

# Shelf-life and consistency of active dry yeast for breweries

Philippe Janssens



THE OBVIOUS CHOICE FOR BEVERAGE FERMENTATION





# INTRODUCTION

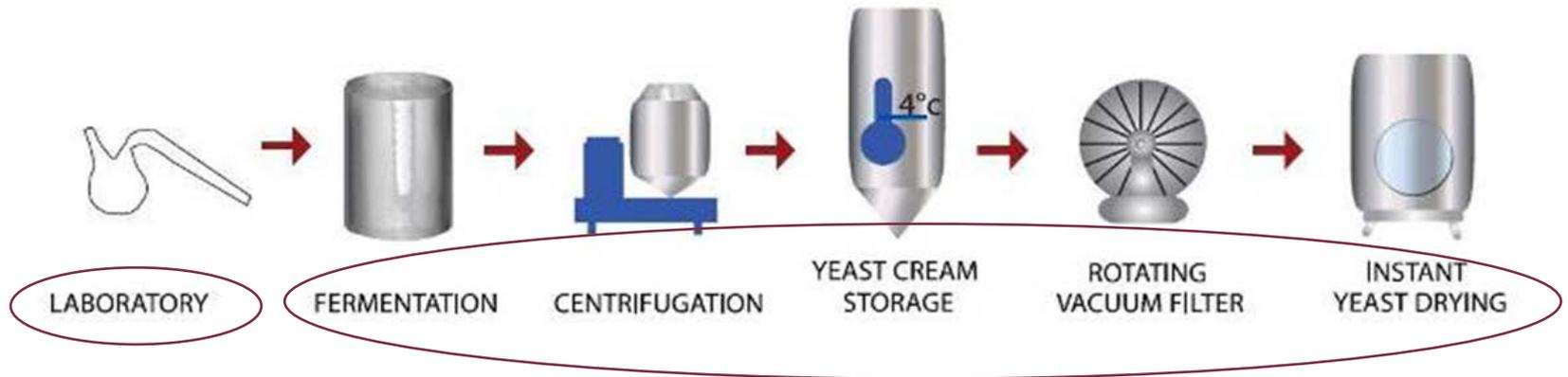
## ➤ THE DRYING PROCESS

1. MANUFACTURING PROCESS
2. YEAST CELL CYCLE & PHYSIOLOGY
3. MEMBRANE DURING DRYING
4. KEY LEARNINGS

## ➤ ACTIVE DRY YEAST IN THE BREWING INDUSTRY

# INTRODUCTION : THE DRYING PROCESS

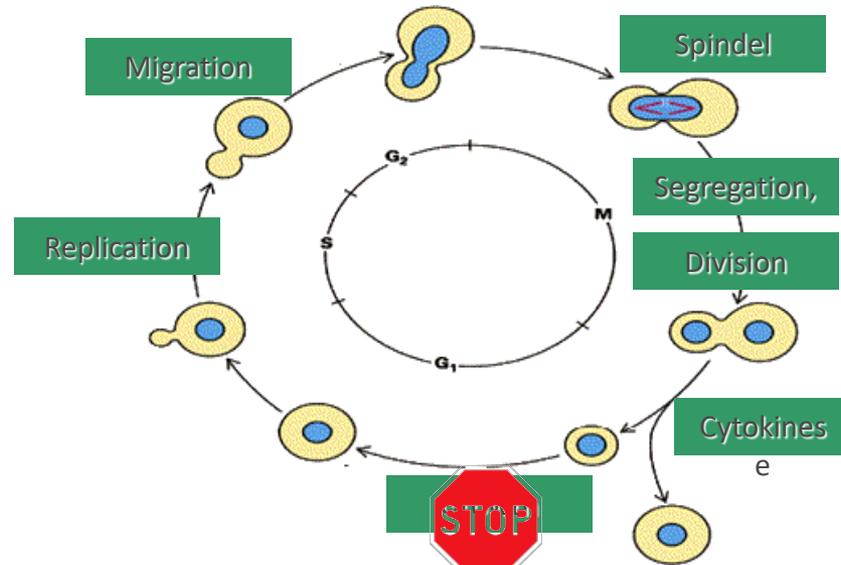
## 1. MANUFACTURING PROCESS : A DAY TO DAY INCREMENTAL IMPROVEMENT



# INTRODUCTION : THE DRYING PROCESS

## 2. YEAST CELL CYCLE & PHYSIOLOGY

### Yeast duplication in the fermenter

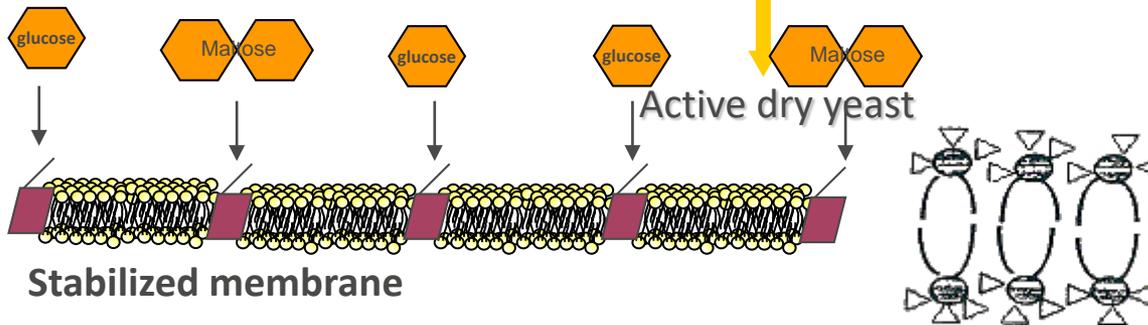


Yeast Shaping

Ready to Start



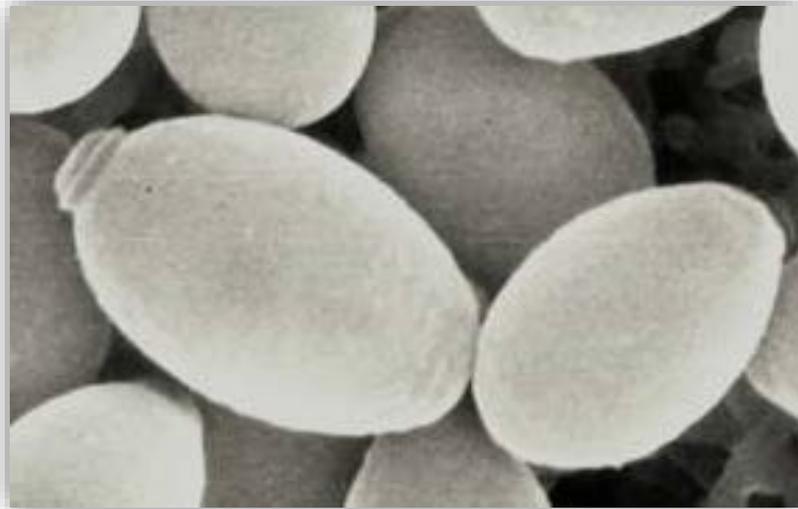
“Doors” are open for sugar assimilation



Stabilized membrane

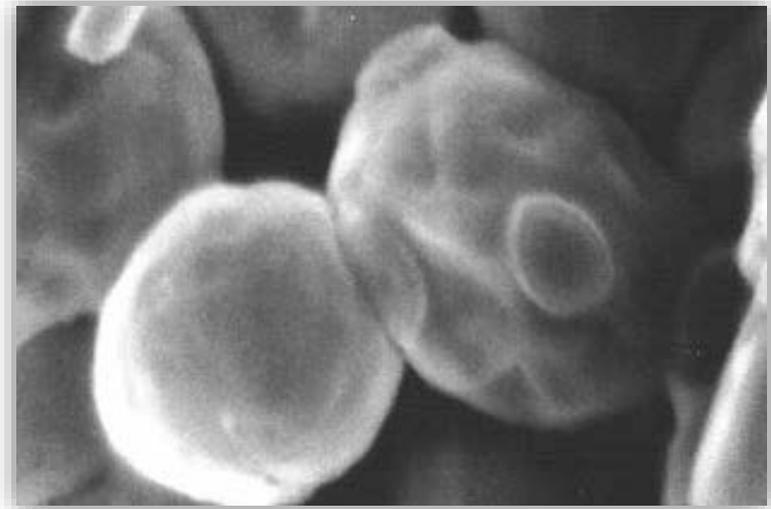
# INTRODUCTION : THE DRYING PROCESS

## 3. MEMBRANE DURING DRYING



### Before drying

- 25-30% Dry Matter
- Smooth Cell Surface



Gx6000

### After drying

- 94-96,5% Dry Matter
- Uneven Cell Surface

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## INTRODUCTION : THE DRYING PROCESS

### 3. MEMBRANE DURING DRYING (CONT'D)

Membrane = Phospholipids + Proteins + Carbohydrates + Lipids + ...



Full size



Size reduction



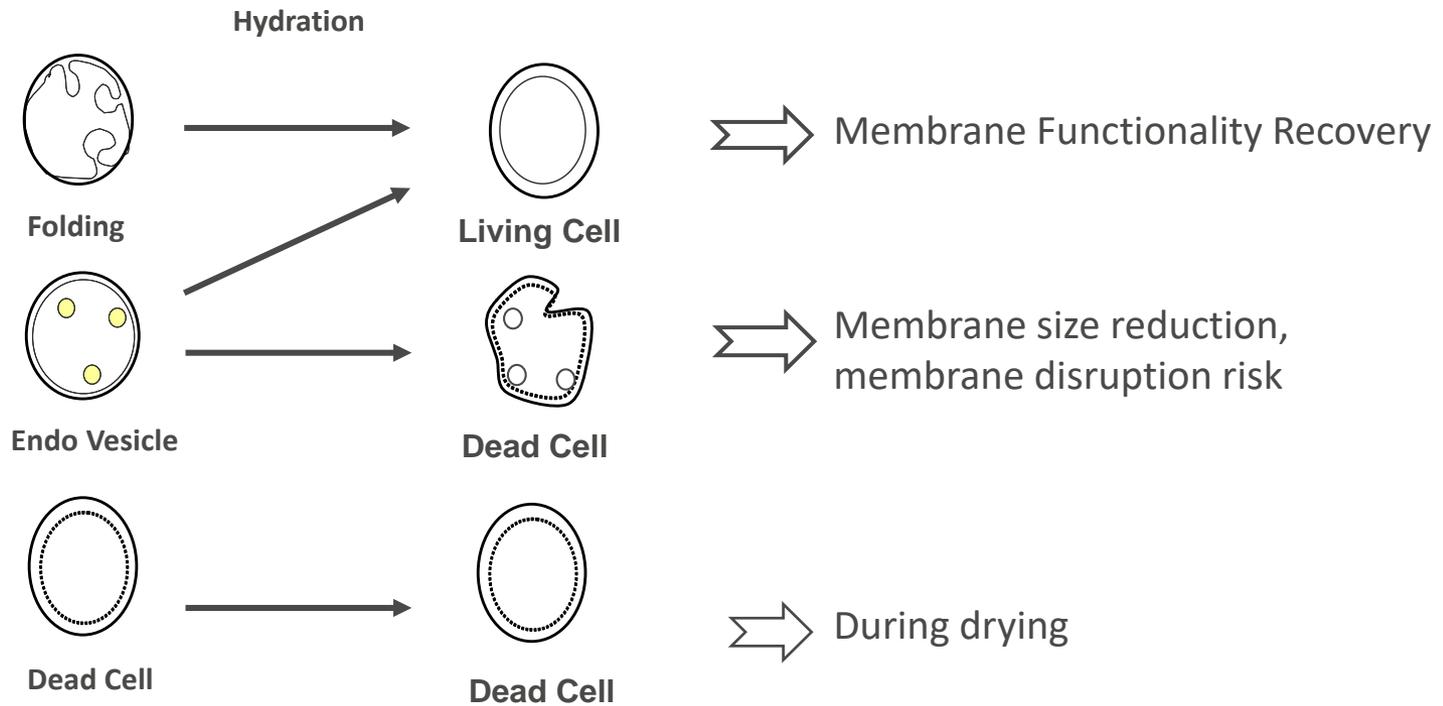
Folding



Drying

# INTRODUCTION : THE DRYING PROCESS

## 3. MEMBRANE DURING DRYING (CONT'D)



The yeast manufacturer's know-how makes the difference!

# INTRODUCTION : THE DRYING PROCESS

## 4. KEY POINTS

### **Fermentation**

- shape the yeast to the best physiological stage for:
  - drying
  - fermentation readiness
- specific adaptation of recipe to the yeast strain

### **Drying**

- maintaining the membrane integrity
- specific process adaptation to the yeast strain

# INTRODUCTION : ACTIVE DRY YEAST IN THE BREWING INDUSTRY

USE OF ACTIVE DRY YEAST (ADY) IN THE BREWING INDUSTRY IS BECOMING INCREASINGLY ATTRACTIVE DUE TO SEVERAL KEY FEATURES

- Capacity to be stored for extended periods of time
- Availability and Speed at which it can be used
- Use for primary and secondary (bottle & keg conditioning) fermentations
- Range of Products and Applications
- Reliability & Consistency
- Facilitate practices for multi-site beer production, seasonal beer production and contract brewing

ABUNDANT SCIENTIFIC LITERATURE (SINCE 1996)

Fermentation with dried yeast – S. Fels, Y. Gosselin, B. Taidi – BRFI Quaterly, 1996, October, 17-19

The use of dry yeast in the brewery industry – A. Debourg, L. Van Nedervele – Proceeding of the 27<sup>th</sup> EBC Congress, 1999, 751-760,

Practical use of dried yeast in the brewery industry – S. van den Berg, A. Van Landschoot – Cerevisia, 2003, 28(3), 25-30

Bottle refermentation of high alcohol-beers – Y. Gosselin – XIV Chair J. De Clerck Special Beers The Belgian paradox, 2012

## AIM OF THE WORK

# DETERMINE THE SHELF-LIFE AND CONSISTENCY OF ACTIVE DRY YEAST FOR BREWERIES

## 1. FORCED AGEING TESTS

- ✓ 10 ADY (3 lager & 7 ale strains)
- ✓ Various production batches for each yeast
- ✓ Forced ageing tests corresponding to **2, 3** and **4** years of natural ageing



## 2. NATURAL AGEING

- ✓ 2 ADY (1 lager & 1 ale strain)
- ✓ Natural ageing during **3 years and 8 months** at -20°C, 5°C and 25°C



# RESULTS

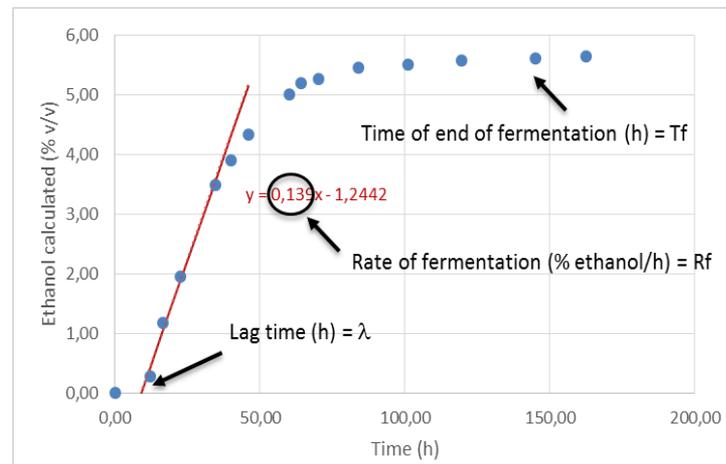
## 1. FORCED AGEING TESTS

- a. 1. Fermentative power and viability determined before & after forcing tests
- b. 2. Flask fermentation performances before & after forcing tests

$\lambda$  = lag time (h)

$R_f$  = rate of fermentation (% ethanol (v/v)/h)

$T_f$  = time of end of fermentation (h)



Analysis at the end of fermentation:

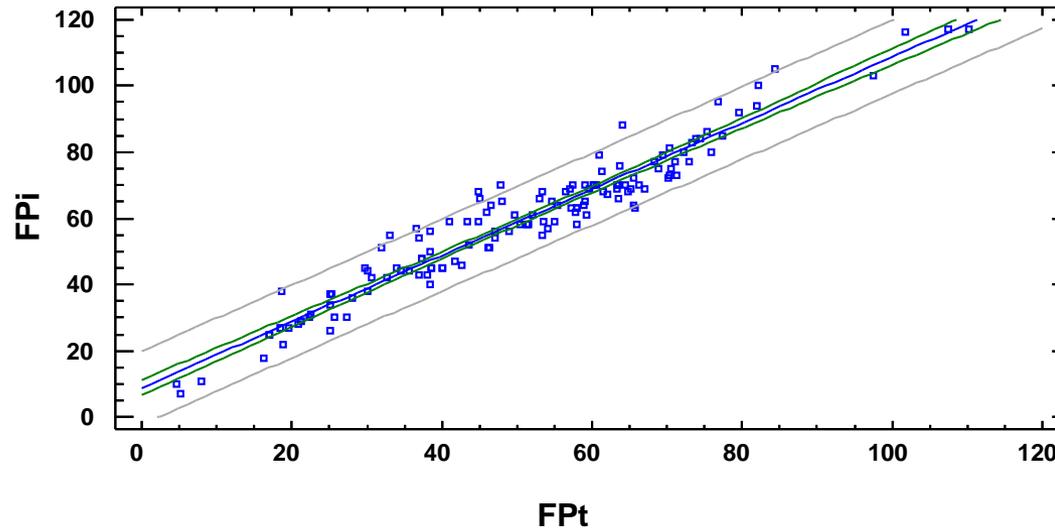
- ethanol,
- volatile compounds (acetaldehyde, esters, higher alc., VDK's),
- residual sugars.

## FORCED AGEING TESTS: RESULTS

### 1. RELATIONSHIP BETWEEN FERMENTATIVE POWER DETERMINED JUST AFTER PRODUCTION (FPI) AND AFTER SOME TIME OF STORAGE (FPt)

$$FPI = 8,9 + 0,997 * FPt$$

$$r = 0,966$$

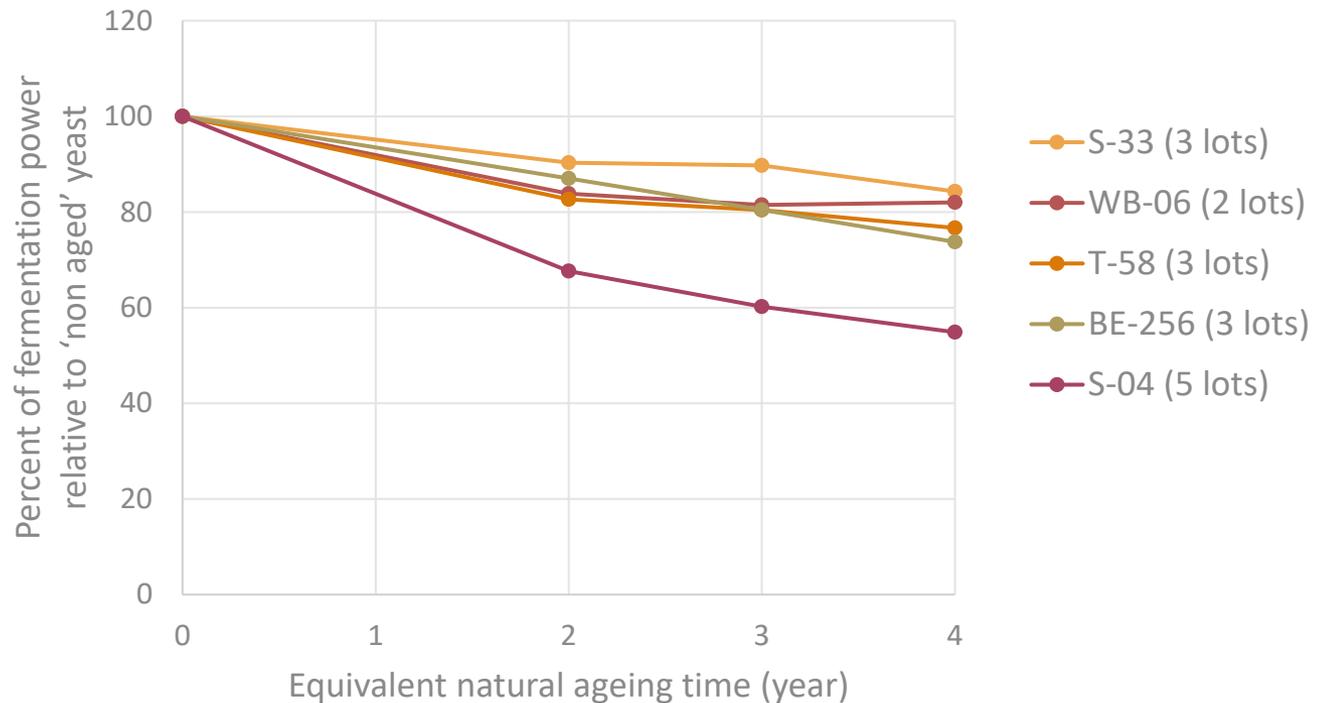


Fermentative power is expressed in mL CO<sub>2</sub>/h.g yeast dry weight

# FORCED AGEING TESTS: RESULTS

## 2. INFLUENCE OF FORCED AGEING ON YEAST FERMENTATIVE POWER

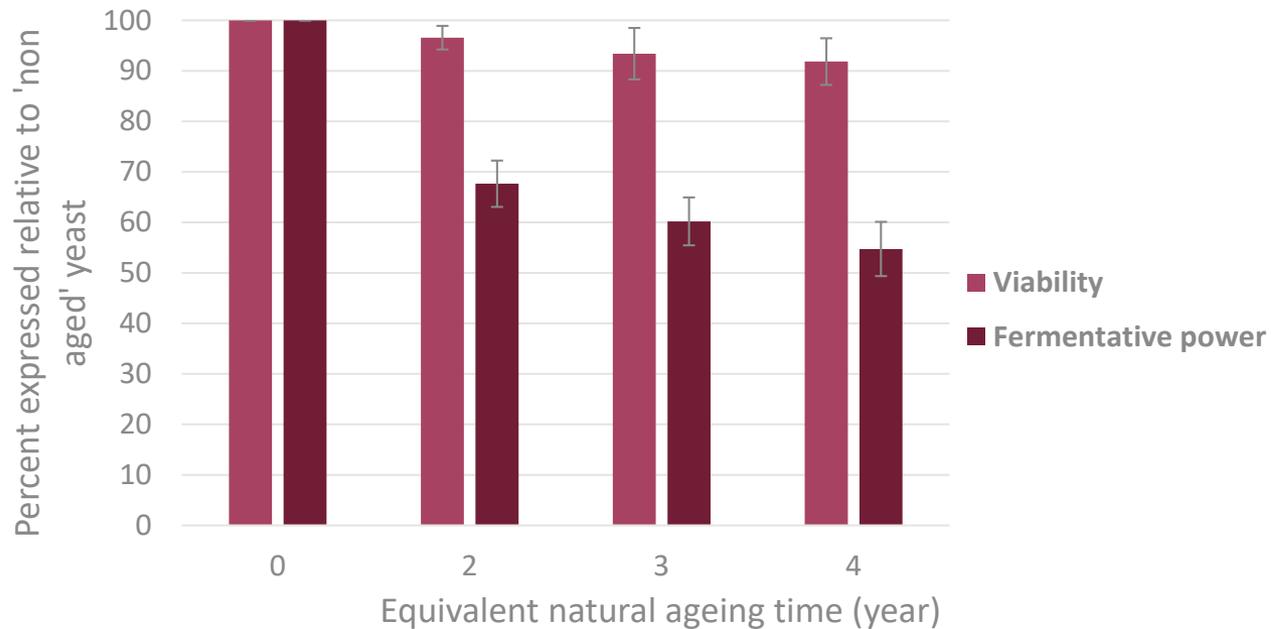
### Ale brewing yeast strains



## FORCED AGEING TESTS: RESULTS

### 3. FERMENTATIVE POWER AND VIABILITY DETERMINED BEFORE AND AFTER FORCING TEST

#### Ale brewing yeast strain SafAle S-04 (5 production batches)

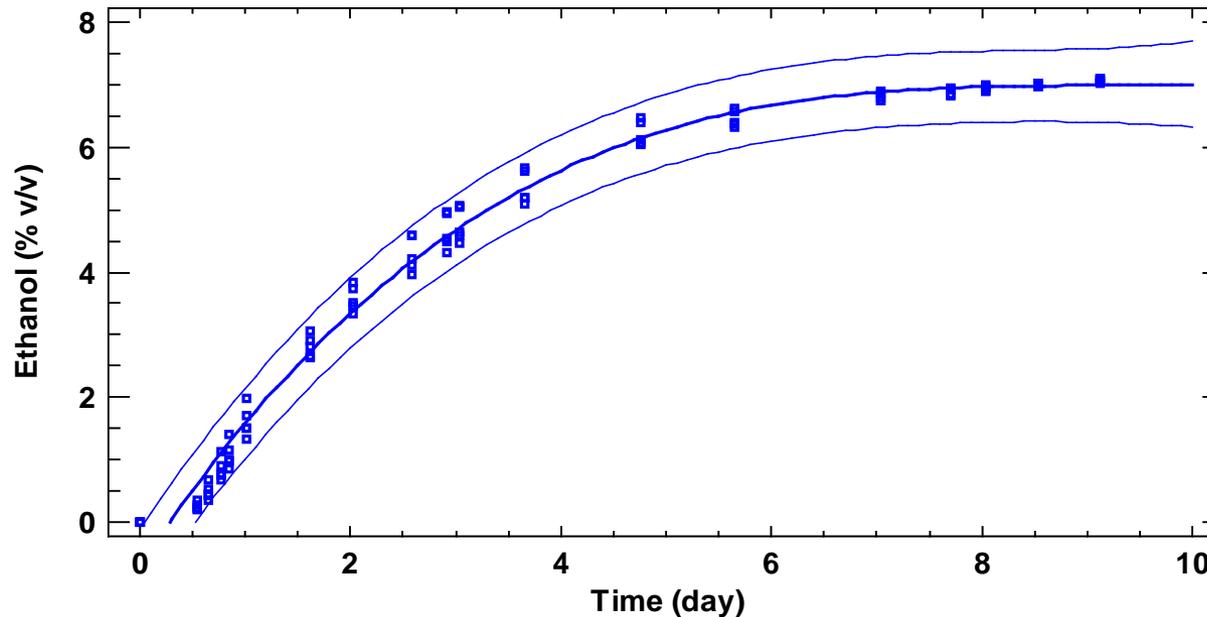


⇒ Fermentation performances on wort

# FORCED AGEING TESTS: RESULTS

## 4. FERMENTATION PERFORMANCES

### SafAle S-04: Kinetics comparison of fresh yeast (5 production batches)



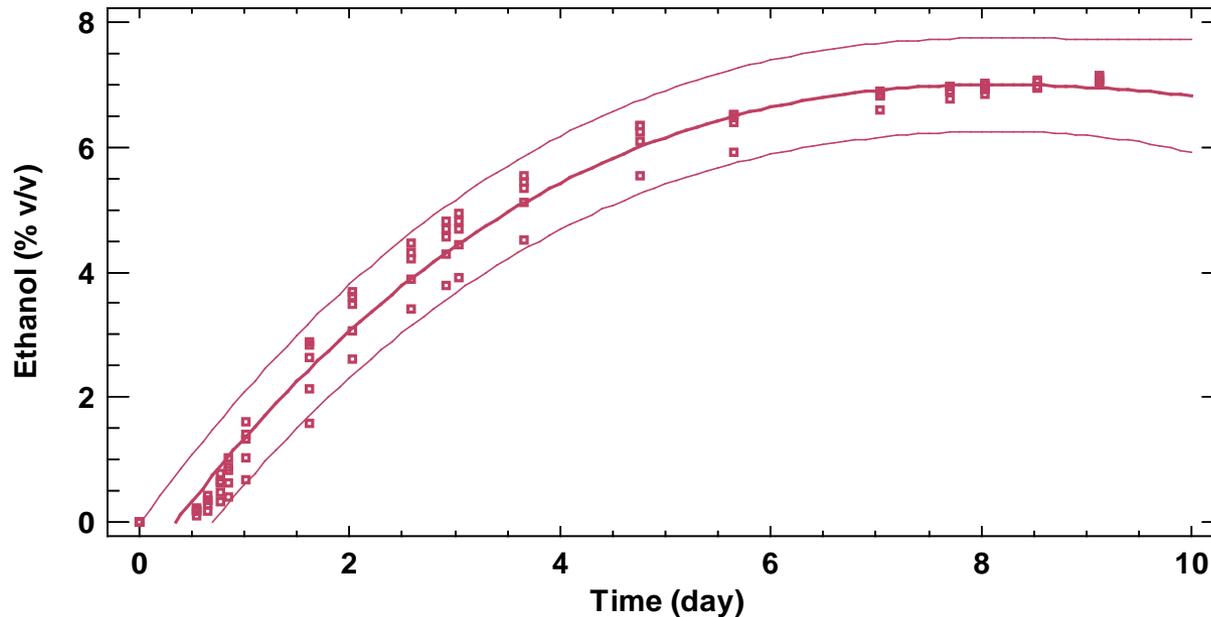
**Fermentation conditions** for Ale brewing yeast strains :

Pitching rate : 50 g/hL, standard wort (Weyermann syrup) at 15°P, temperature 20°C

# FORCED AGEING TESTS: RESULTS

## 4. FERMENTATION PERFORMANCES

### SafAle S-04: Kinetics comparison of yeast aged 4 years (5 production batches)



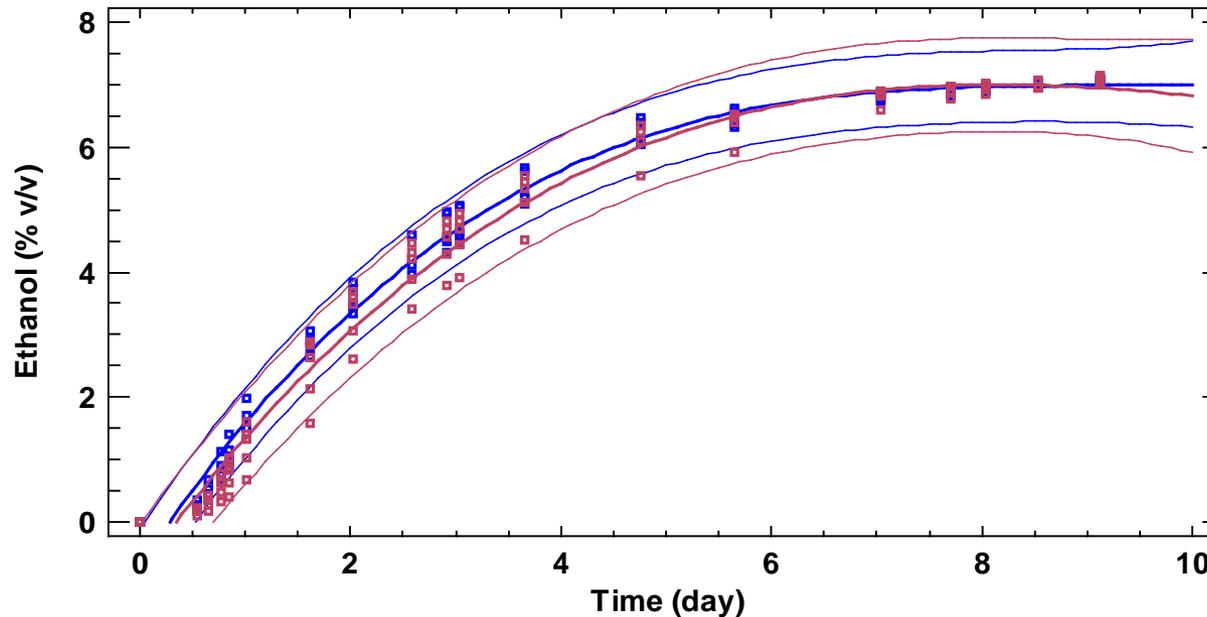
Fermentation conditions for Ale brewing yeast strains :

Pitching rate : 50 g/hL, standard wort (Weyermann syrup) at 15°P, temperature 20°C

## FORCED AGEING TESTS: RESULTS

### 4. FERMENTATION PERFORMANCES

#### SafAle S-04: Kinetics comparison of fresh yeast vs yeast aged 4 years (5 batches)

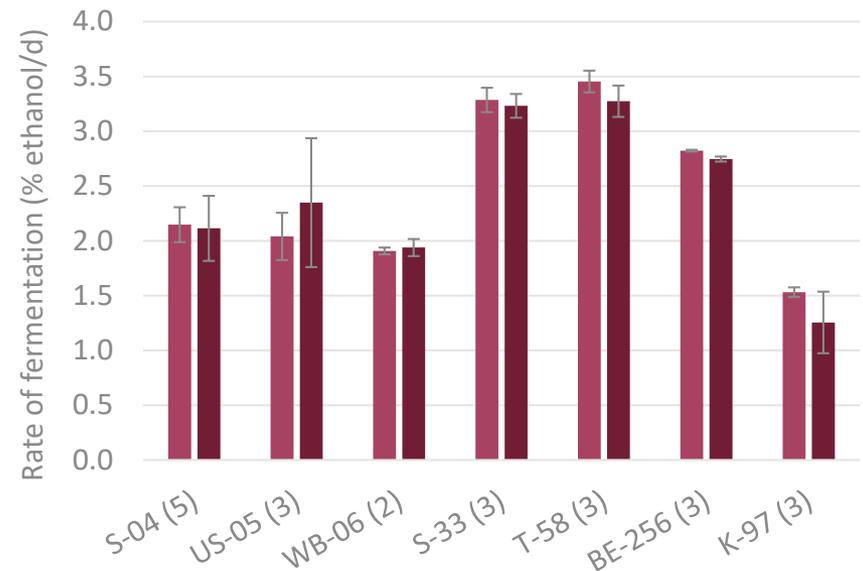
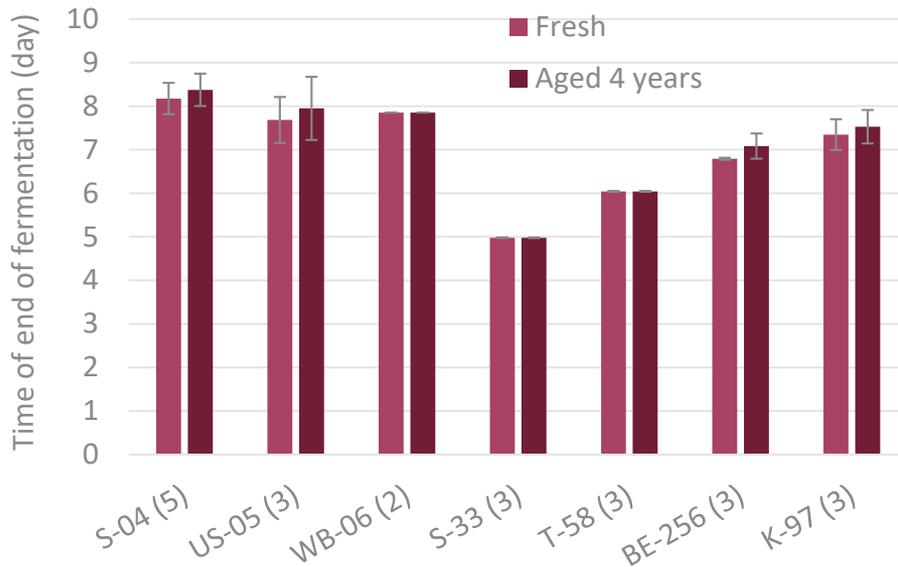


→ No significant difference between fresh and forced aged yeast

# FORCED AGEING TESTS: RESULTS

## 4. FERMENTATION PERFORMANCES

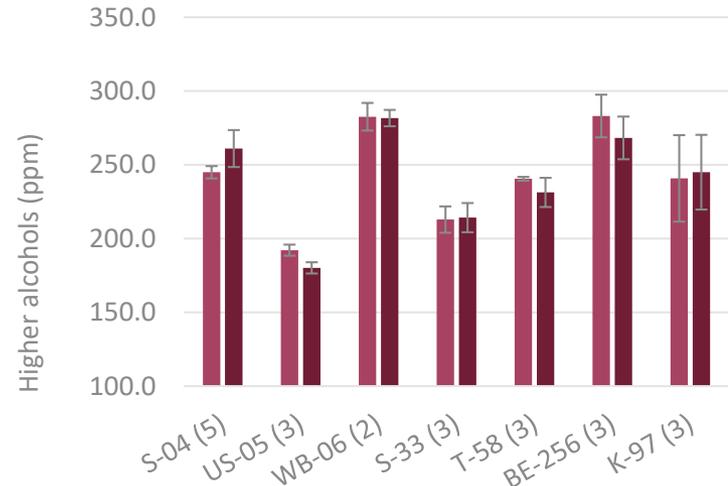
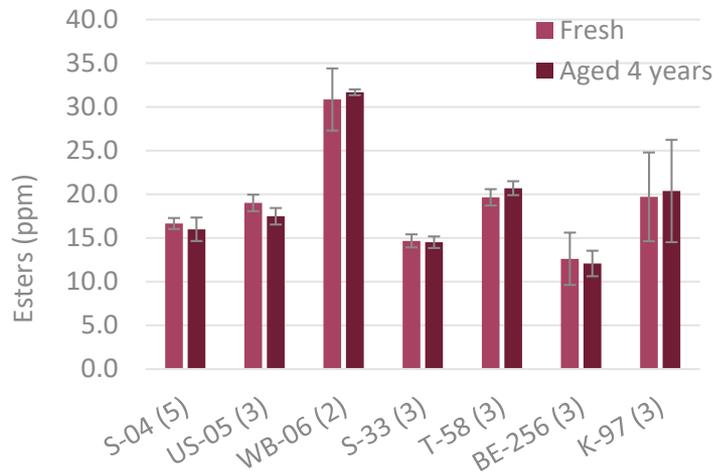
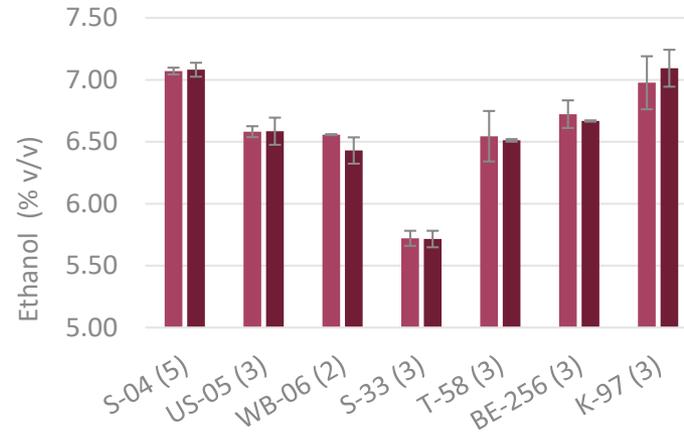
### Ale strains: Impact of accelerated ageing on time of end of fermentation and fermentation rate



# FORCED AGEING TESTS: RESULTS

## 4. FERMENTATION PERFORMANCES

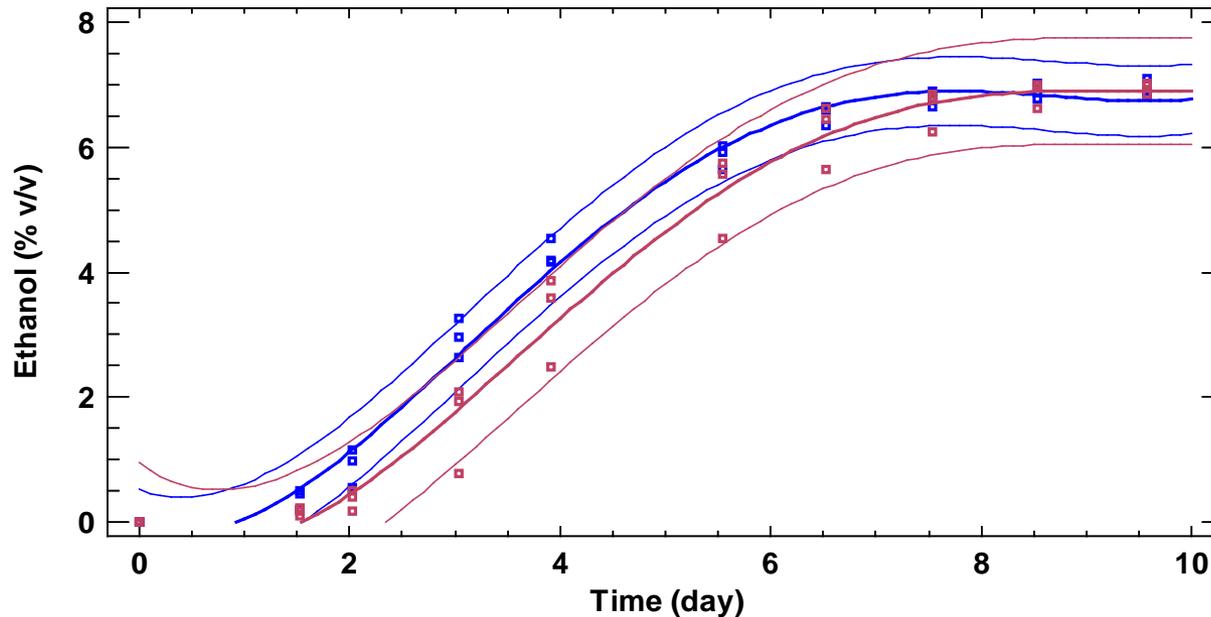
### Ale strains: Impact of accelerated ageing on volatile compound production



# FORCED AGEING TESTS: RESULTS

## 4. FERMENTATION PERFORMANCES

### SafLager W-34/70: Kinetics comparison of fresh yeast vs yeast aged 4 years (5 batches)



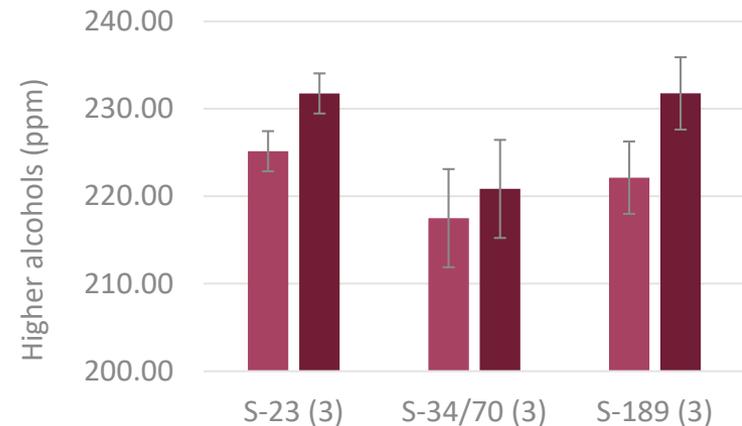
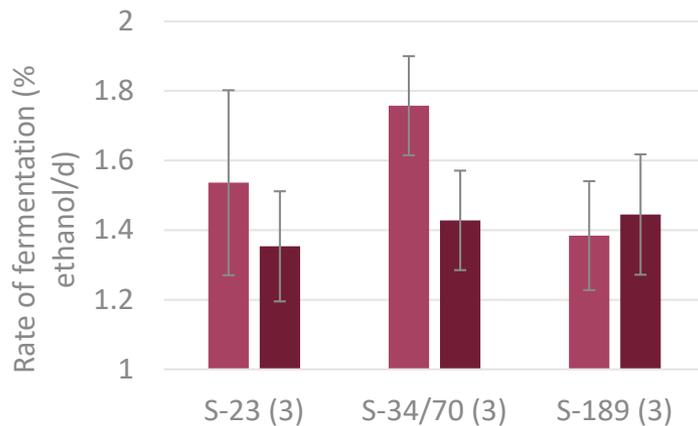
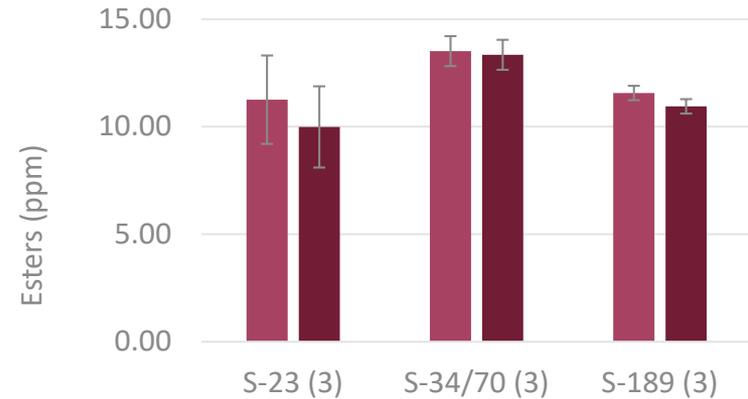
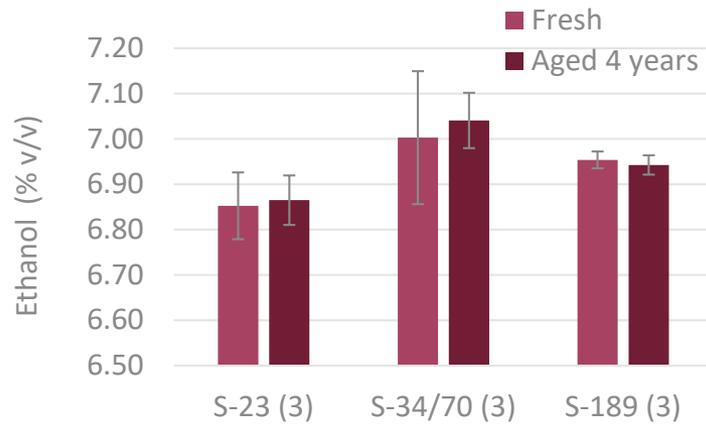
**Fermentation conditions** for Lager brewing yeast strains :

Pitching rate : 100 g/hL, standard wort (Weyermann syrup) at 15°P, temperature 14°C

# FORCED AGEING TESTS: RESULTS

## 4. FERMENTATION PERFORMANCES

### Lager strains: Impact of accelerated ageing test on final ethanol concentration, fermentation rate and volatile compound production



# RESULTS

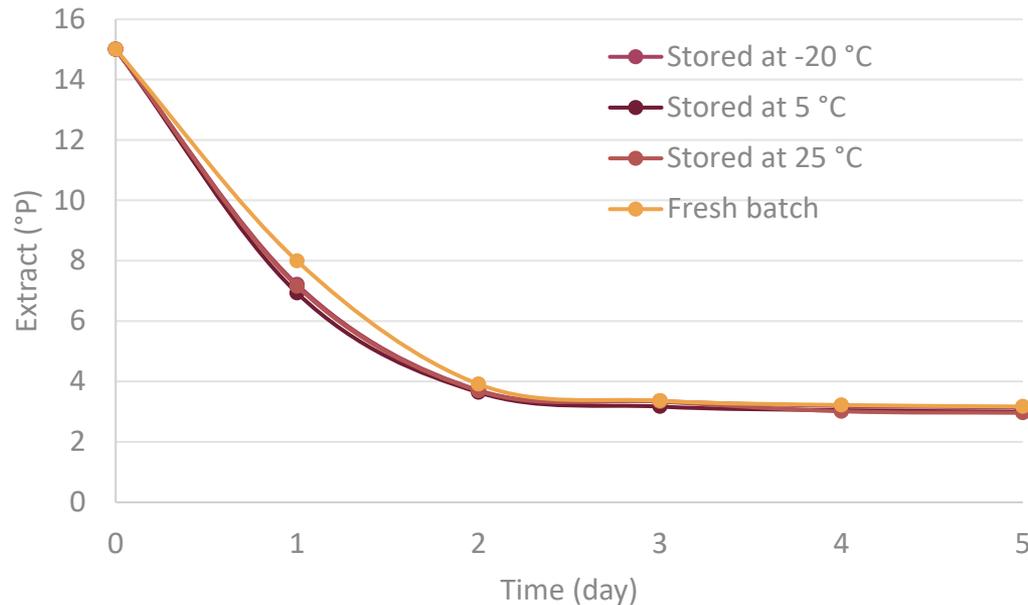
## 2. NATURAL AGEING

- a. Fermentation performances after storage during 3 years and 8 months at different temperatures (-20°C, 5°C and 25°C)
  - ✓ 2 ADY (lager yeast W-34/70 and ale yeast S-04)
  - ✓ Comparison with a new fresh batch of yeast
  - ✓ Pitching by dry yeast weight and viable yeast cell count
  - ✓ Same wort for all assays from pilot brewery of KU Leuven (15°P pure malt), fermenter 50L
  - ✓ Analyses at the end of fermentation: ethanol, acetaldehyde, esters, higher alcohols, vicinal diketones, sulfites, residual sugars
  
- b. Beer tasting by an expert panel

# NATURAL AGEING: RESULTS

## 1. FERMENTATION PERFORMANCES

### SafAle S-04: Kinetics comparison of fresh yeast vs yeast stored 3 years and 8 months at -20°C, 5°C, 25°C



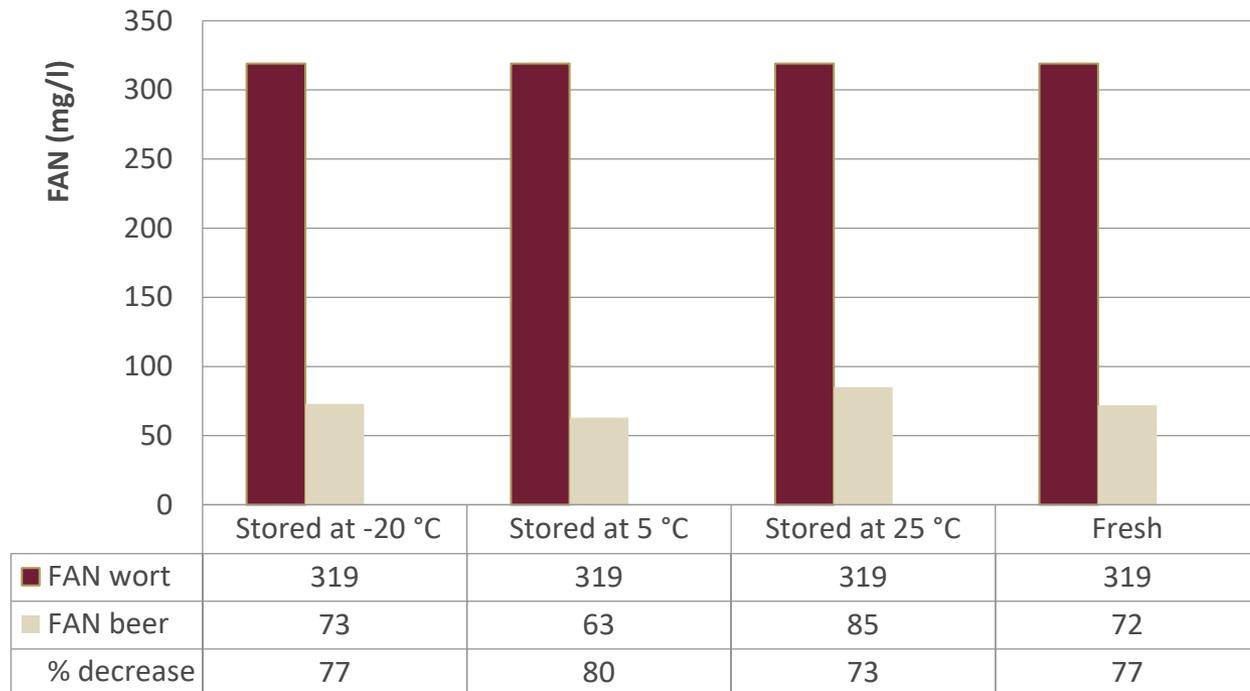
Yeast sample	Viability (expressed in % relative to fresh yeast )
Stored at -20°C	98
Stored 5°C	94
Stored at 25°C	94

Pitching rate 40 g/hL  
T°: 23°C

# NATURAL AGEING: RESULTS

## 1. FERMENTATION PERFORMANCES

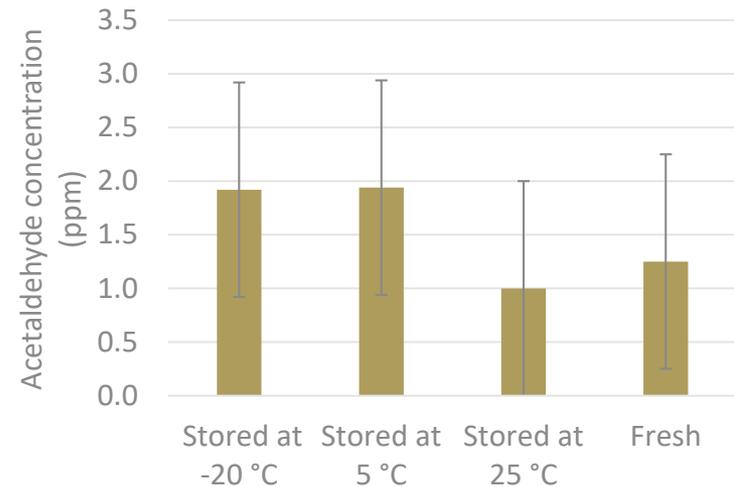
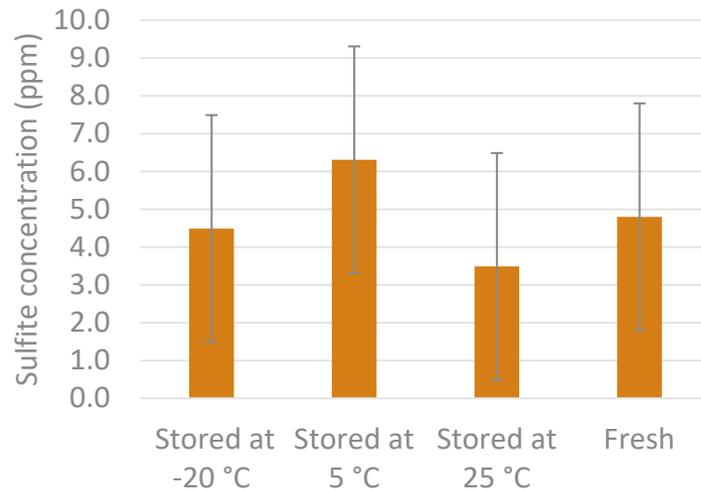
### SafAle S-04: FAN reduction of fresh yeast vs yeast stored 3 years and 8 months at -20°C, 5°C, 25°C



# NATURAL AGEING: RESULTS

## 1. FERMENTATION PERFORMANCES

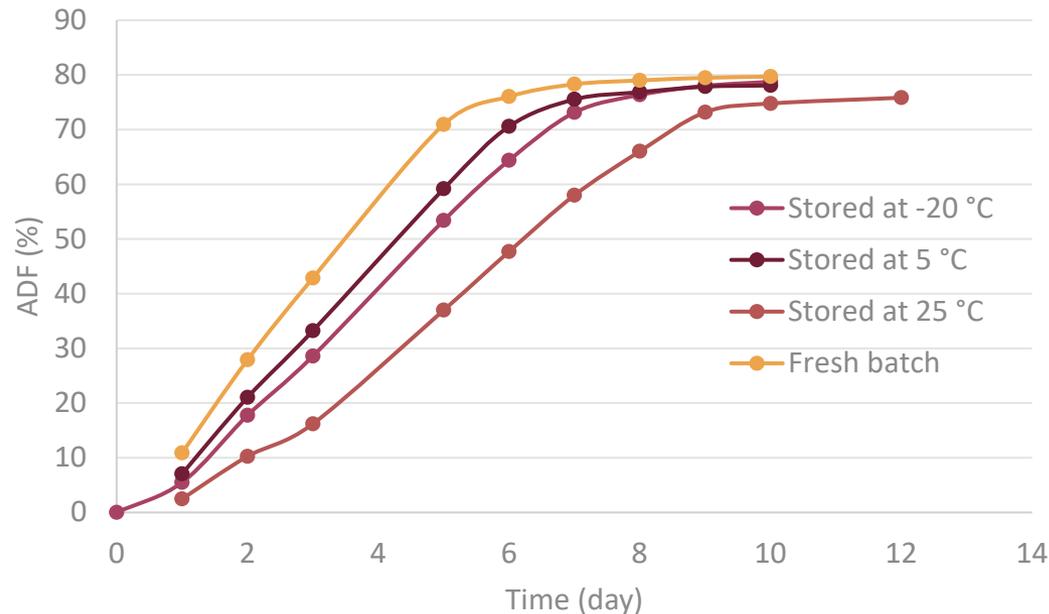
### SafAle S-04: Sulfite production of fresh yeast vs yeast stored 3 years and 8 months at -20°C, 5°C, 25°C



# NATURAL AGEING: RESULTS

## 1. FERMENTATION PERFORMANCES

### SafLager W-34/70: Kinetics comparison of fresh yeast vs yeast stored 3 years and 8 months at -20°C, 5°C, 25°C



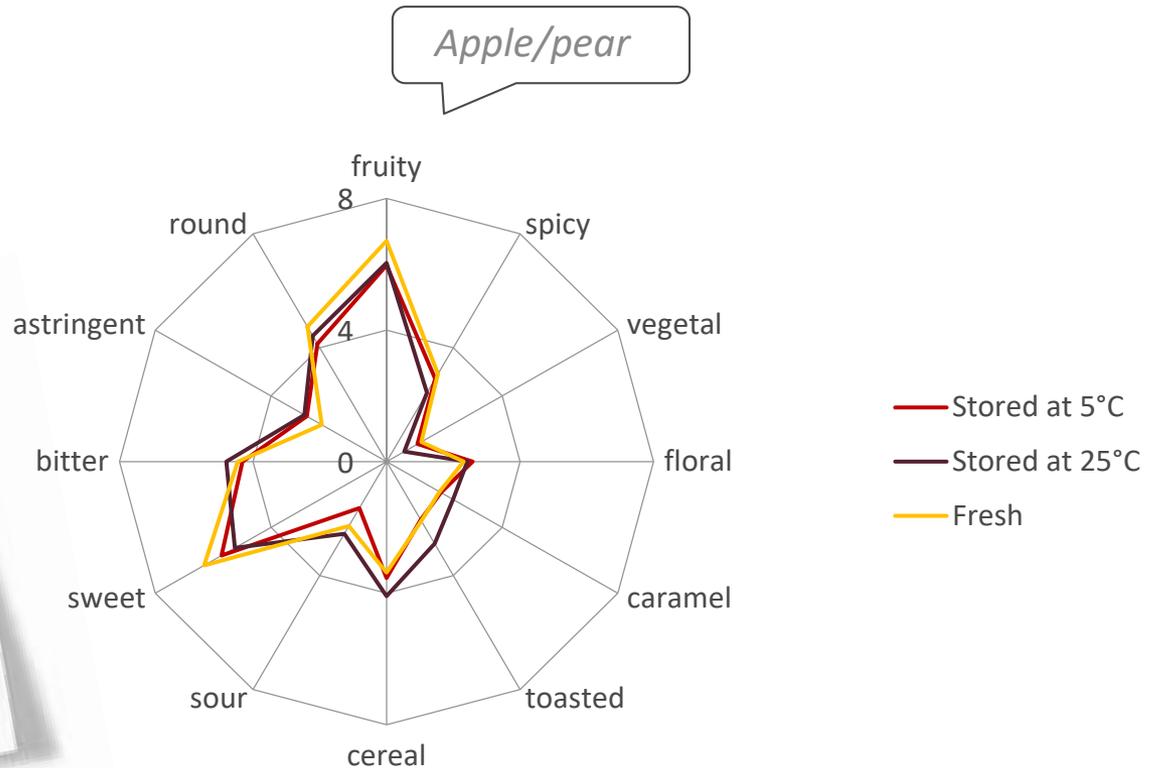
Yeast sample	Viability (expressed in % relative to fresh yeast )
Stored at -20°C	81
Stored 5°C	96
Stored at 25°C	59

Pitching rate 120 g/hL  
T°: 14°C

# NATURAL AGEING: RESULTS

## 2. BEER TASTING BY AN EXPERT PANEL

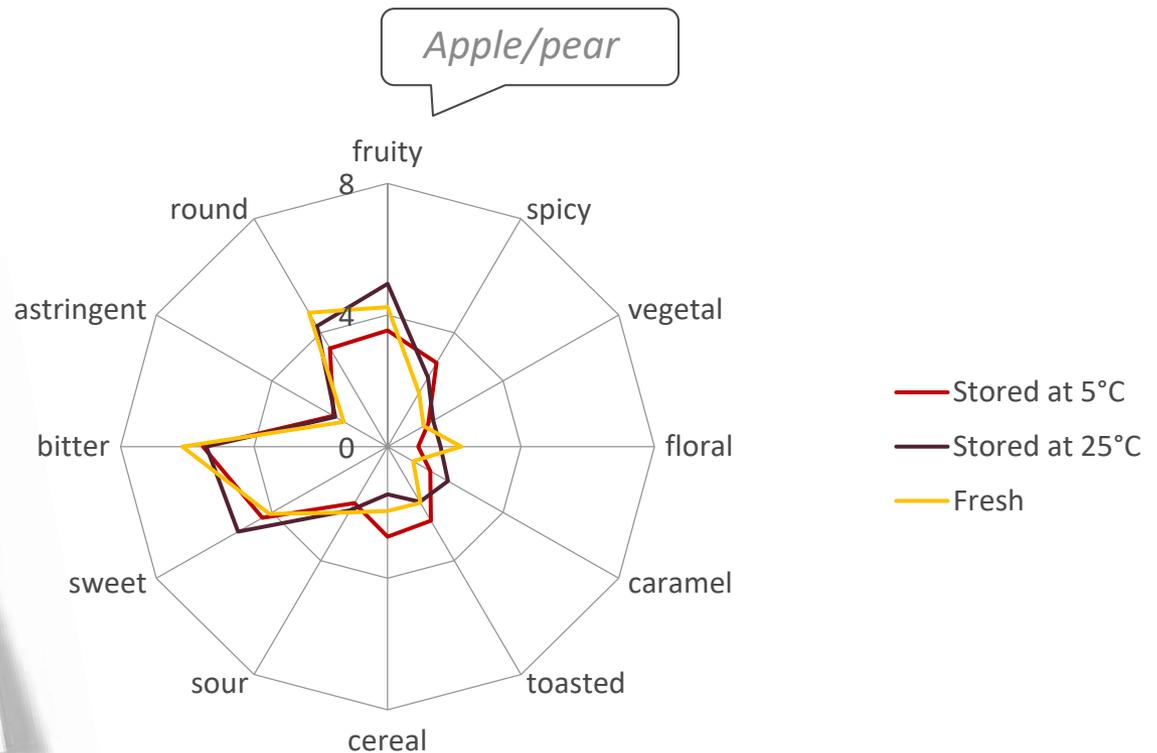
**SafAle S-04: Testing of beer obtained with fresh yeast vs yeast stored 3 years and 8 months at 5°C and 25°C**



# NATURAL AGEING: RESULTS

## 2. BEER TASTING BY AN EXPERT PANEL

**SafLager W-34/70: Testing of beer obtained with fresh yeast vs yeast stored 3 years and 8 months at 5°C and 25°C**



## CONCLUSIONS

- ✓ NO SIGNIFICANT DIFFERENCES BETWEEN FRESH AND AGED YEAST
- ✓ REAL SHELF LIFE OF 3 TO 4 YEARS FOR ALE AND LAGER BREWING YEASTS DOES NOT AFFECT THE QUALITY
- ✓ STORAGE IN COOL AND DRY CONDITIONS IS HIGHLY RECOMMENDED



## ACKNOWLEDGEMENTS

Laurence Van Nederveelde



Annick Boeykens



Thank you for your attention!

Questions?



THE OBVIOUS CHOICE FOR BEVERAGE FERMENTATION