *There are several levels of panel at Lesaffre* », explains Camille Dupuy, head of the sensory analysis laboratory. « *Firstly, there is a panel of novices who carry out triangular differentiation tests. Then we have qualified and expert panels who have received training. They are able to evaluate sensory intensity on a notation scale and to refer to precise descriptions. They have also learnt to distance themselves from their personal references and from intuitive reactions.* »

The expert panel was set up in 2003 to describe the textures of crust and loaf of various bread products: white bread, brioches, baguettes, pitta bread. The experience that Lesaffre has acquired at world level enables it to adapt more easily to clients' requirements. ■

(1) The perception level of a component corresponds to the concentration at which the substance is discernible by a human being, but cannot be identified. This level depends not only on the concentration of the molecule but also on the matrix in which it is incorporated. Moreover, each person has his own unique perception level for any given component.

This diagram shows the process of analysis for the identification of existing markets and the development of new products. It defines a progression of tools that are used to explore and refine the knowledge of taste components according to needs and problems. The results of the analysis generate guidelines for marketing activities and quality assurance. According to the steps followed, they can also serve to identify customer demand and translate it into a detailed technical specification.

## The Analytical Approach to Bread Aromas



# From theory to practice

In order to illustrate the preceding method of taste analysis with actual examples, five representative types of bread were made.

1. Directly made bread, 3 hour programme.
2. Retarded proofing (14 hours at 10°C).
3. Directly made bread, 3 hour programme with the addition of 2% strongly acidic dehydrated fermented rye flour.
4. Round loaf with raising agent, retarded proofing using 5% of ready-to-use liquid raising agent with guaranteed minimum bio-cultures.
5. Country-style bread with 20% liquid raising agent with variable bio-cultures.

N.B. For practical reasons, the raising agents in breads 4 and 5 were used at a date close to their use-by date

## Recipes for the selected breads

	Direct breadmaking with yeast	Retarded proofing with yeast	Direct breadmaking with dehydrated fermented flour	Raising agent with variable biomass	Long proofing with raising agent with guaranteed minimum biomass c
<b>FORMULA</b>					
Wheat flour T55	100%	100%	100%	91%	90%
Rye flour T130				9%	10%
Water	61,50%	62,50%	64%	60%	53%
Salt	1,80%	2%	1,80%	2,20%	2%
Yeast block "hirondelle bleu"	3%	1,20%	2,50%	2%	0%
Improver "bis bleu"	1%	1%	1%		
Dehydrated fermented flour			2%		
Raising agent with variable biomass				20%	
Raising agent with guaranteed minimum biomass					5%
<b>PROGRAMME</b>					
Type of kneading machine	spiral	spiral	spiral	spiral	spiral
<b>Kneading</b>					
V.L.	3 min	3 min	4 min	4 min	5 min
V.R.	5 min	5 min	5 min	3 min	30 sec
<b>Resting</b>					
Machine division	20°C/10 min 340 g	20°C/10 min 350 g	20°C/20 min 350 g	20°C/3 h 500 g	25°C/14 h 1 kg
Resting	20°C/10 min	20°C/10 min	20°C/20 min	20°C/20 min	20°C/20 min
<b>Shape</b>	batard (long and thin)	batard (long and thin)	batard (long and thin)	batard (long and thin)	round
<b>Proofing</b>	2h/20°C	14h/20°C	2h/20°C	1h/21°C	3h/25°C
<b>Baking</b>	18 min/230°C	30 min/230°C	35 min/230°C	40 min/230°C	45 min/225°C

These different types of breadmaking were chosen in order to study three parameters and their interactions:

- the type of acidification (dehydrated fermented flour versus raising agent);
- the length of fermentation (direct versus retarded proofing)
- the quality of raising agent (raising agent with variable biomass versus raising agent with guaranteed minimum biomass)

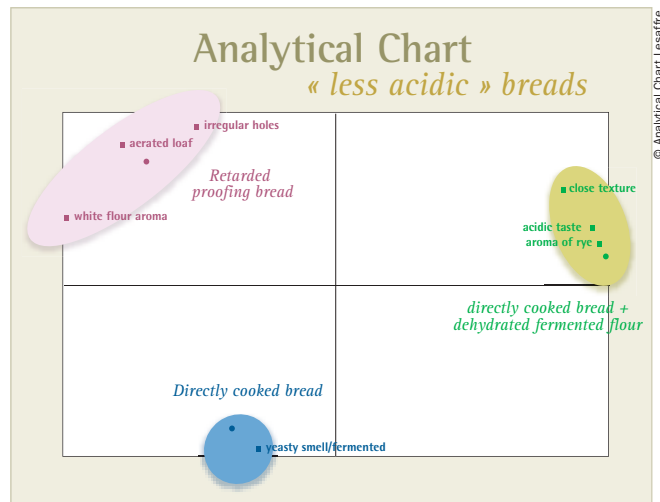
After tasting by the qualified panel a statistical analysis (Analysis of Main Ingredients\*) was carried out in order to identify groups of homogenous products.

\* The AMI represents a diagrammatic projection of products/descriptions. The two axes are linear combinations of evaluated sensory descriptions.

This first analysis isolated 2 homogenous groups which were re-analysed with sensory analysis and then with olfactometric analysis:

- a group of « non-acidic/slightly acidic » breads: directly baked breads, retarded proofing breads, bread with dehydrated fermented flour;
- a group of « more acidic » breads: bread made with guaranteed minimum biomass raising agent, bread made with variable biomass raising agent, bread with dehydrated fermented flour.

The AMI shows that the bread made with dehydrated fermented flour has intermediate characteristics. It was therefore included in each of the two groups for detailed analyses.



## Group of « non-acidic or slightly acidic » breads

The « analytical approach to bread aromas » table (page IX) shows that physico-chemical analysis is not very relevant for this type of product. Only sensory analysis and olfactometric analysis are useful.

- The directly baked bread has a characteristic « yeasty/fermented » aroma, typical of this type of breadmaking and often much appreciated. With olfactometric analysis we have been able to show that this aroma mainly comes from a few molecules arising from the metabolism of the yeast, such as 2-methyl-1-butanol (fermented, winy), 3-methyl-1-butanol (whisky, malt) and phenylethanol (rose, winy).
- In the bread made with dehydrated fermented flour one also finds an acidic character. Moreover, the rye aroma is very evident. However the colour of the bread is significantly darker. The aromatic type is therefore easily recognisable.

In the olfactometric analysis one finds that in the presence of dehydrated fermented flour the above-mentioned aromatic components are still present in similar quantities. Nevertheless, several other molecules were also detected in the analysis in addition to acetic acid:

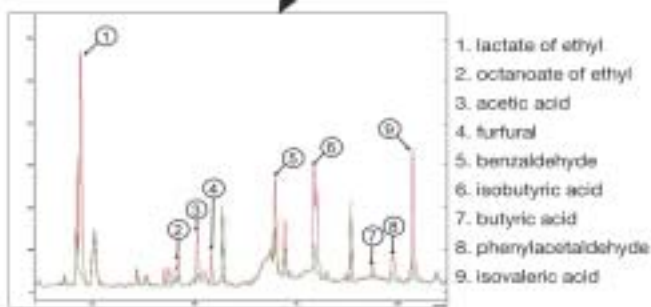
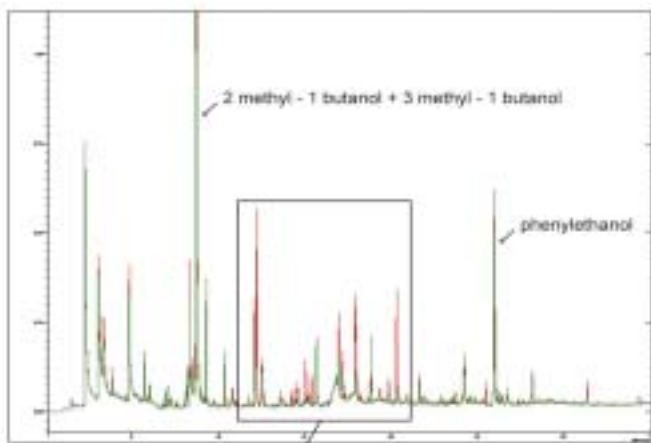
- isobutyric, isovaleric and butyric acids, lactate of ethyl and octanoate of ethyl; traces of fat and butter
- benzaldehyde, furfural: grilled traces
- phenylacetaldehyde: honey traces

These new molecules were able to « mask » the perception of the « yeast » odour.

- The bread made with yeast with a retarded proofing programme also allowed the transformation of this yeasty type into a more cereal-like white flour note. The olfactometric analysis shows that the dominant aromatic molecules in the direct baking programme are metabolised into a great variety of molecules which give this « cereal » note.

In the « non-acidic or slightly acidic » breadmaking we have illustrated two ways of improving bread flavours:

- the addition of aromatising products gives a typical flavour, even with a small quantity of additive and masks the « yeasty » notes (in our example a dehydrated fermented flour revealed an acidic taste);
- the lengthening of fermentation (in this case by retarded proofing) transforms the « yeasty » note into a « cereal » note and improves the texture and therefore the aromatic intensity.



Gas chromatographic and mass spectrometric profiles of odour molecules shown in olfactometry:

- bread made directly (in green)
- bread made directly containing dehydrated fermented flour (in red)

### Group of « more acidic » breads

In this group of products the physico-chemical analysis makes complete sense:

- the bread with dehydrated fermented flour and the bread with variable biomass raising agent are equivalent in terms of pH (approx. 4.67), but the latter attains 3 times greater concentrations of acetic (0.6 compared to 0.2 g/kg). This difference translates into a much clearer perception of acidity in the sensory analysis;
- in this breadmaking programme, only the bread made with the minimum guaranteed biomass reaches the specifications of the « *décret pain* » [Bread law] (bread pH < 4.3 and concentration of acetic acid > 0.9 g/kg of bread) with concentrations of lactic acid and acetic acid respectively 3.5 and 2 times greater than those for bread made with variable biomass raising agent.

The physico-chemical analysis is completed by sensory and olfactory analyses.

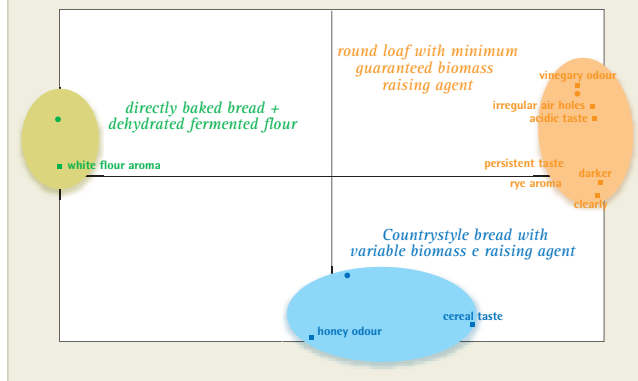
In this new frame of reference the « *pain sur levain* », i.e. the bread made with dehydrated fermented flour, is less aromatic (« *white flour* » description) and the « *acidic* » note disappears. The bread made with the raising agent with the minimum guaranteed biomass has the strongest aromas of « *vinegar* », « *rye* » and « *persistent taste* ». It also has a darker colour and a much more irregular texture. This is a typical traditional type bread, clearly made with a « *raising agent* ».

By olfactometric analysis of the bread made with the guaranteed minimum biomass, we found a significant amount of acetic acid and various molecules:

- acetate of ethyl, acetate of isoamyle, p-cimene: fruity notes
- 2-pentyl furan, saturated fatty acids from C6 to C9: buttery and cheesy notes
- furfural and furfurylic alcohol: grilled notes

All these molecules contribute to the aromatic richness of bread made with a raising agent.

## Analytical Chart « more acidic » breads



The bread baked with the variable biomass raising agent was also interesting in terms of taste. The sensory evaluation showed evidence that its dominant aromas were « *honey* » and « *cereal* » and that overall it was less acidic. The texture was more regular and the bread was lighter in colour. It is an interesting aroma but it does not have the characteristic notes of bread made with raising agent.

In the group of breads made « *with a raising agent* », the bread with dehydrated fermented flour stood out immediately through its lack of richness and aromatic intensity.

Comparison of the two breads made with raising agents showed clear evidence of the need to combine a raising agent with a guaranteed minimum biomass and a long fermentation in order to achieve the richness and aromatic intensity of real bread made with raising agents, as well as consistency in the mouth, characteristic texture and good keeping properties.

The breads that we have chosen to illustrate the analytic exploration of bread flavours are just one example among others. We could have chosen to examine other characteristics:

- development of the aroma created by raising agents with variable biomass of various ages;
- the aromatic diversity of breads made with raising agents with a guaranteed minimum biomass according to various breadmaking programmes;
- a comparison of the aromatic contribution of dehydrated fermented flours and liquid fermented flours;
- the aromatic diversity of breads made = from starter cultures based raising agents, with variable flora;
- a comparison with a bread with natural raising agents or a bread with a raising agent with guaranteed minimum biomass
- decrease in salt by using yeast derivatives.

The list could be even longer!

These analytic disciplines are revolutionising the approach to taste in breadmaking.

### Two means of generating taste

The different breadmaking methods described here highlight the two complementary ways of generating taste in breadmaking:

- the addition of flavour-enhancing products adds taste without changing the breadmaking method. These products clearly typify the bread but they do not give it the aromatic richness of products that have an active fermentation, even when they are added in very large quantities (raising agent with variable biomass);
- the combination of fermentation agents and long maturation result in the aromatic richness of traditional breads but require more complex production methods.

These two methods - practicality and long fermentation - are not contradictory. Sensory analysis clearly shows that each of them produces its own aromatic type. Rather than being opposites, they bring diversity. ■

## The influence of taste products on the characteristics of bread

(1) : variable according to quantity used  
 (2) : variable according to the age of the product  
 (3) : variable according to process  
 (4) : dose added in relation to the final flour corresponding to 0.2-0.5% of the sourdough flour

light  
 Medium  
 Strong

Products	Applications	Quantity Used	Aromas										Colour		Texture	Freshness	Shelf-life
			grilled, toasted note	acid note	sour-dough note	honey	baobab, buttery	fruity acid note	fermented note	cereal note	taste enhancer	inside colour	colour of crust	improvement of texture	freshness	anti mould	
Non live products	cereals	Baguette, country-style bread, special bread	(1)					(1)			(1)	(1)					
		Traditional baguette, ciabatta/pavé	(1)				(1)			(1)	(1)						
	yeast combination	Baguette, country-style bread, special bread, ciabatta/pavé	1-3%														
		Traditional baguette	1-3%														
	dried fermented flour	Baguette, country-style bread, special bread, ciabatta/pavé	1-3%														
		Baguette, country-style bread, special bread, ciabatta/pavé	1-5%														
	liquid fermented flour	Rye bread	1-5%														
		Brioche/white loaf	1-5%														
		Traditional baguette, bread with sourdough taste	1-5%														
		raising agent with variable biomass	Baguette, country-style bread, special bread, ciabatta/pavé	5-20%													
Live products	yeast	Traditional French baguette, country-style, special	1-3%														
		Traditional baguette, ciabatta/pavé	0,1-3%														
		Brioche/white loaf	2-4%														
	raising agent with guaranteed minimum biomasse (conforms to bread law legislation)	Traditional baguette, bread with sourdough taste	5-15%														
		Sourdough bread, bio bread	5-15%														
		Viennese bread	5-15%														
		Brioche/white loaf	5-15%														
	Acetic starter	Traditional baguette, bread with sourdough taste, special breads	0,04%-0,1% (4)														
		Sourdough bread, bio bread	0,04%-0,1% (4)														
	Lactic starter	Traditional baguette, bread with sourdough taste, special breads	0,04%-0,1% (4)														
Brioche/white loaf		0,04%-0,1% (4)															

Craft bakers and industrial manufacturers today have a very wide choice of taste products on the market to improve not only the aromas, but also the colour and structure of the bread, its freshness and shelf-life, according to the product. These products range from simple flavour enhancers, the addition of which does not alter the breadmaking process, to live ready-to-use raising agents that enable the creation of a range of unique and varied breads according to which usage method is chosen.

Presently the products on offer tend to be complete breadmaking aids, combining improvements in rheology, appearance, taste, freshness and shelf-life. These products allow bakers to concentrate on their real job - the creation of bread.

### Glossary

**Aroma** : the volatile components of bread released (into the retro-nasal passage) when it is chewed.

e.g. rye, honey

**Shelf-life**: the length of time that bread conserves its microbial quality before the appearance of mould.

**Colour**: colour of the interior (white, cream, yellow, beige, grey, caramel), colour of the crust (golden, brown, dark brown, red).

**Flavour**: the combination of sensations perceived by the nasal passage (odours), the taste passage (tastes) and the retro-nasal passage (aromas). The other senses (sight, sound, touch) also indirectly influence flavour.

**Freshness**: the upkeep of the bread's sensory characteristics (crustiness, softness, aroma).

**Odour**: emanations from the volatile ingredients of bread which can be perceived by olfactory equipment. e.g. benzaldehyde (bitter almond), furfural (caramel)

**Savour**: a sensation that stimulates taste, e.g. piquant, acid.

**Texture**: texture is associated with the consistency of the bread when it is seen, touched and chewed (the inside, the crust) e.g. the holes in the bread: aerated/dense; the softness when touched or in the mouth: soft/firm, flexible/resistant, sticky/dry.

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## In Conclusion

In these pages, bread has frequently been compared to wine and cheese. It is true that what these three foodstuffs have in common is that fermentation plays an essential part in their development, particularly in the synthesis of their aromas.

Bread, which is a basic nutritional staple when buying power is low, becomes an accompaniment when the standard of living rises. For some time now, rather than being an « essential », bread and the « pleasure » derived from its taste have been considered as accessories - unlike its two brothers, wine and cheese, which have always been discussed and appreciated in generous terms. We love to talk about our past experiences, our new discoveries and our special moments.

With the huge selection now on offer bread has become a food of character and has confirmed its right to be the centre of interest. It is not just « tasted » with cheese but agreeably complements most foods. It can even be eaten on its own, just for pleasure!

Bread has come to this stage of being highly valued due to the development of technique. Scientists, industrial manufacturers and craftsmen all work together to satisfy the tastes of a more knowledgeable and more demanding clientele who love both tradition and experimentation.

These days, the art of making tasty bread can be pursued with a large palette of different resources. Physico-chemical analytical tools, an understanding of bread flora and mastery of the production of live micro-organisms enable us to offer bakers products that guarantee performance, are easy to use, reliable and safe so that they can create quality bread with excellent taste, but also with a good shelf life, texture and appearance.

It is up to bakers to make full use of their creative talents and skills, and up to scientists and manufacturers of fermentation agents to give them the tools that they need.

It is in pursuit of this logic and in this environment that Lesaffre carry on with the development of their products and techniques, motivated by: « the cultivation of taste in breadmaking ». ■