

# Free Flowing Frozen Yeast: the Highest Quality of Baked Frozen Croissant

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## I. Introduction

Nowadays, consumers are asking for fresh and crusty Breads and bakery products any time of the day. The sales growth in Retail Market and the development of small bakery shops are a clear indicator of this market increase. Frozen Dough Technics, when well controlled and used, enable the manufacturing of high quality end products. For bakers; Frozen Dough gives them many advantages such as a wider range of products and easier distribution to distant areas. In the Bake off Bakery, it is the assurance of a better sales organization (no shortage, less unsold products) and better flexibility, particularly during busy periods.

Besides the baking Process, the raw materials choice plays a predominant role in the quality of the final product. Thus the Flour quality and Bread Improvers choice are essential for frozen dough

technics. But sometimes bakers tend to forget how important it is to choose the correct yeast and the impact it can have on the quality of the end product.

In the frame of the "International Symposium on next generation technology for global industry" organized by KoSfost (Korean Society of Food Science and Technology) in collaboration with SPC Group, Lesaffre has introduced a study conducted in its French Baking Center™ related to the impact of patented yeast FFFY (Free Flowing Frozen Yeast) on the quality of frozen Croissants. After having introduced FFFY characteristics, this article will highlight its behaviour in Frozen Dough and will show the results of a sensory analysis test performed on Frozen Croissants baked with FFFY and Croissants compared to croissants baked in direct process with Korean compressed Yeast.

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## 2. Impact of deep freezing process on yeasts

As a living organism, the freezing process is a real thermic shock for baker's yeast.

Even though baker's yeast has a natural cryo-resistance, fermenting activity might be affected. The freezing process causes cells alteration through two mechanisms. First mechanism is direct and linked to ice crystals formation, whose shape, numbers, size and localization depend on freezing speed. Second mechanism is indirect and linked to the apparition of hyper osmotic conditions.

Indeed, ice crystals which appear in an extra cellular environment come from change of the state of pure water: thus, various osmolyt present in the dough (salts, sugars...) are concentrated in the remaining water, whose quantity decreases in the course of time. The Aqueous matrix surrounding the cell becomes more and more concentrated; which causes an increase of osmotic pressure. Since intracellular water tends to go out from it to compensate this phenomenon which leads to a plasmolyse of the weakest cells.

To resist this kind of stress, yeasts have some weapons such as trehalose which protects membrane integrity. However this sugar is quickly consumed by baker's yeast when fermenting activity starts in the dough. It is therefore essential to control the start of fermenting as much as possible and to avoid use of rapid yeasts, more sensible to stress conditions.

Frozen, liquid or compressed yeast performance depends on its storage conditions. Thus a one-week-old compressed yeast will be more stable in a frozen dough stored at  $-18^{\circ}\text{C}$  than a-four-weeks-old one. From this point of view, FFFY enables a more consistent quality production thanks to its "semi-dry" state, its storage conditions at  $-20^{\circ}\text{C}$

and its two-year-shelflife compared to compressed yeasts with fluctuating shelf lives.

In the case of compressed yeast, a decrease of fermenting power is ineluctable because of its consumption of sugars in the cell (trehalose and glycogen). In frozen dough, there are more biochemical reactions in the cell heart with compressed yeast compared to FFFY (less free water).

Frozen dough storage at  $-18^{\circ}\text{C}$  which is itself a stress for yeast leads to the disappearance of reserve sugars. Their quantity is therefore not enough for final fermentation after dough thawing. On industrial line, this phenomenon leads to a delay of the fermentation start. Aware of this, bakers mostly increase yeast dosage to compensate the lack of fermenting power and to ensure the most rapid proofing after thawing.

Besides a significant costs increase, this can lead to stronger yeasted odours and taste which can have negative consequences on consumers.

In this context, LESAFFRE researchers have developed adapted yeasts to deep freezing processes named Free Flowing Frozen Yeast whose strain is selected for its preservation in frozen conditions.

## 3. Free Flowing Frozen Yeast or FFFY

Free Flowing Frozen Yeast (FFFY or 3FY) gathers many assets especially in "stressed" baking conditions such as deep freezing. Besides the practical advantages related to FFFY ease of use, (instant use, easy dosage, optimized hygiene, good dispersibility in the dough) it has technical advantages which makes it a real technological innovation.

FFFY manufacturing is based on a perfect command of yeast drying process, which has been patented by LESAFFRE (Patent number EP0237427A2). Yeast drying is controlled to reach

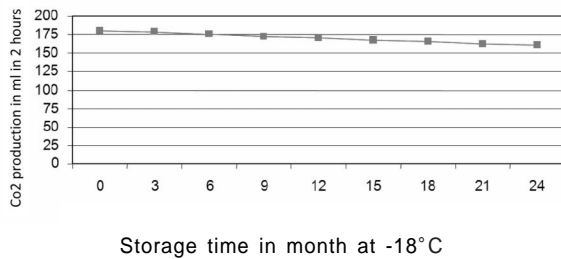


Figure 1. FFFY Gas production according to storage time

78% dry matter; this step is then followed by a stage of quick deep freezing, which gives FFFY all its originality and the technicity of its manufacturing process.

FFFY is nowadays recognized for its consistency and for the stability of its performances over the time. Various studies have underlined that FFFY keeps all its fermenting power during its 2-year- shelflife (storage at -18°C). (Cf. Figure 1)

Yeast age has no consequences on its fermenting power, which is a major advantage compared to compressed yeast, whose fermenting activity decreases progressively over the time.

FFFY is much more adapted than compressed yeast to face “the stress” caused by deep freezing dough. Since it is partially dehydrated, FFFY has a better resistance to the thermic chock imposed by deep freezing. This asset is also valid when cold water, ice or cool jacket mixers are used.

#### 4. FFFY behaviour in frozen dough

To have good frozen dough storage, it is necessary to limit the start of fermentation before deep freezing to avoid here-above mentions issues on end products in terms of volume and appearance.

Production environment has to be cooled to reach a temperature between 18°C and 20°C so that croissant dough temperature remains around 15°C. This temperature will limit yeast metabolic activity.

Thanks to its “semi-dry” state, FFFY has been developed to resist to cold environments and to have a retarded fermentation in frozen dough processes. Compared to Korean compressed yeast, FFFY fermenting activity is delayed by 60 minutes, which is enough to conduct all the necessary baking steps before dough deep freezing stage. (Cf. Figure 2)

This retarded effect decreases over the time: The 22% gap at 30 minutes of fermentation is reduced to 14% at 60 minutes (Table 1). This characteristic allows FFFY to keep its cellular integrity and all its fermenting power after dough thawing.

Compressed yeast and FFFY Co<sub>2</sub> production measurement on a risograph highlights FFFY retarded effect in frozen lean dough

FFFY fermenting power is kept until bake off of

Table 1. Gas production results in ml, risograph measurement of FFFY and CY in normal dough without sugar

Proofing time	30 min	60 min
CY	27	72
	Control	Control
FFFY	%	difference
	21	62

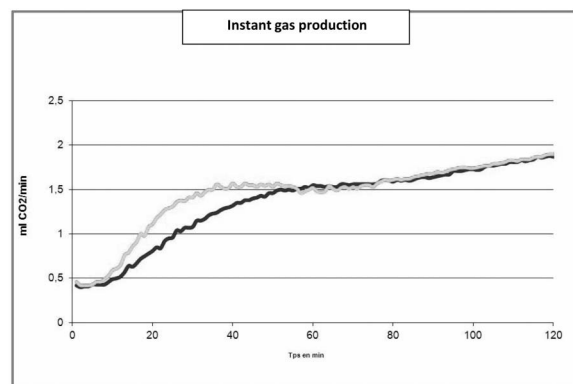


Figure 2. Graphic representation of CY and FFFY Co<sub>2</sub> production over the time.



frozen products and remains stable during all final fermentation after thawing. This guarantees an optimized dough rise and an optimized volume of end products.

## 5. Presentation of the sensory analysis tests: recipes, test procedures (processes):

### Materials:

2 Croissants recipes have been tested through the sensory analysis:

- One Croissant made in a direct process with Korean compressed yeast (fresh yeast); the formula includes 100% Korean strong flour: 52% water, 8% sugar, 5% butter, "special for layers", 4% fresh yeast, 2% salt and 1% Lesaffre bread improver for direct process.
- One Croissant made with frozen dough ready to proof with FFFY. The formula includes 100% Korean strong flour : 55% water, 8% sugar, 5% butter, "special for layers", 2,2% LHS Lesaffre yeast, 2% salt et 1% bread improver for "frozen dough" Magimix Blue.

### Dough preparation:

Doughs are mixed in a spiral mixer (3 min in first speed + 4 min in second speed). At the end of the mixing, the dough temperature was 15°C +/- 1°C.

- Concerning the Croissant made by direct process, a proofing time of 45 minutes at 5°C, folding follows this operation.
- In the case of the frozen Croissant, the proofing time is reduced to 5 to 10 min at 5°C before the folding. Folding with 25% butter includes following steps: a double book, a resting time

of 10 min at 5°C, a double book and a resting time of 30 min at 5°C.

- Then, Croissants of 50g to 55g are moulded with a machine.

The direct process croissant is proofed 100 min. at 28°C before a baking of 15 min at 170°C.

The frozen Croissant is placed in a blast freezer 20 min at -30°C. Then, Croissants are packed in plastic bags which are hermetically closed, and packed in a carton. They are stored at -18 °C during 10 days. For their bake off, after a thawing of 1 hour at room temperature and after a final fermentation of 2 hours at 28°C, croissants are baked 15 min at 170°C.

### Procedures of sensory analysis tests

After baking and cooling, the 2 types of Croissants have been compared by a panel of taste analysis experts and by a panel of texture analysis experts.

Products are scored from 0 to 10 on a continuous scale (QDA international method) using:

- Reference attributes "taste odour appearance"
- Reference attributes "texture" of LESAFFRE panel

Panellist use a technical vocabulary defined during their training.

Sensory profiles are made thanks to data given by panellists with TASTEL software

Taste and texture results are presented through a "spider chart"

Croissants baked with FFFY have a stronger fermentation flavour than croissants baked with Korean compressed yeast (Cf. Figure 3).

Croissants baked with Korean compressed yeasts have a slightly stronger butter and caramel flavour. Main difference between both croissants is related to acid flavour which is stronger for croissants

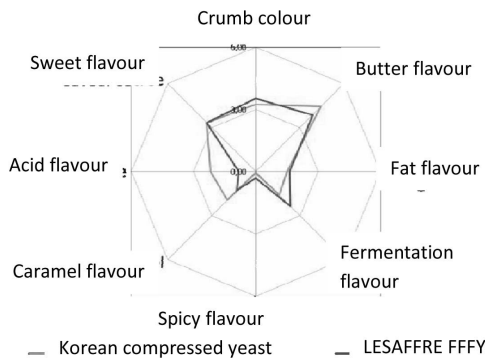


Figure 3: Spider chart for croissant appearance/flavour results.

baked with Korean compressed yeast.

Croissants baked with FFFY are crustier, flakier, flexible, smooth and melt in the mouth, better than a croissants baked with compressed yeast (Cf. Figure 4).

These characteristics exactly correspond to croissants consumers' expectations. We can also conclude that texture difference is in favour of croissants baked with FFFY.

Korean compressed yeast LESAFFRE FFFY

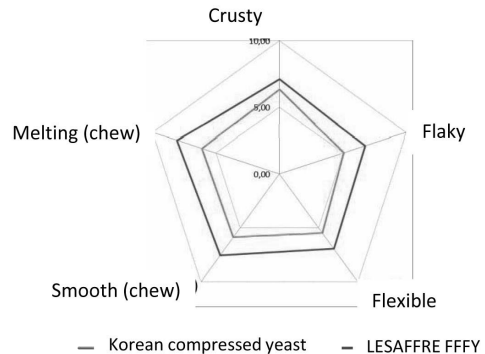


Figure 4: Croissant texture spider chart.

## 6. Conclusion

Thanks to its 160 years of experience in the field of yeast and baking solutions, LESAFFRE is firmly dedicated to provide solutions to its customer's needs through a wide ingredient range (bread improvers; active, dry and liquid leaven, blends...) and proposes customized technical solutions especially through its 25 baking centers all over the world.

With its FFFY, LESAFFRE makes available to Korean bakers a frozen yeast adapted to all bakery processes and especially to frozen dough

### **LESAFFRE: a pioneer in bread analysis**

Part of LESAFFRE French baking center, sensory analysis department is equipped with an 8 cabin, ventilated laboratory conforming to AFNOR regulation (French normalization association).

The 8 tasting cabins are equipped with TASTEL software specialized in sensory tests data collection and treatment.

Two "Texture" (8 external panellists) and "taste, odour and appearance" (18 internal panellists) experts panels are able to characterize, describe and give a sensory profile to bakery products (baguette, sandwich bread, leaven bread, pizza, donut...) so the texture and flavours can be described by descriptors. Each panellist has been trained for 20 hours and has between 1 to 10 years' experience.

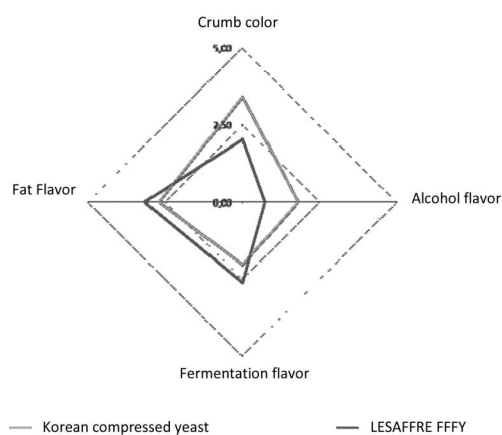


Figure 5. Shikpan flavour spider chart.

processed in normal as well as frozen dough.

Regarding frozen croissant baked in direct process, FFFY guarantees high quality end products which are crustiest and more melting than products baked with Korean compressed yeast

In other baking applications such as Shikpan baked in 4hours sponge and dough process, FFFY has shown all its technical and sensory advantages.

Shikpan baked with FFFY have a whiter crumb colour and a lighter alcohol flavour than shikpan baked with Korean compressed yeast (Cf. Figure 5).

This difference is related to Korean compressed yeasts manufacturing process which are mainly manufactured with a cane molasses substrate which gives a stronger flavour and colour to the bread.

The originality of the FFFY manufacturing process avoids giving stronger flavour and colour to end products such as sandwich breads.

With FFFY, bakers have, from now on, perfectly adapted yeast for their technical constraints which is easy to dose, always available and has the same fermenting power during all its two-year shelflife (storage at  $-18^{\circ}\text{C}$  during 2 years).

## Acknowledgement

Thanks to the organoleptic profile given to end products, FFFY meets Korean consumers' expectations.