# DIASTATICUS: HOW IT FUNCTIONS & HOW CROSS CONTAMINATION IS A THREAT YOU SHOULD KNOW ABOUT NOW!

KEVIN LANE – TECHNICAL SALES MANAGER – USA & CANADA

THE OBVIOUS CHOICE FOR BEVERAGE FERMENTATION

Fermentis
LESAFFRE FOR BEVERAGES

# AGENDA

- Introduction of Fermentis
- Mashing
  - Starch basics
  - Enzyme activities/optimization
  - Wort composition
- Yeast basics
  - Sugar sequence of yeast
  - Sugar transportation and degradation/fermentation
- Cross contamination risks
  - Fermentation kinetics
  - Flavor profiles
- Diastaticus
  - Functionality
  - Risks associated
  - Theoretical scenario

# FERMENTIS



Fermentis is the business unit of Lesaffre in charge of the development and sales of innovative products and services for **beer**, **wine**, **spirits** and **potable ethanol**.

**Our mission:**

Create & deliver innovative and dependable ferments & derivatives offering sustainable technical solutions to the benefit of all stakeholders worldwide.



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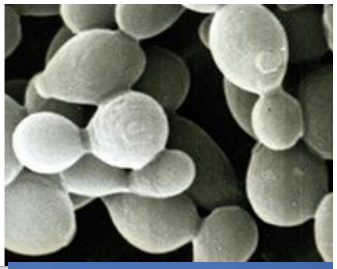
# Fermentis, part of the Lesaffre Group


**180**
researchers

**160**
years of expertise
and know-how



**60**
partners universities
and research centers
around the world


## Radiate internationally

**50** production plants operating in over 40 countries

**180** countries where products and services are marketed

**70** nationalities represented

## Commit for the environment

**15 %**
of all industrial and technical investments are devoted to the environment

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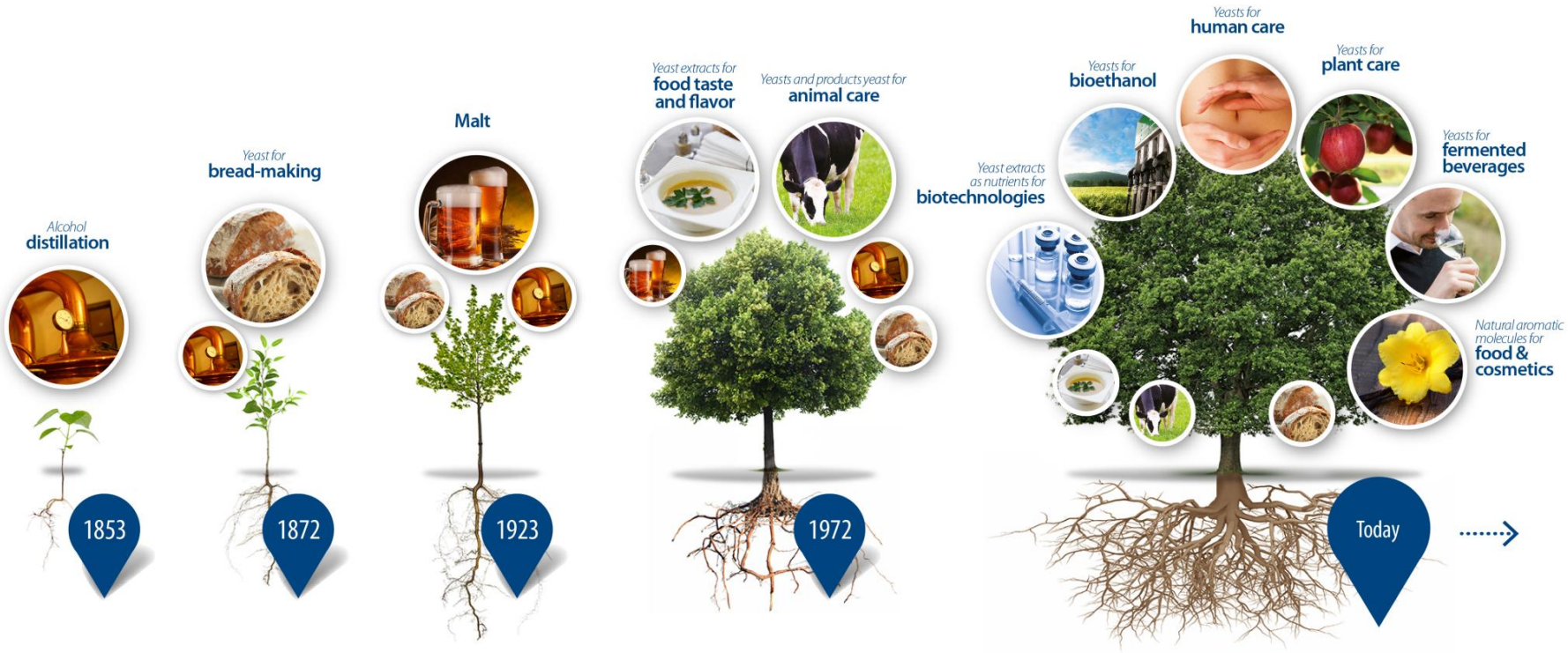
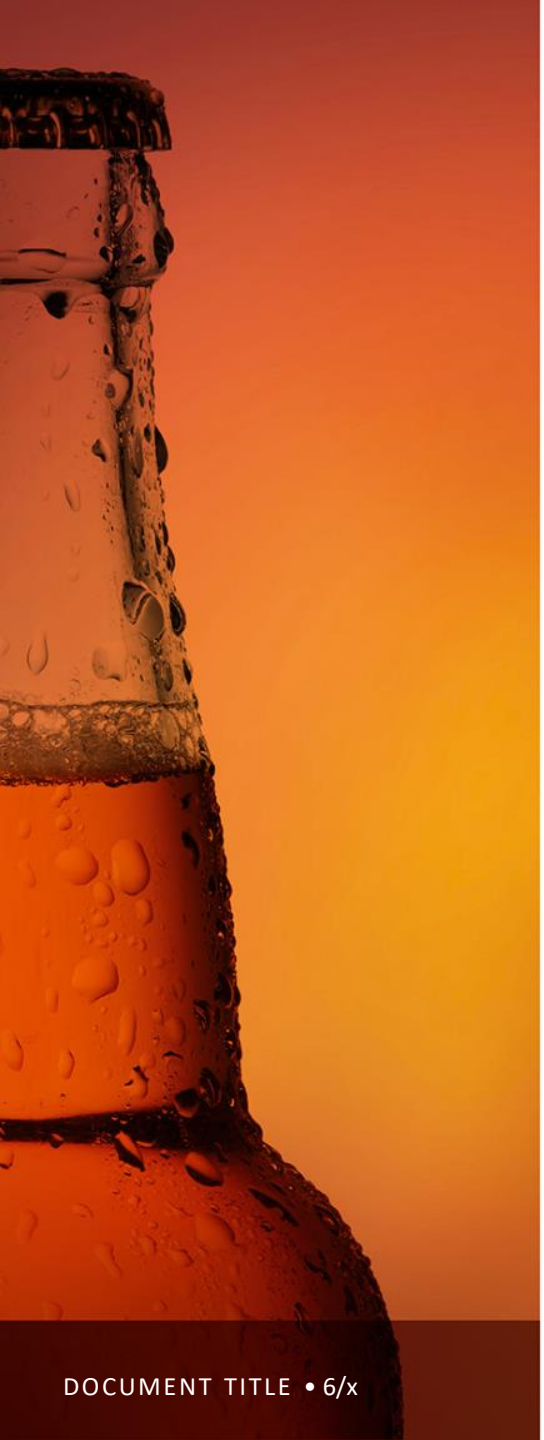
# Lesaffre, 160 years of progress/evolution





# LET'S GET NERDY!

## Mashing



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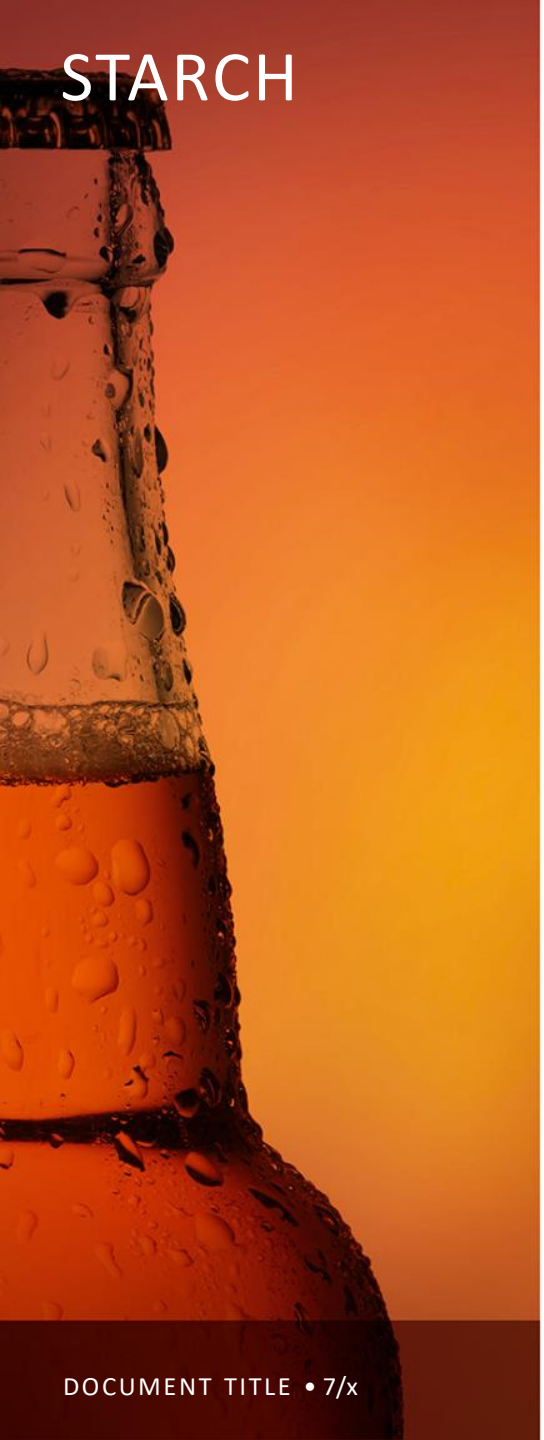
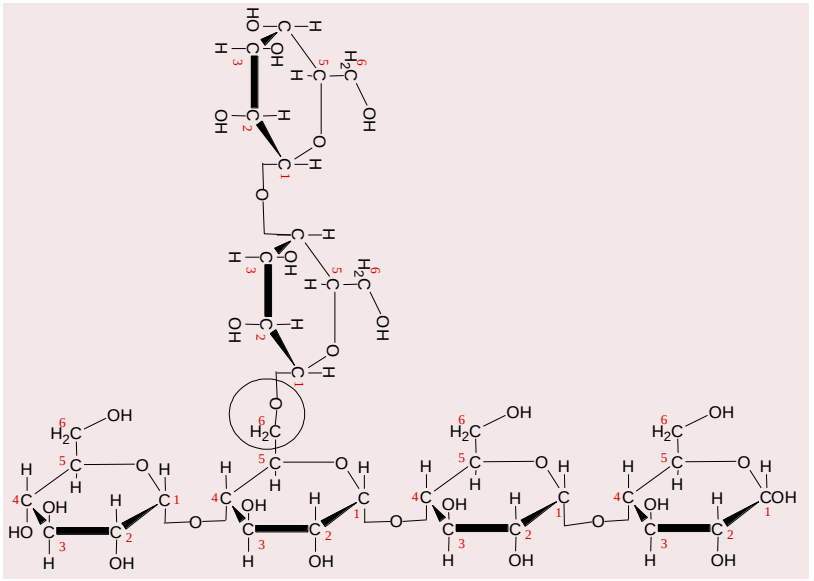



# STARCH

## CONSISTS OF TWO TYPES OF GLUCOSE CHAINS

**Amilose**, linear chain with bonds that are α 1-4

**Amilopectin**, branched chains with α1-4 and α 1-6





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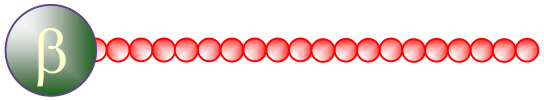
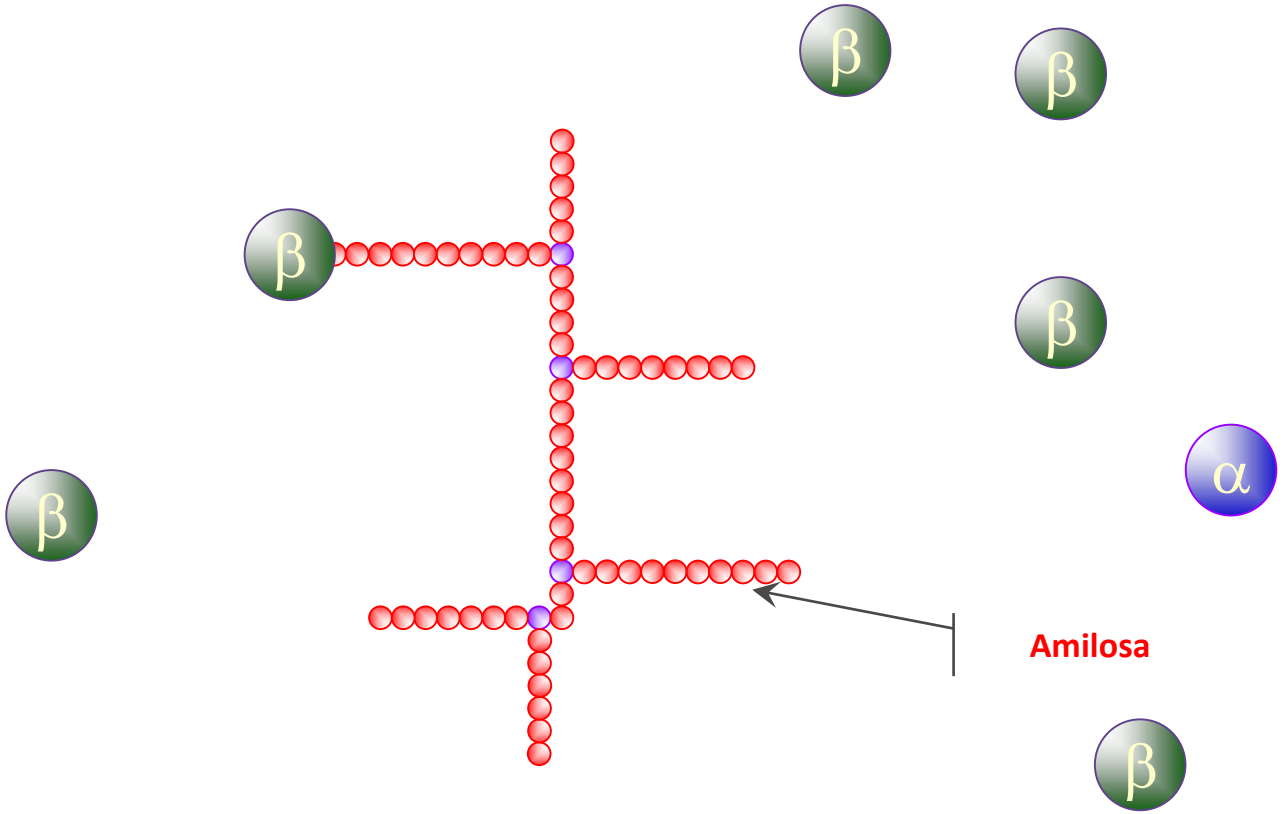
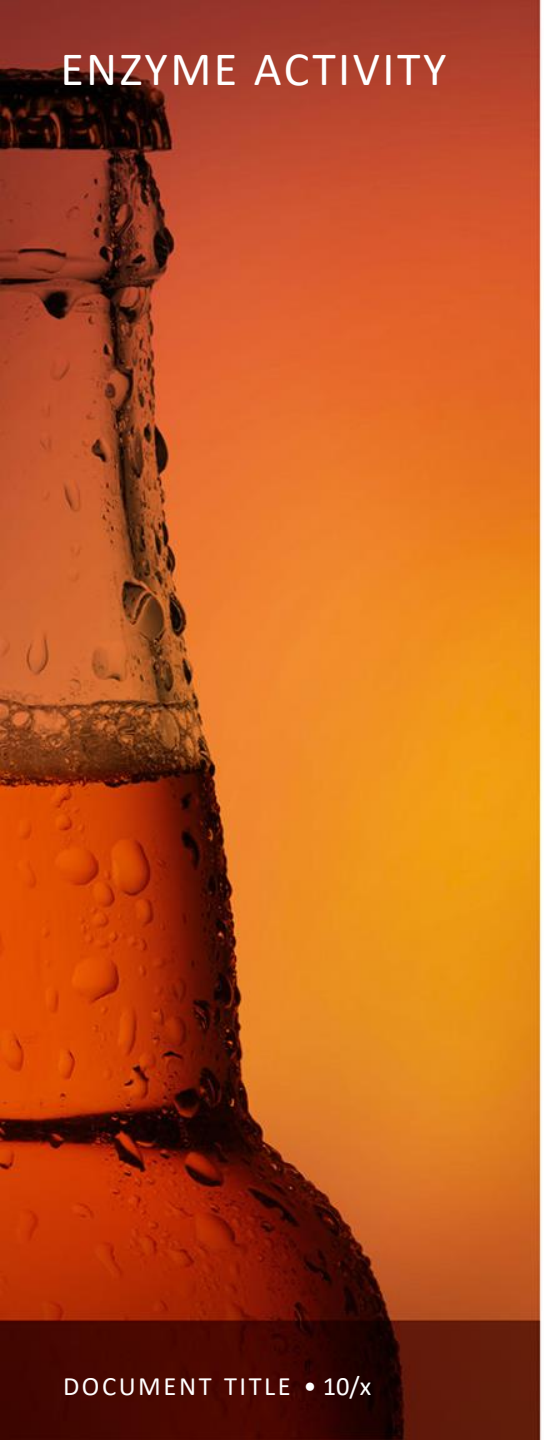
# Degradation of Starch: amilose



# Degradation of Starch: amilopectin





# ENZYME ACTIVITY

| Enzyme | Produces | Optimal pH | Optimal Temperature | Inactivation Temperature |
|---|---|---|---|---|
| α - Amilase (random cuts) | Dextrines and Maltotriose | 5.3 – 5.8 | 67 - 75 ºC (152 - 167ºF) | 80 ºC (176ºF) |
| β - Amilase (brakes from the reducing end) | Maltose | 5.0- 5.5 | 60 - 65 ºC (140 - 149ºF) | 70 ºC (158ºF) |



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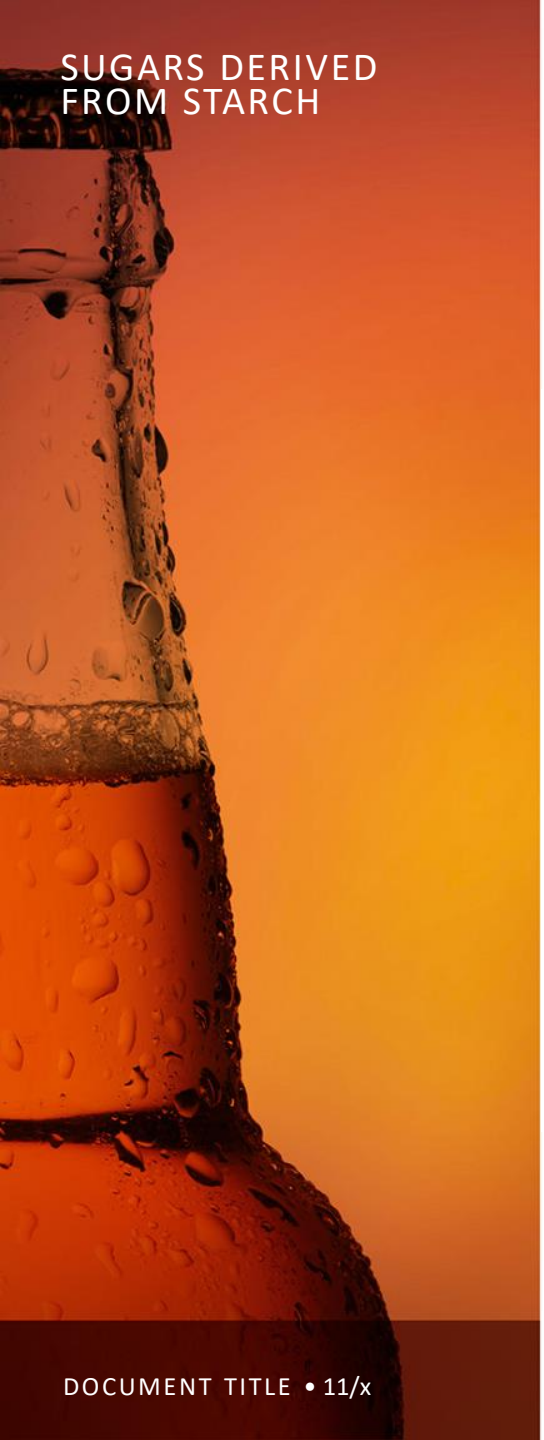
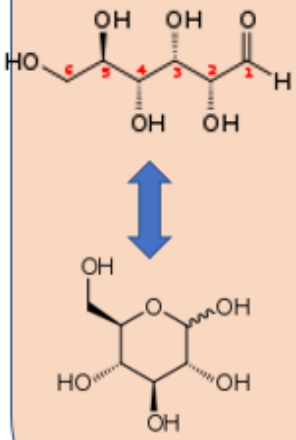


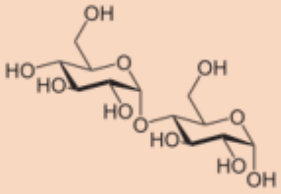
# SUGARS DERIVED FROM STARCH

*Fermentables*

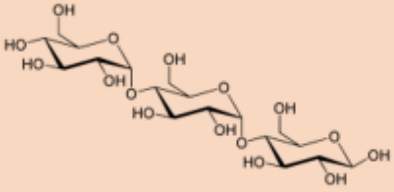
**Glucose**



**Maltose**



**Maltotriose**



**DP1** **DP2** **DP3**

*Non Fermentables*

**Dextrins**

> 3 glucose units

**>DP3**

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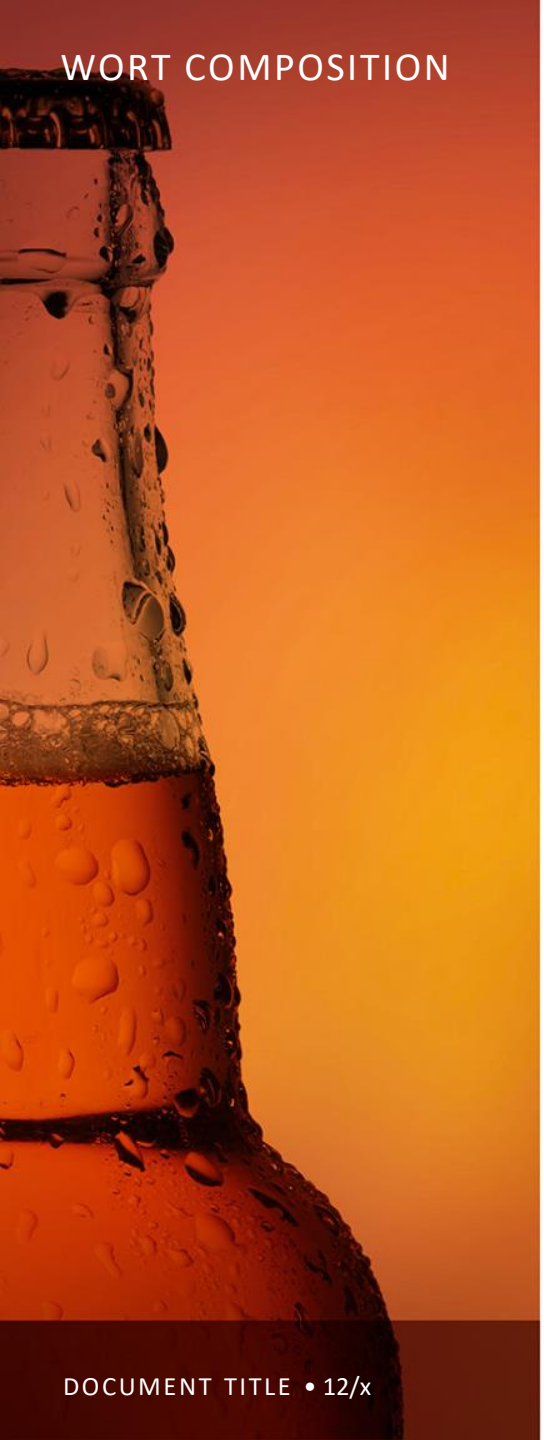

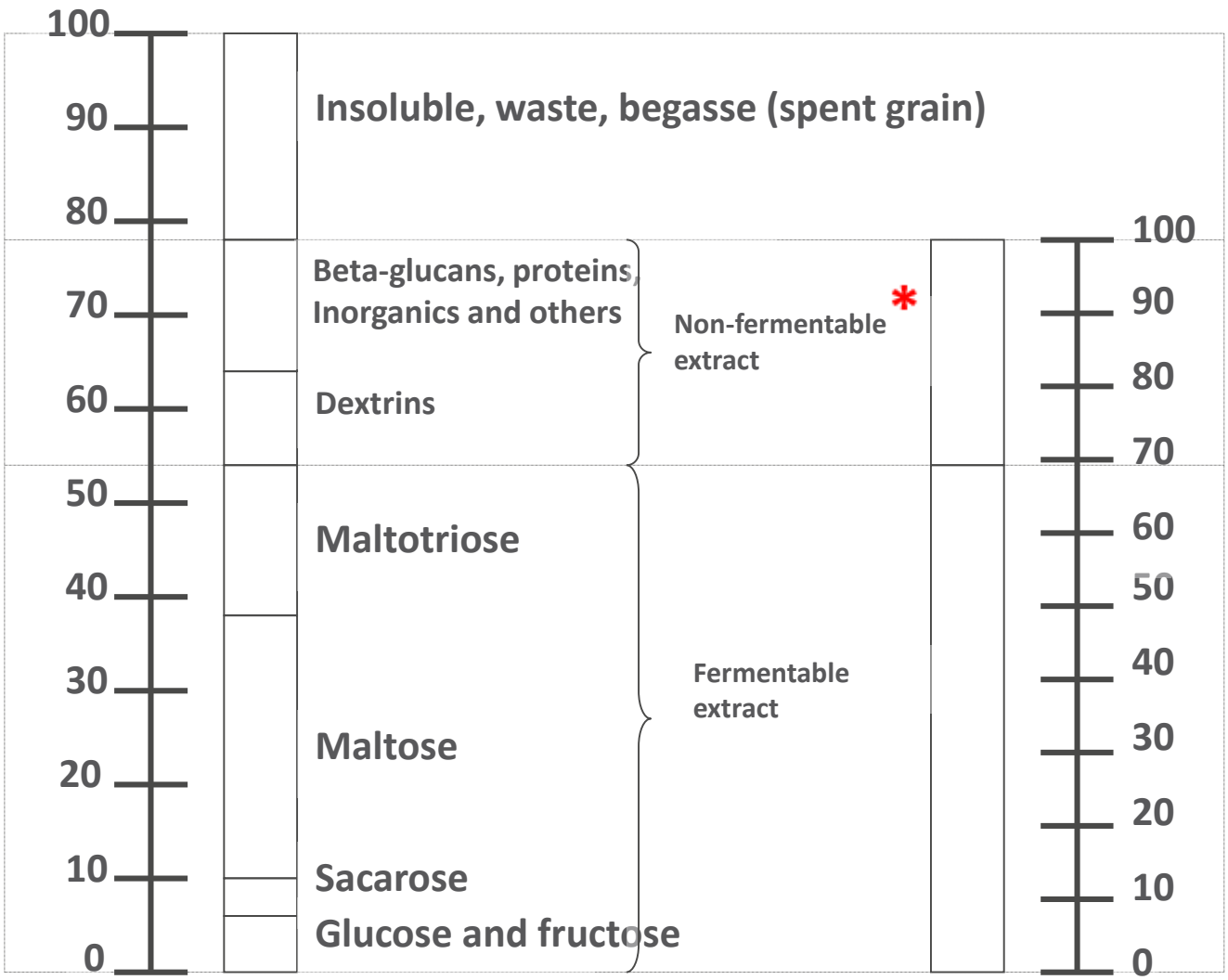


Adaptation of “Technology Brewing and Malting” (Kunze 1996)

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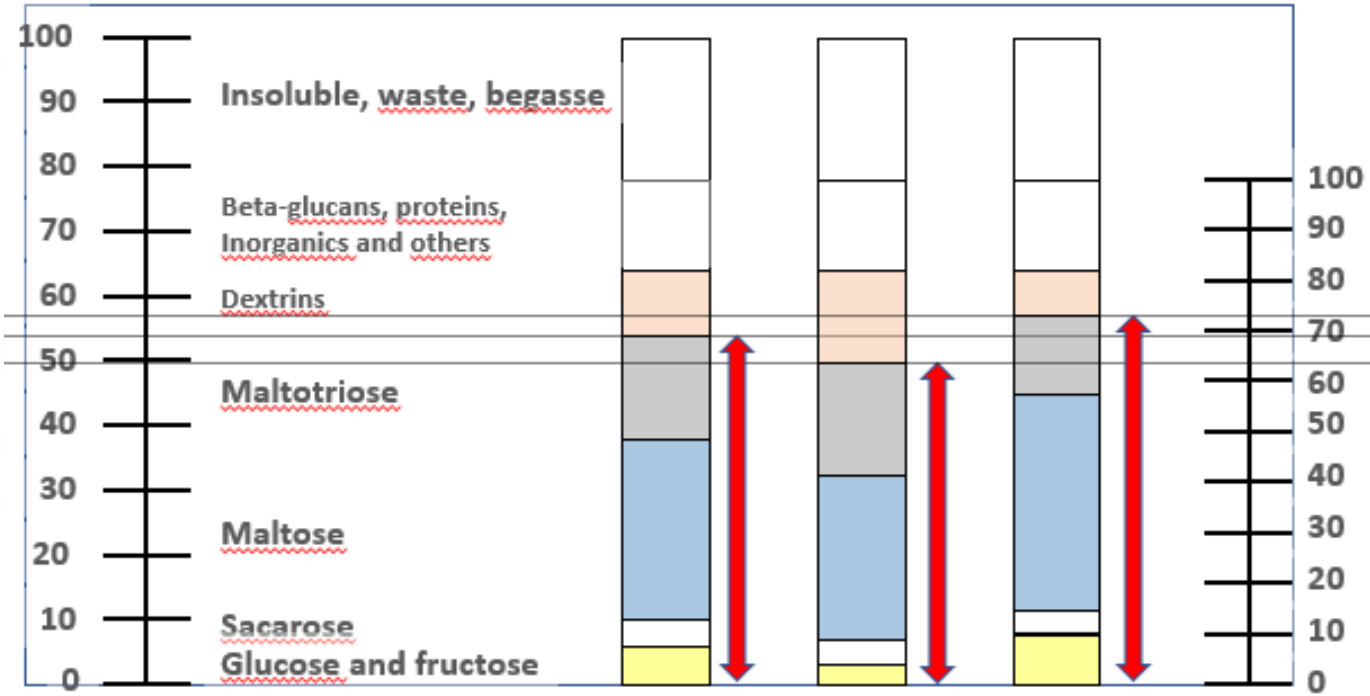
# WORT COMPOSITION DUE TO MASH TEMPERATURE




Adaptation of “Technology Brewing and Malting” (Kunze 1996)



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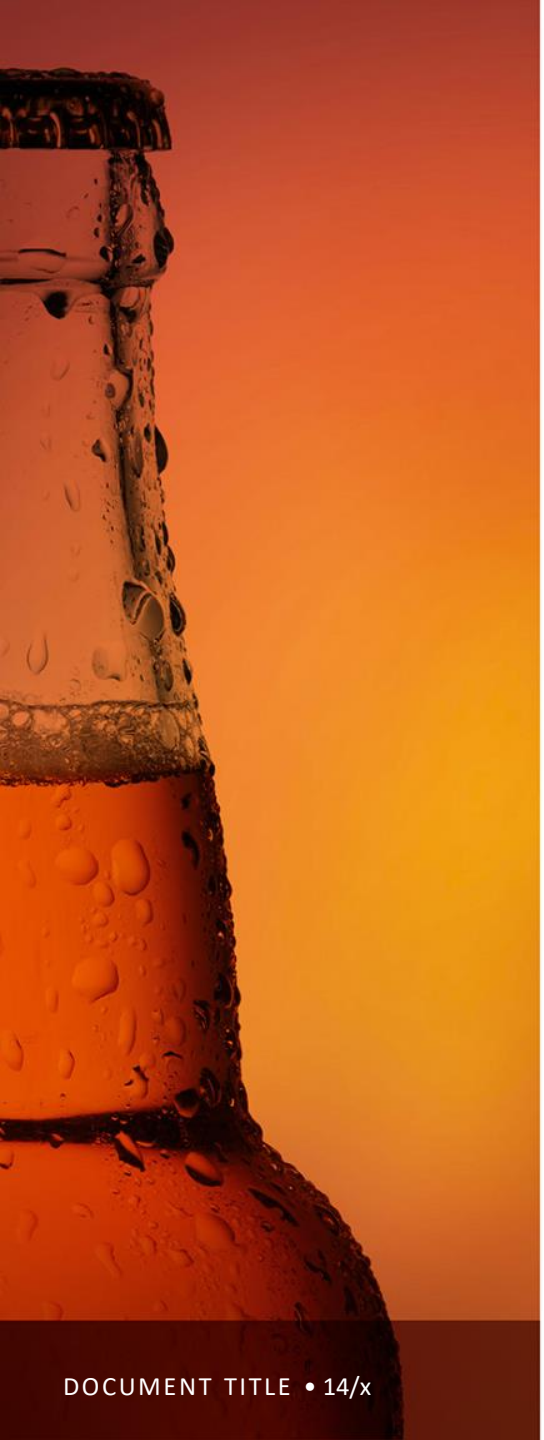

# LET'S GET MORE NERDY!

Yeast basics



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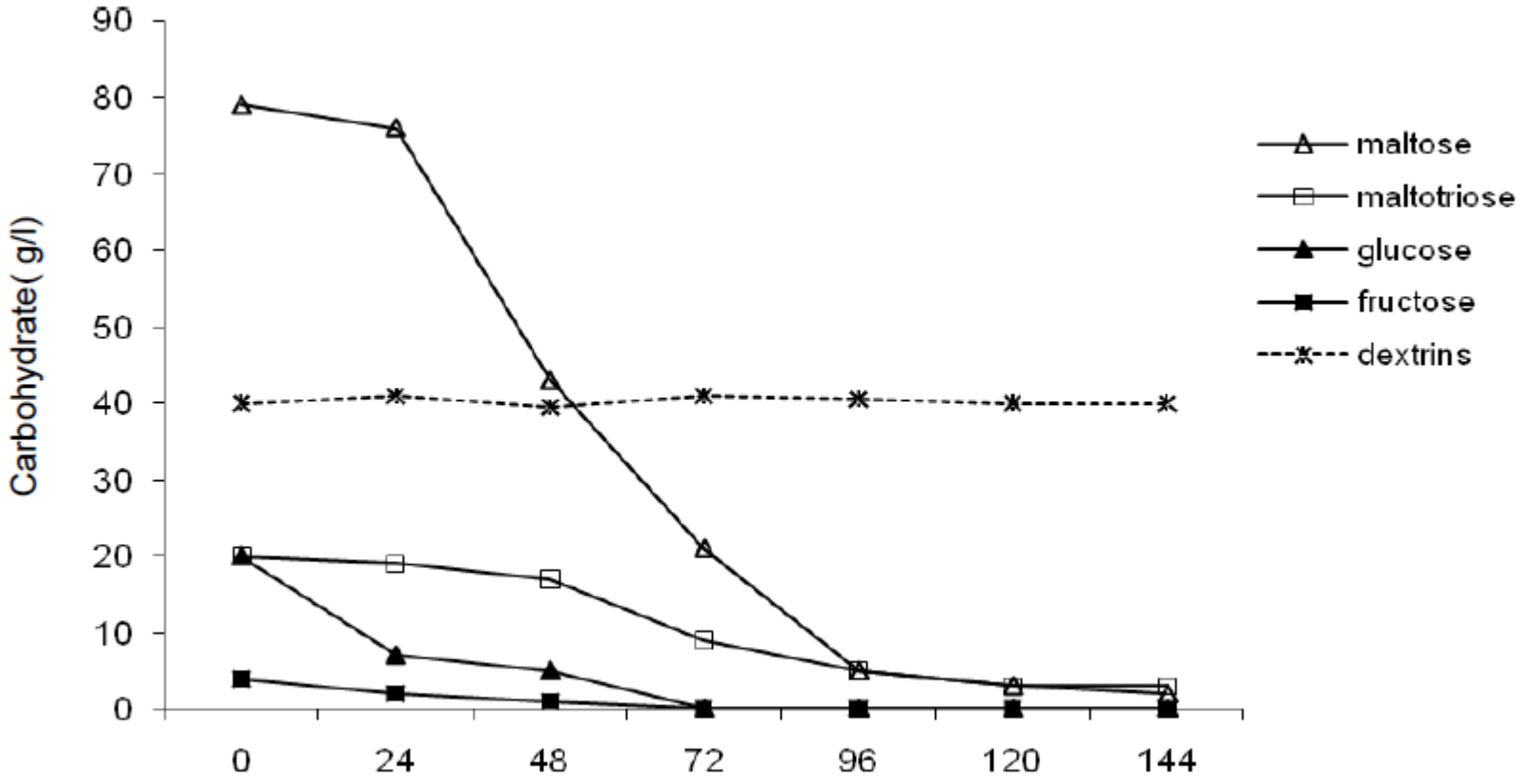
# SUGAR SEQUENCE OF YEAST



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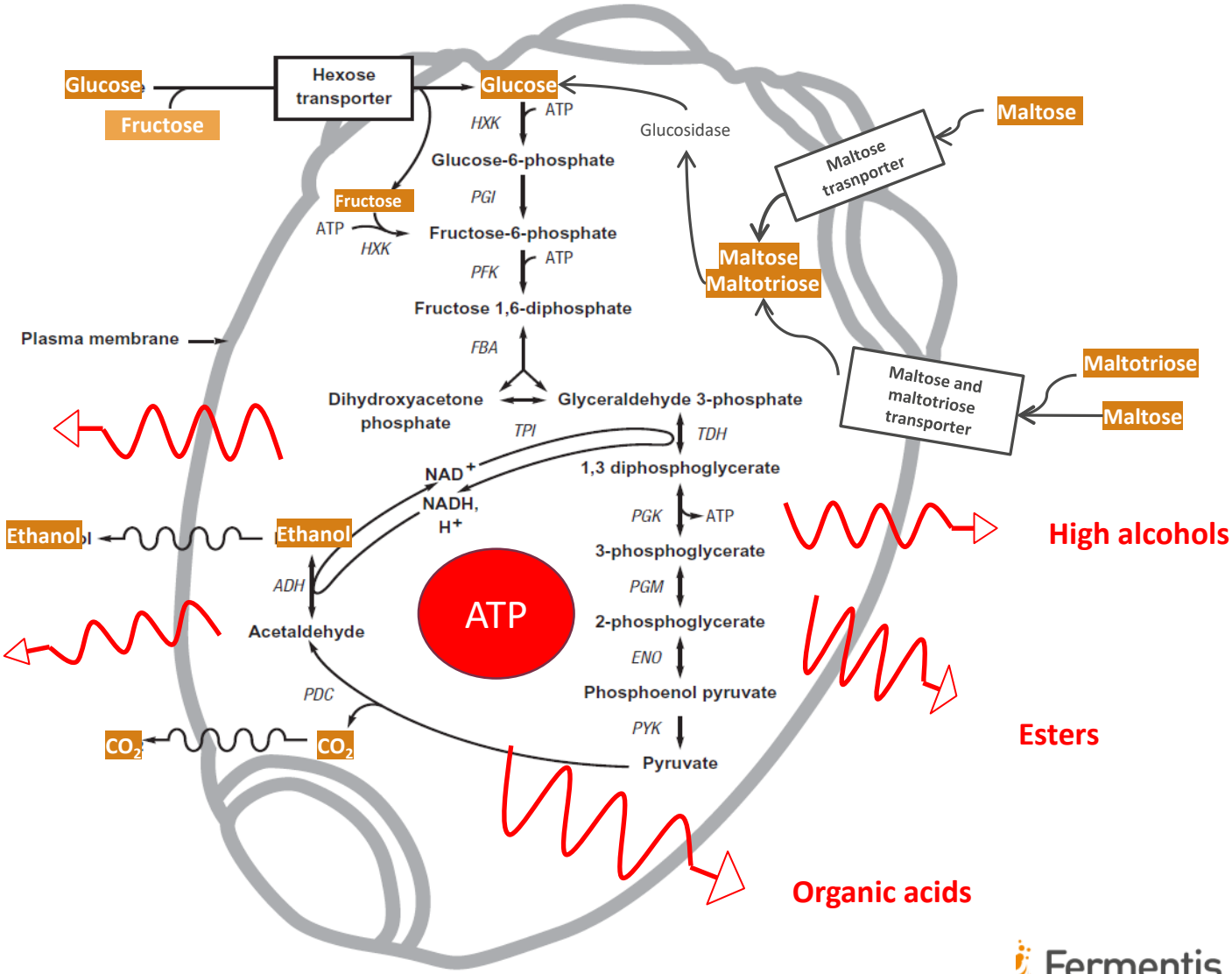
# Yeast function




Source: The alcohol textbook



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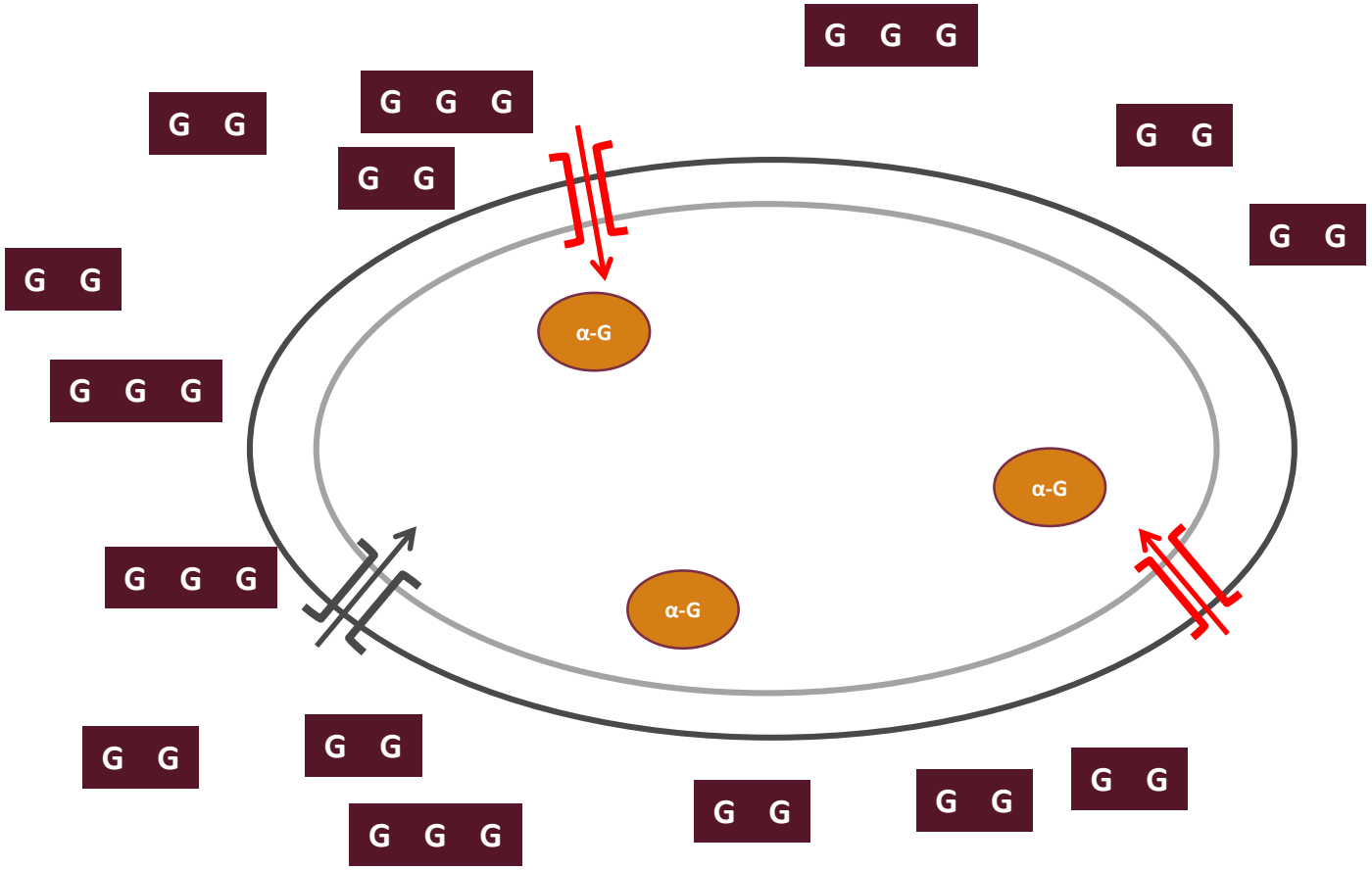
# Utilization of maltose and maltotriose



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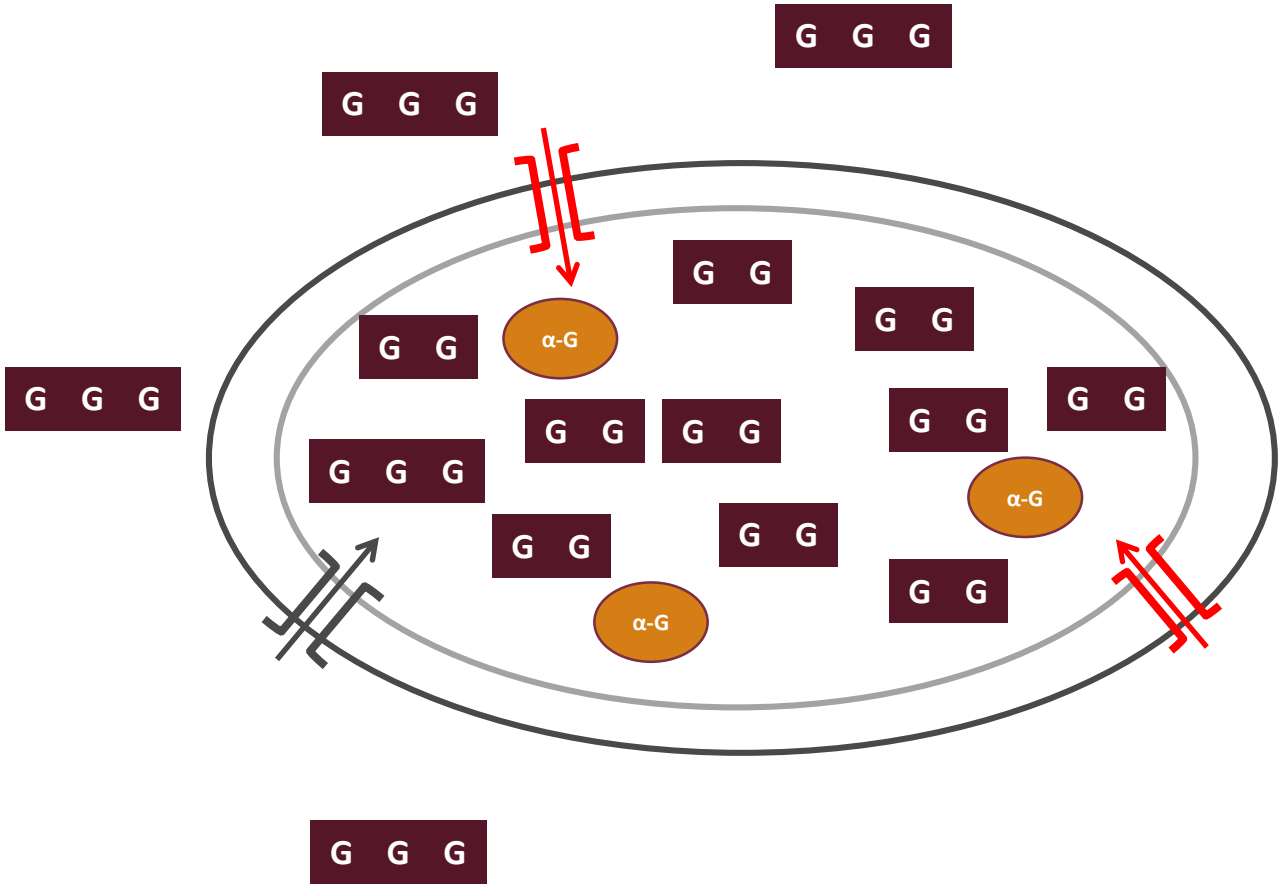

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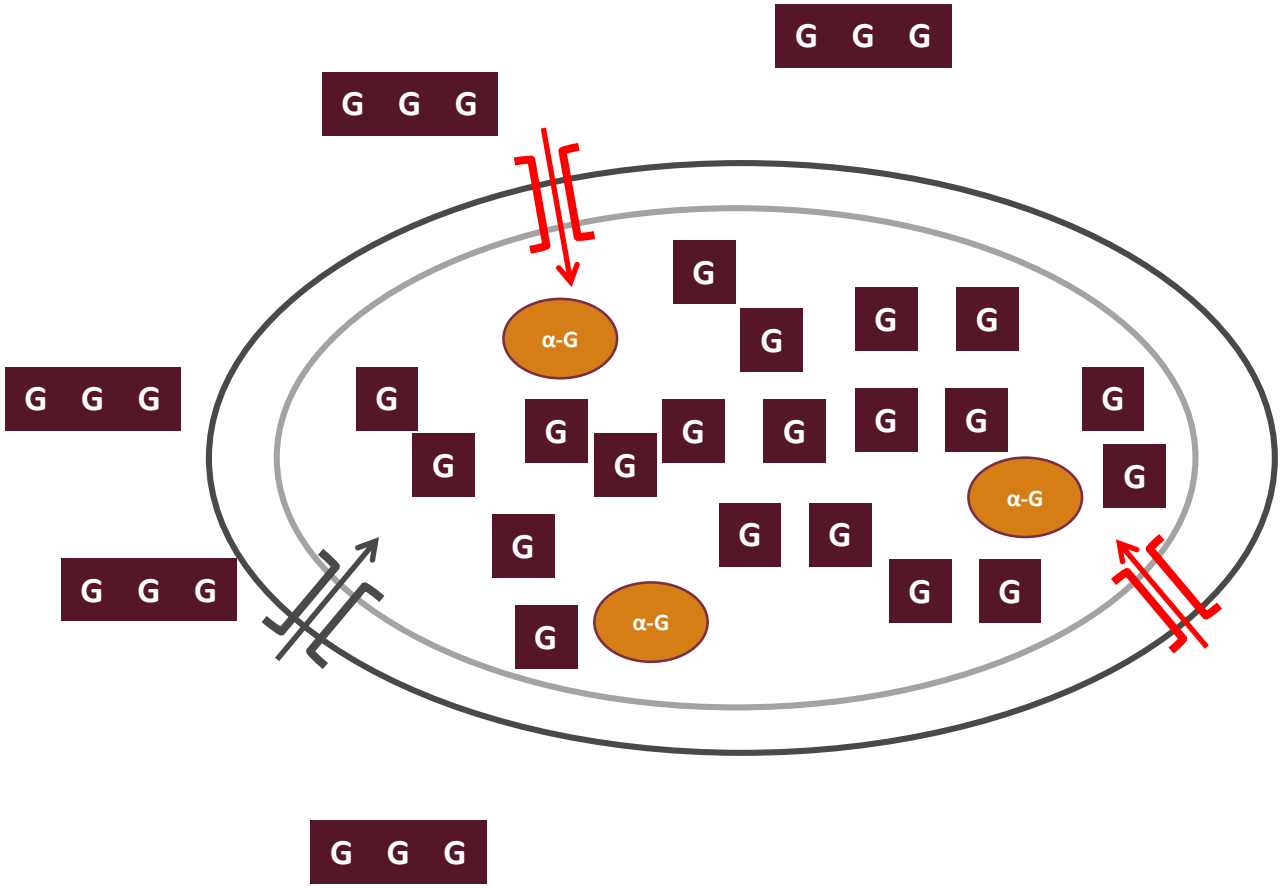

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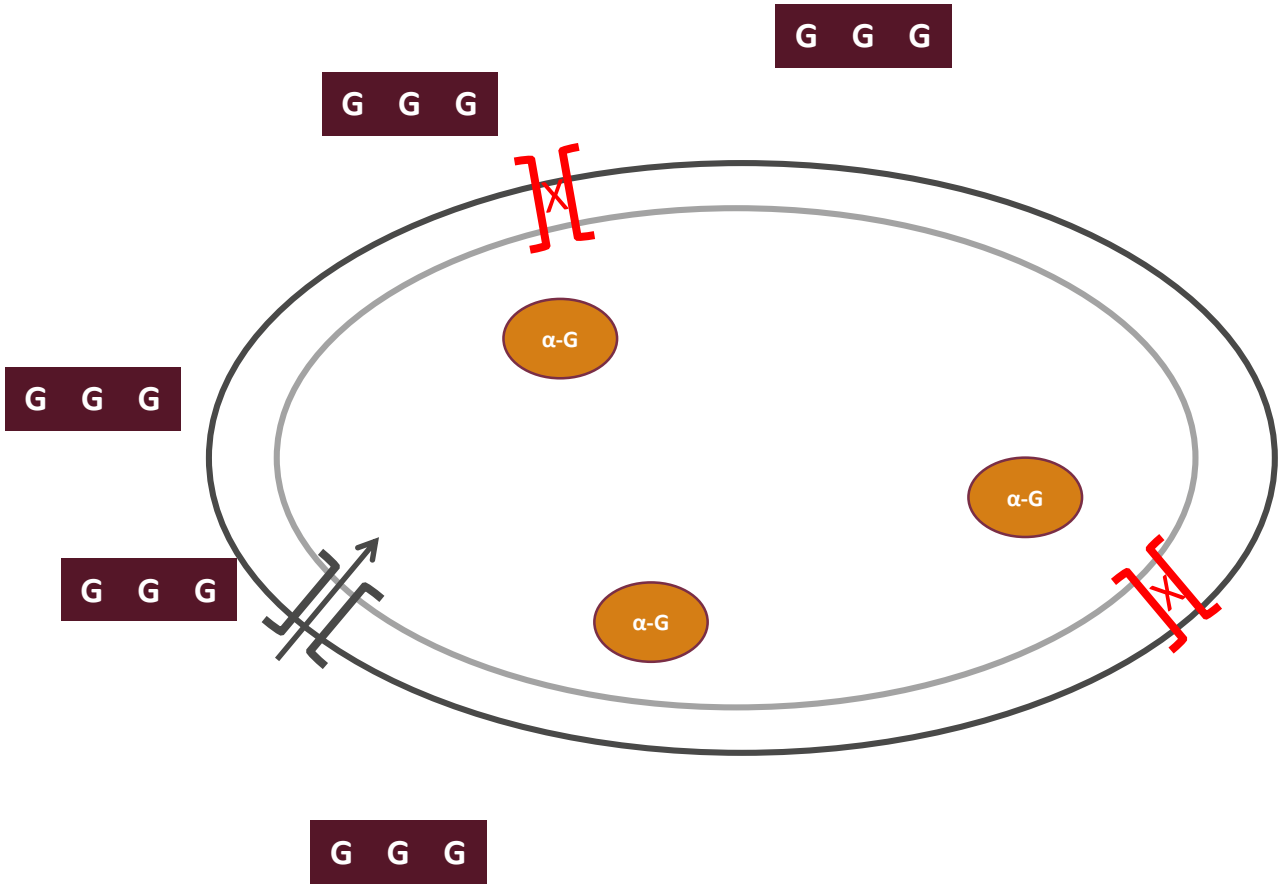

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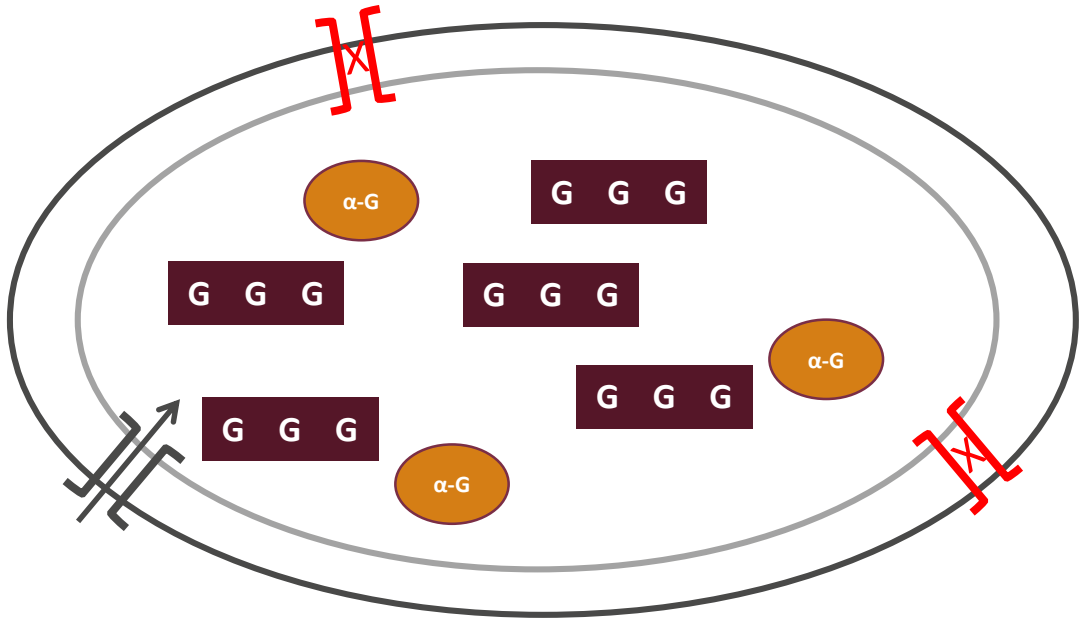

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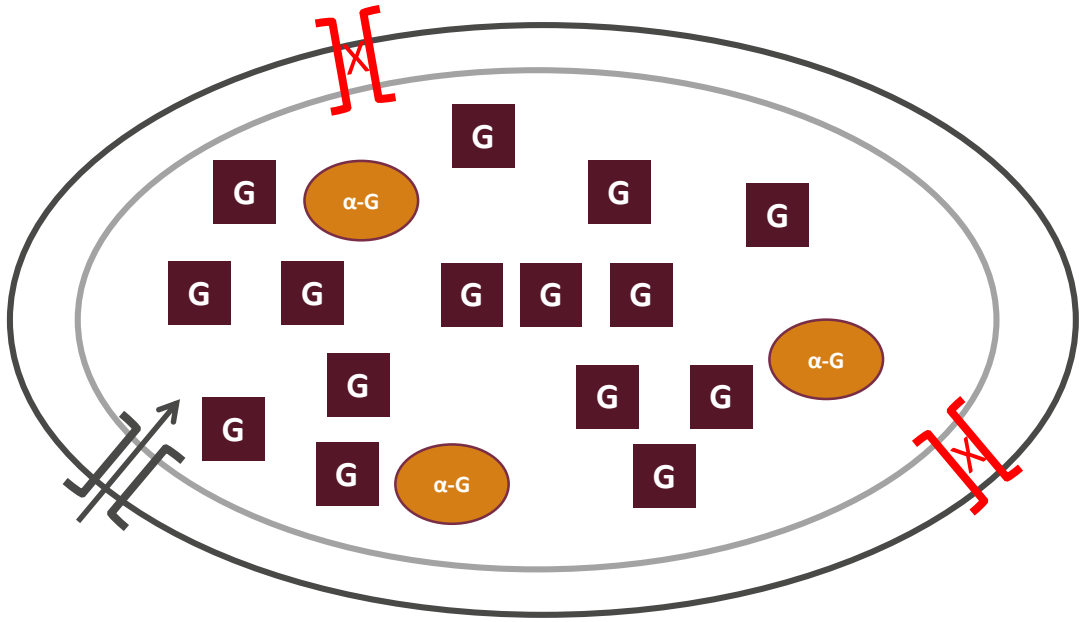

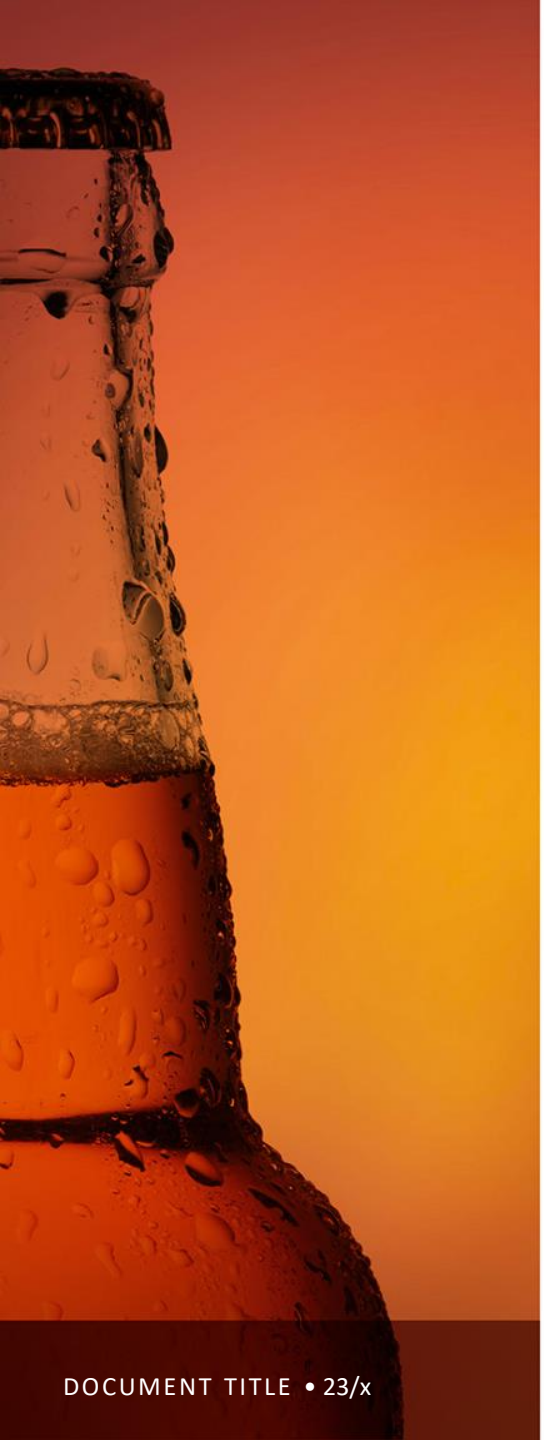

# CROSS CONTAMINATION



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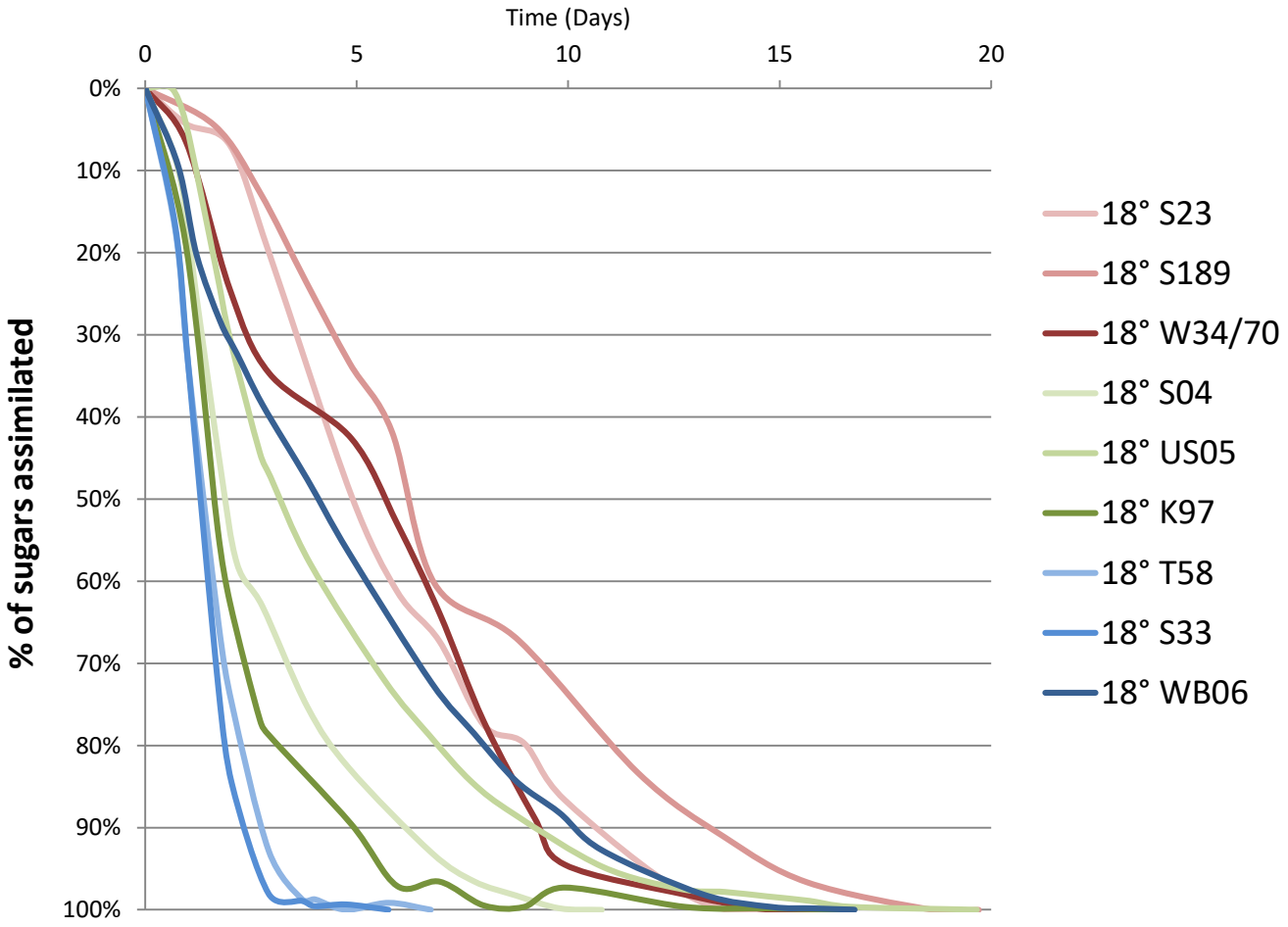
# (MOST OF THE) FERMENTIS PORTFOLIO



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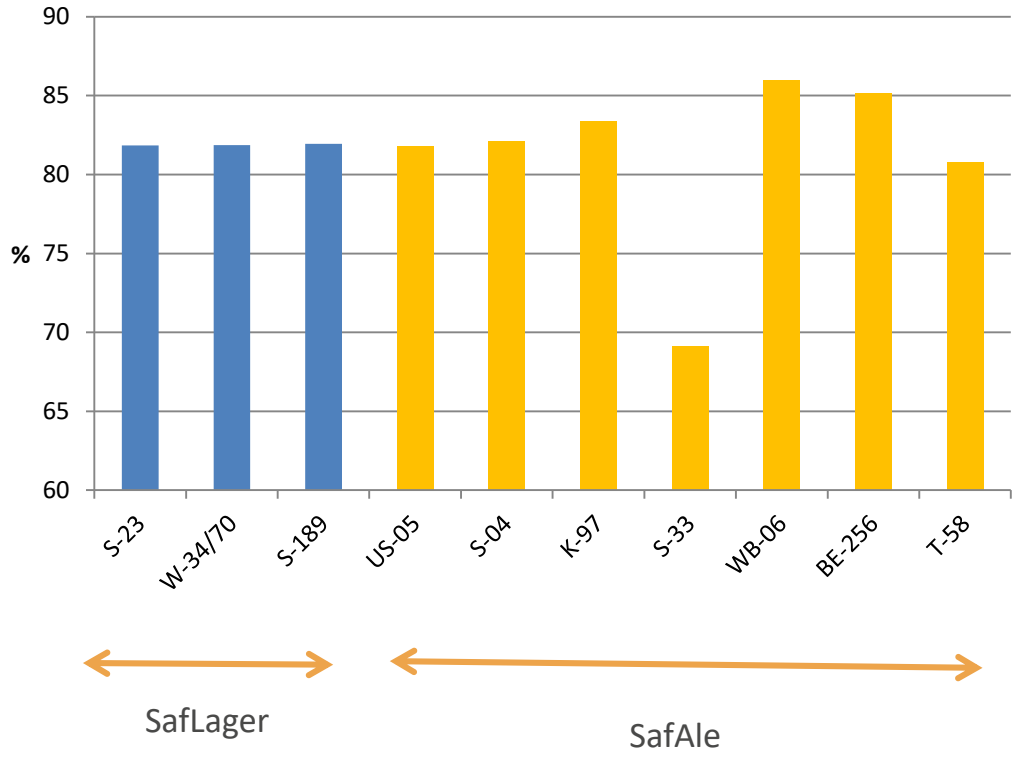
# APPARENT ATTENUATION




Baseline



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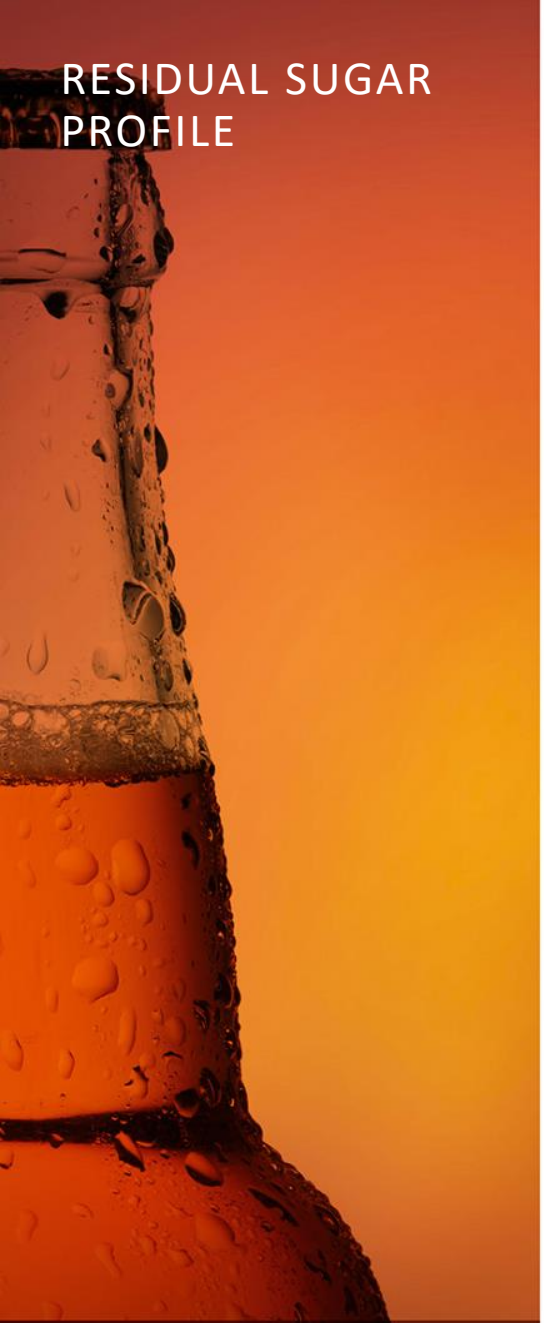
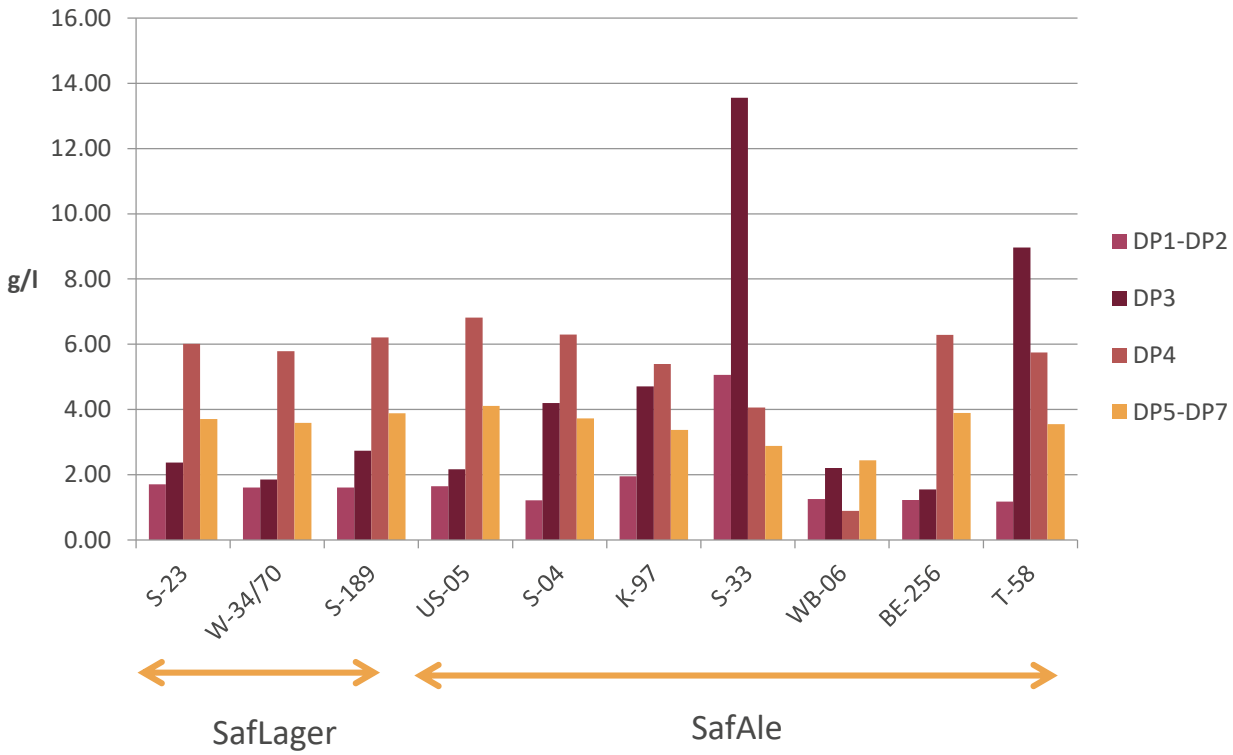
# RESIDUAL SUGAR PROFILE






Baseline



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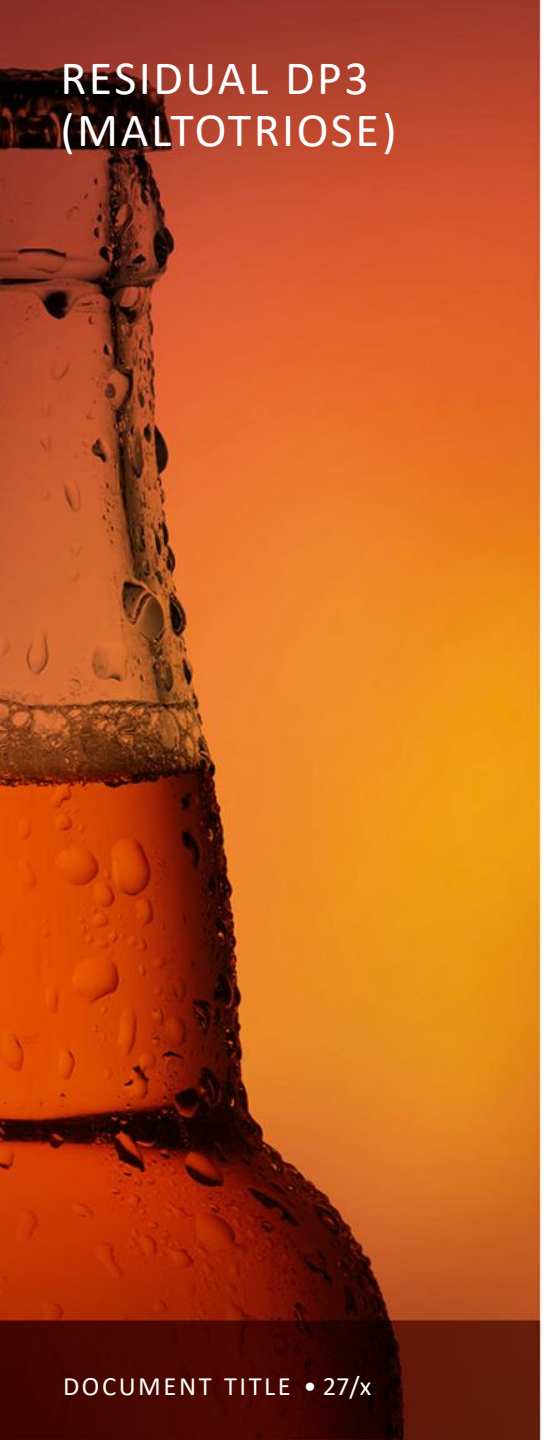
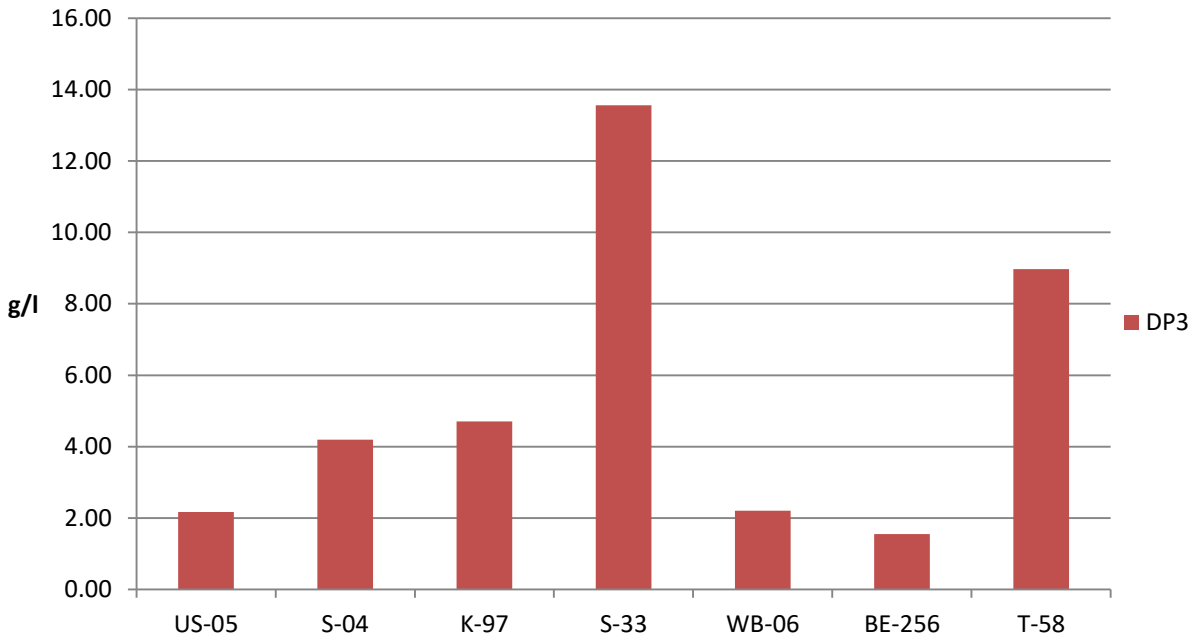
# RESIDUAL DP3 (MALTOTRIOSE)






Baseline



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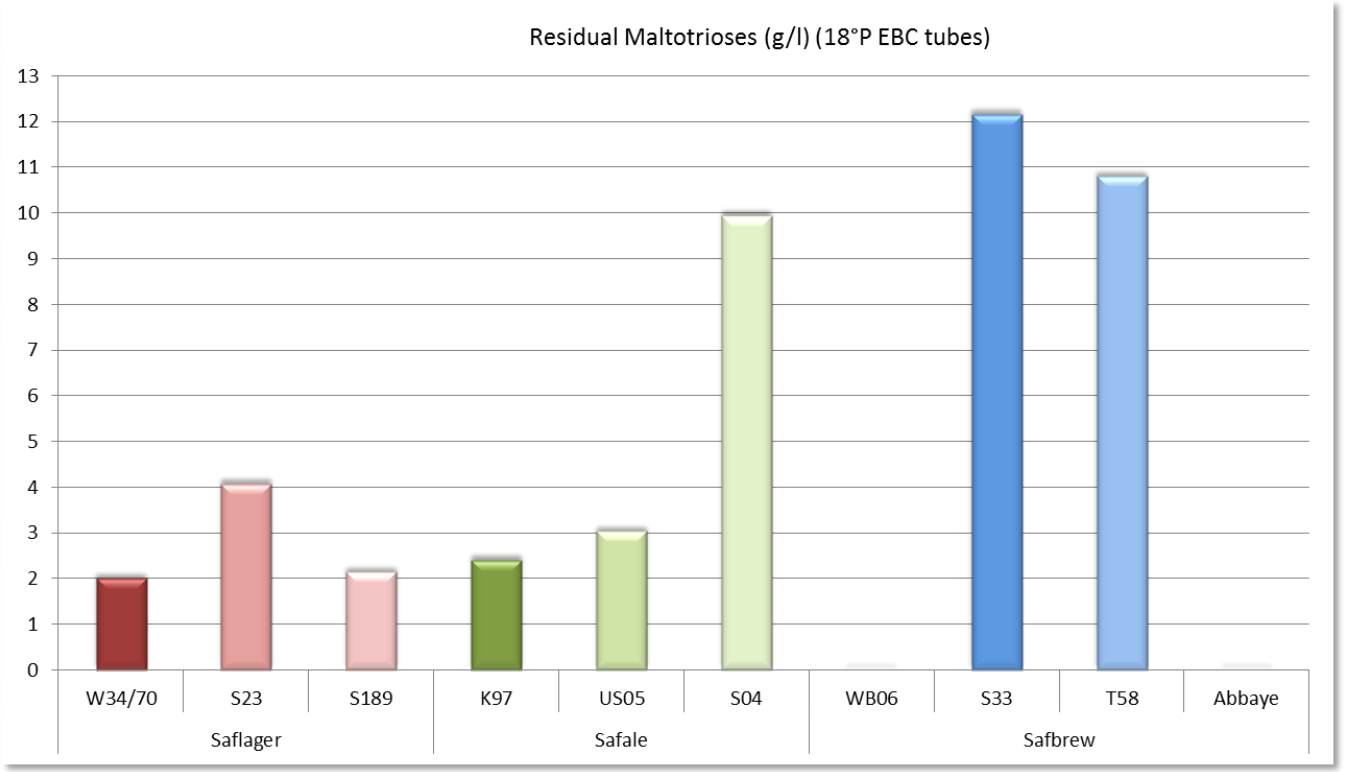
# RESIDUAL MALTOTRIOSE

## Residual matotriose (g/l) (18 °P / tubos EBC)




*depending on the mash



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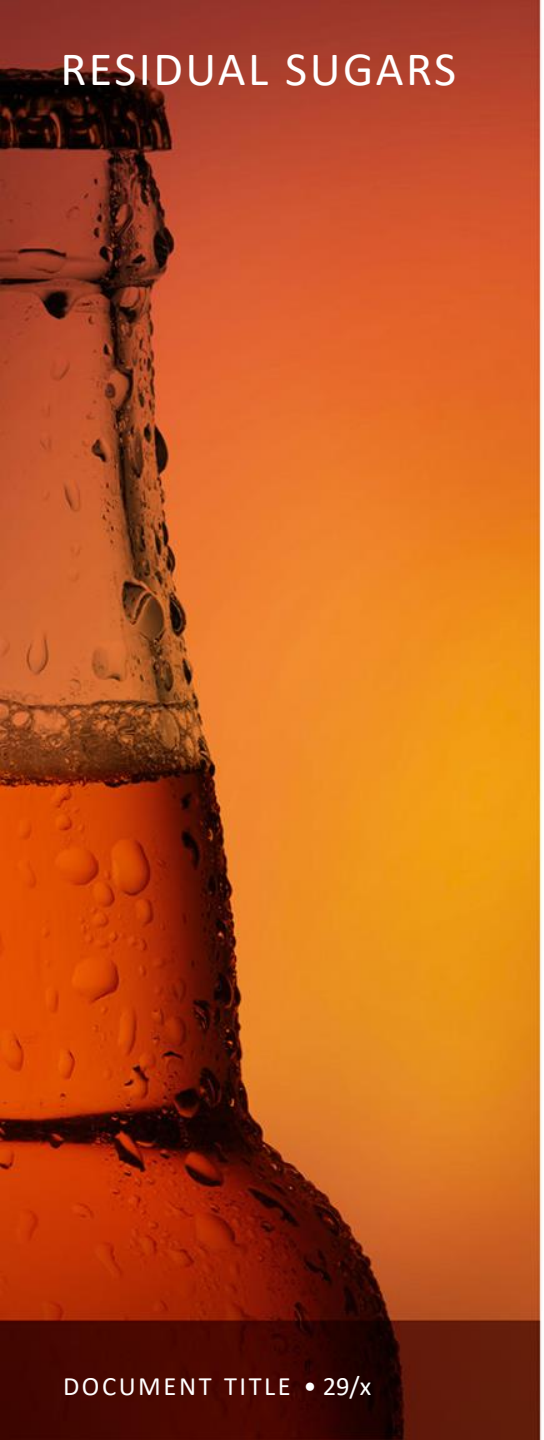
# RESIDUAL SUGARS



| | Residual sugars (g/l) | Potential $CO_2$ (g/l) |
|---|---|---|
| **Safale™ S-04** | 10 | 5 |
| **Safale™ K-97** | 2 | 1 |
| **Safale™ US-05** | 3 | 1,5 |
| **Safbrew™ WB-06** | 0 | 0 |
| **Safbrew™ S-33** | 12 | 6 |
| **Safbrew™ T-58** | 11 | 5,5 |
| **Saflager™ S-23** | 4 | 2 |
| **Saflager™ S-189** | 2 | 1 |
| **Saflager™ W 34/70** | 2 | 1 |



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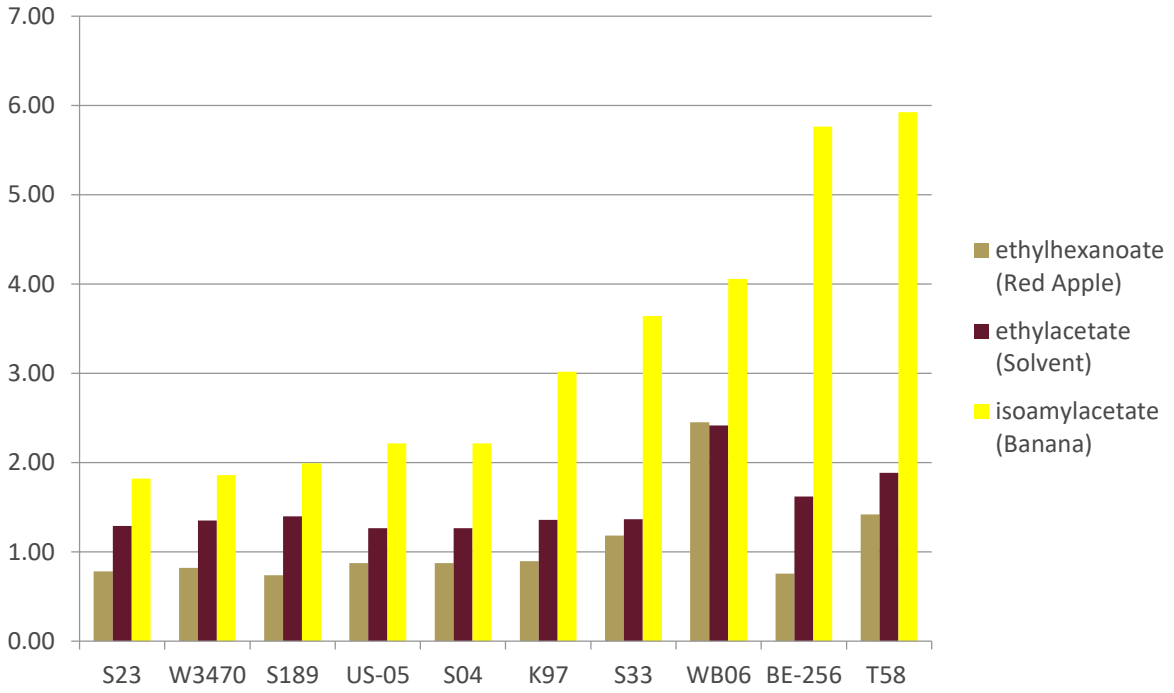
# FRUITY CHARACTER

## ESTERS (ODOR UNIT)



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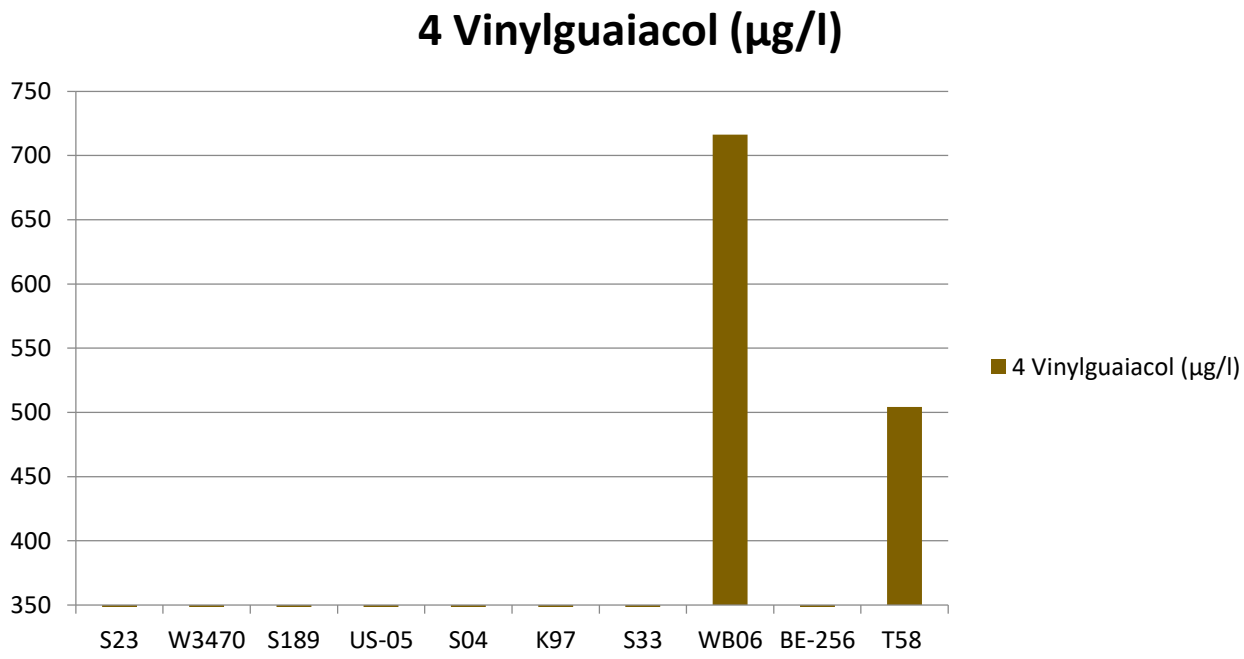
# PHENOLICS

## 4VG




Baseline



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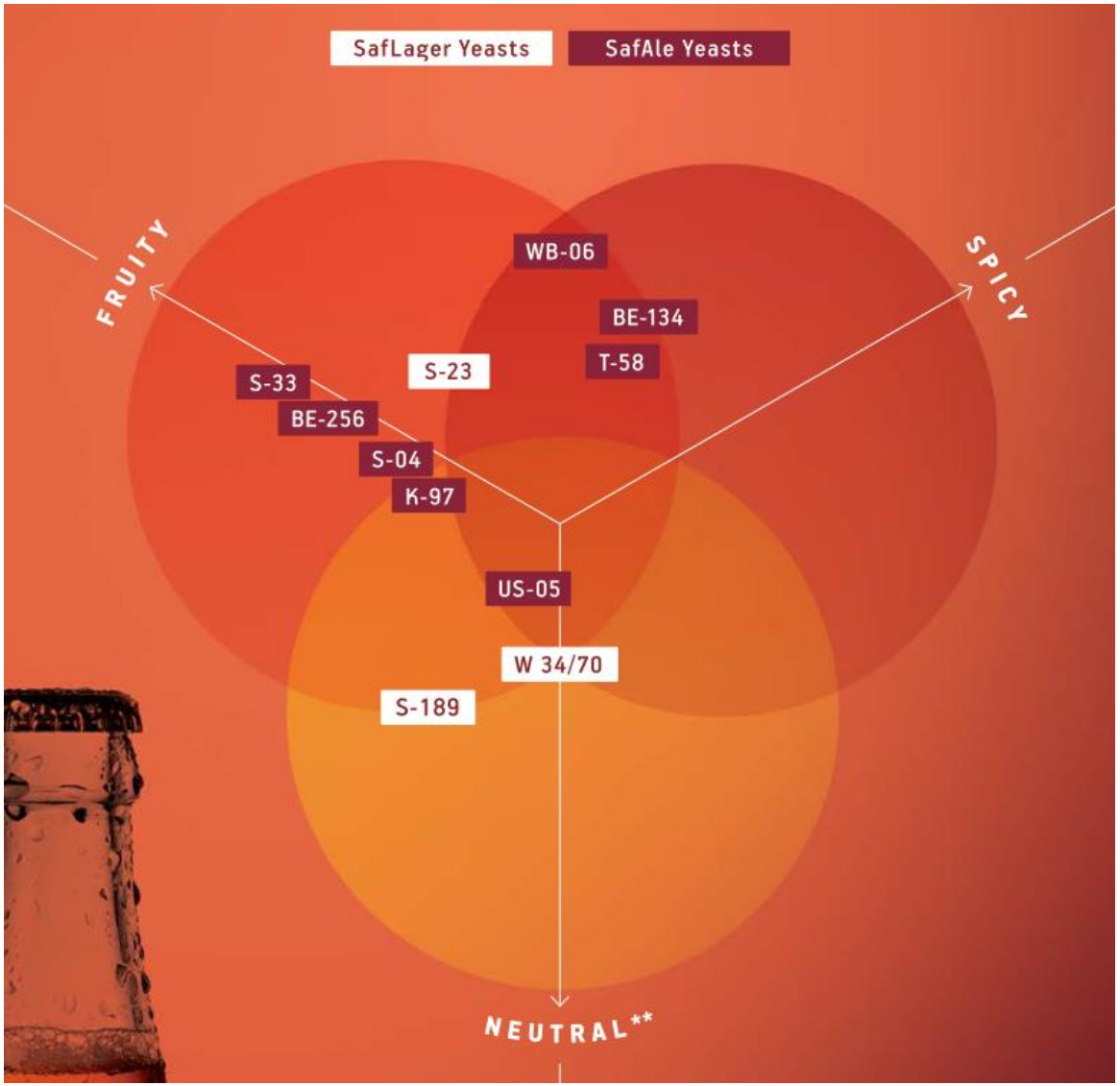
# FLAVOR PROFILES



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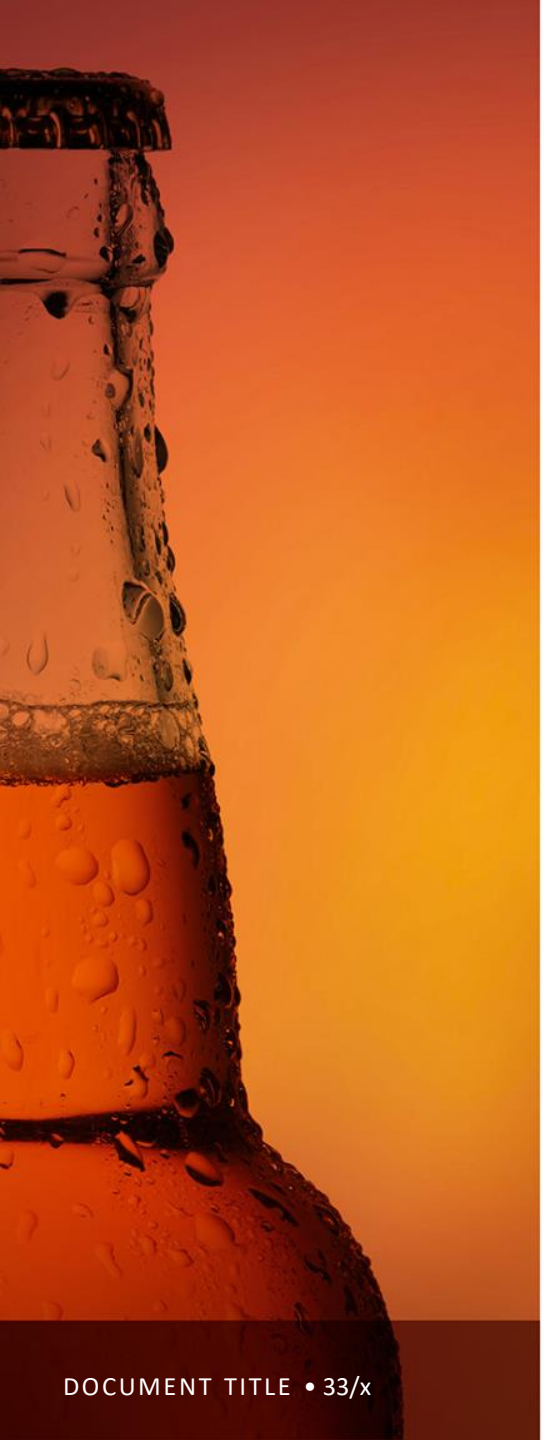

# DIASTATICUS!!!

Functionality

Risks

Hypothetical



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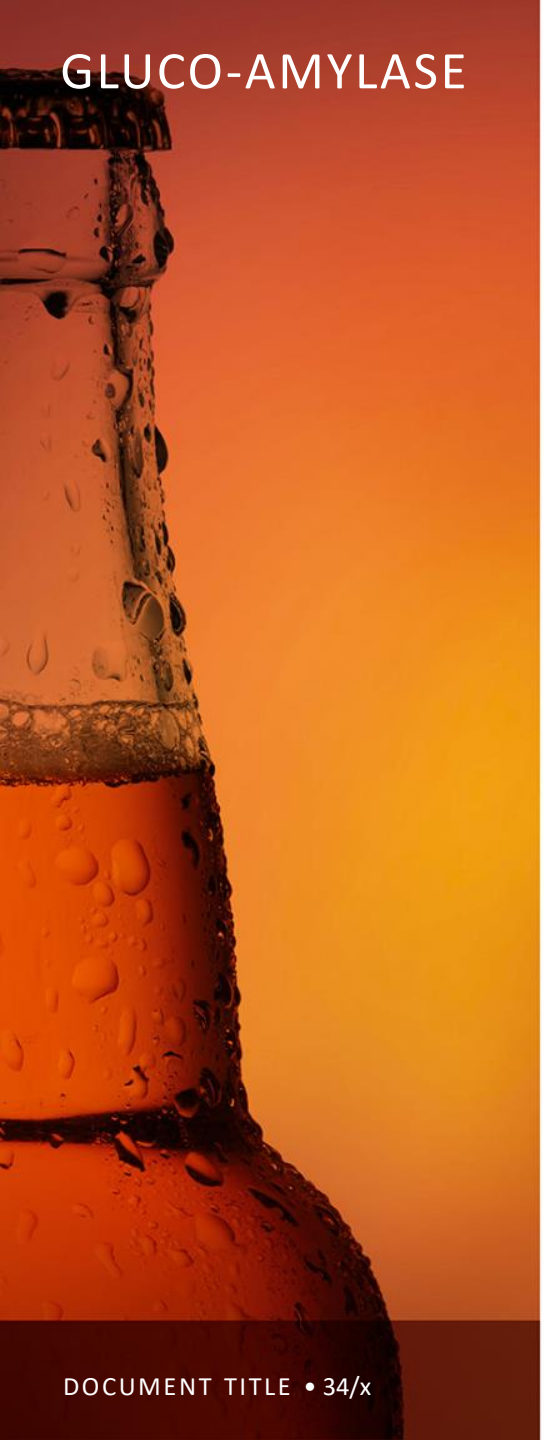
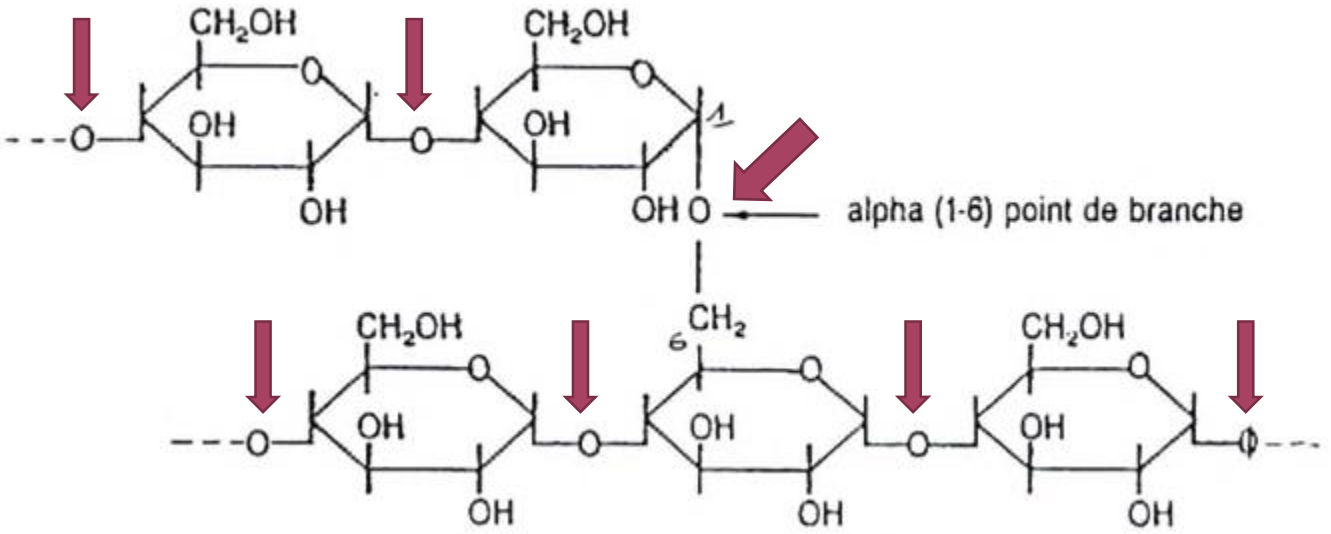
# GLUCO-AMYLASE



- GA HYDROLYZE 1,4 AS WELL AS 1,6-ALPHA-LINKAGES IN AMYLOSE AND AMYLOPECTIN
- PH: OPTIMUM 4-5
- T°: OPTIMUM 55°C

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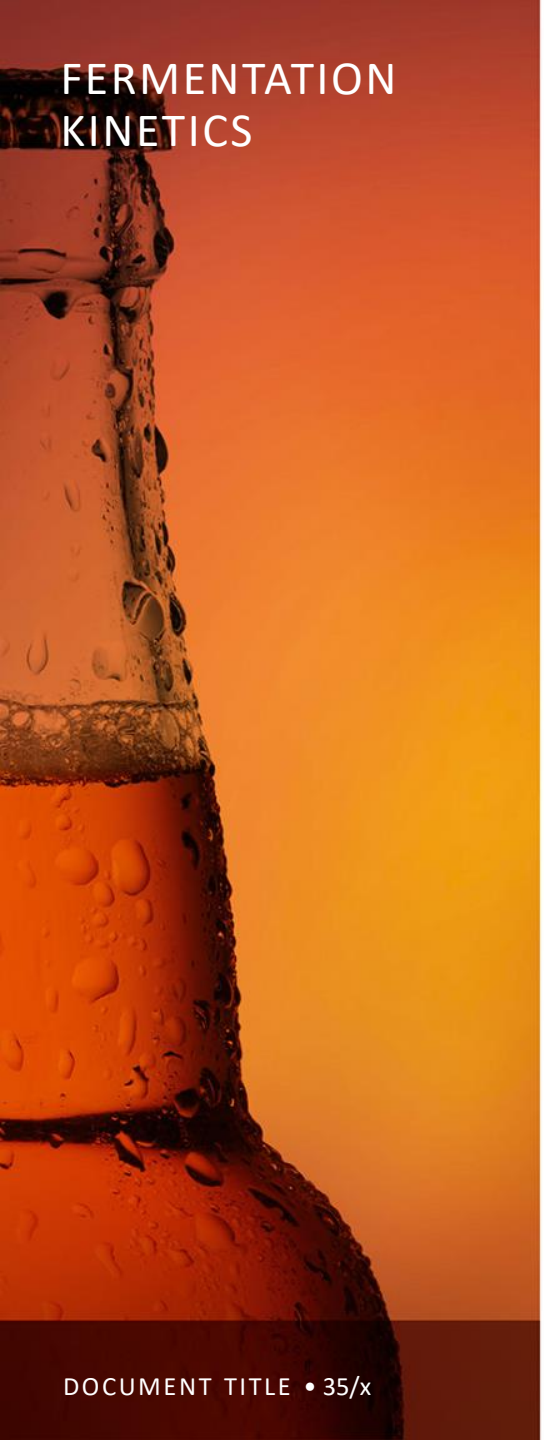
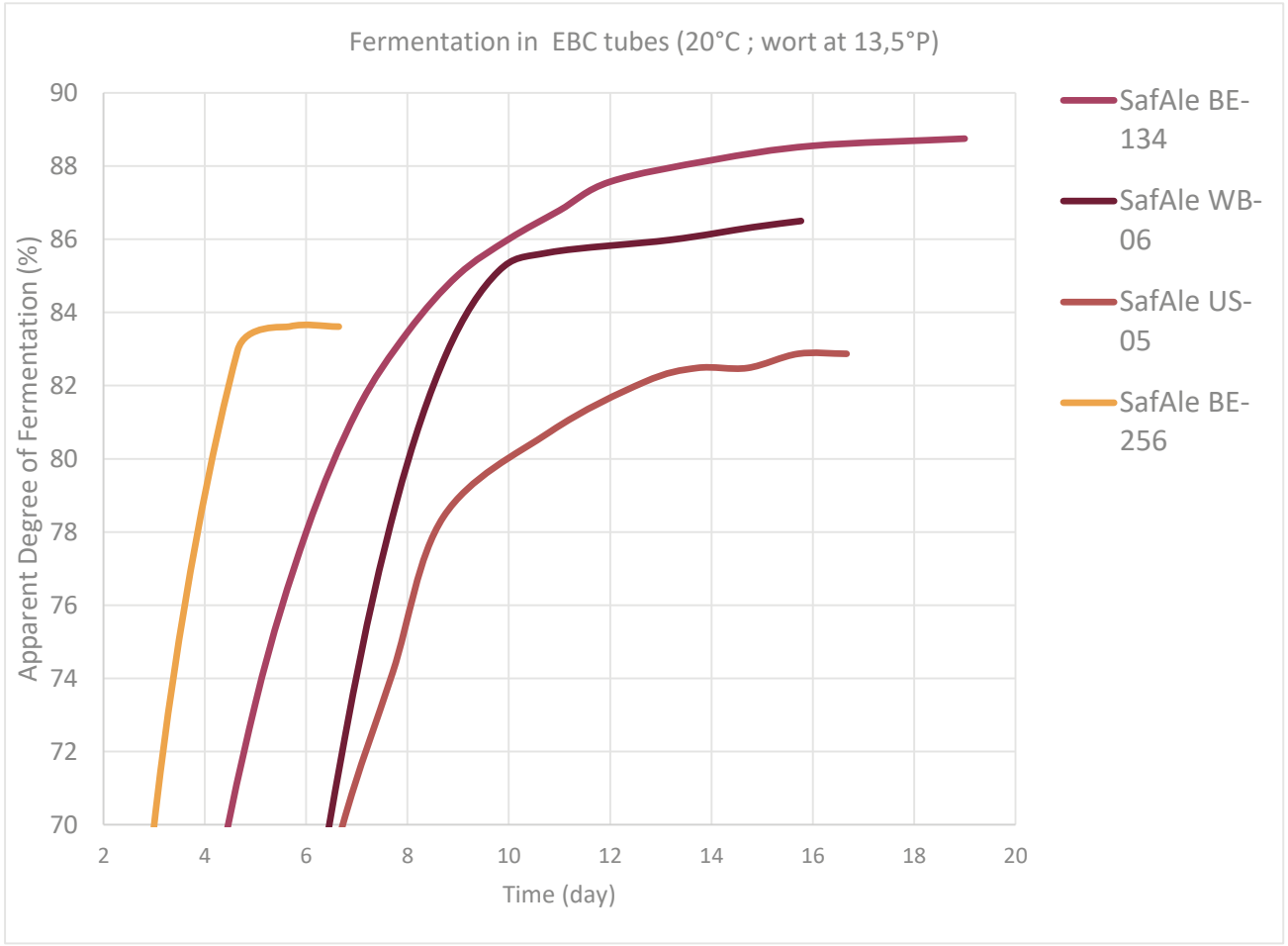
# FERMENTATION KINETICS





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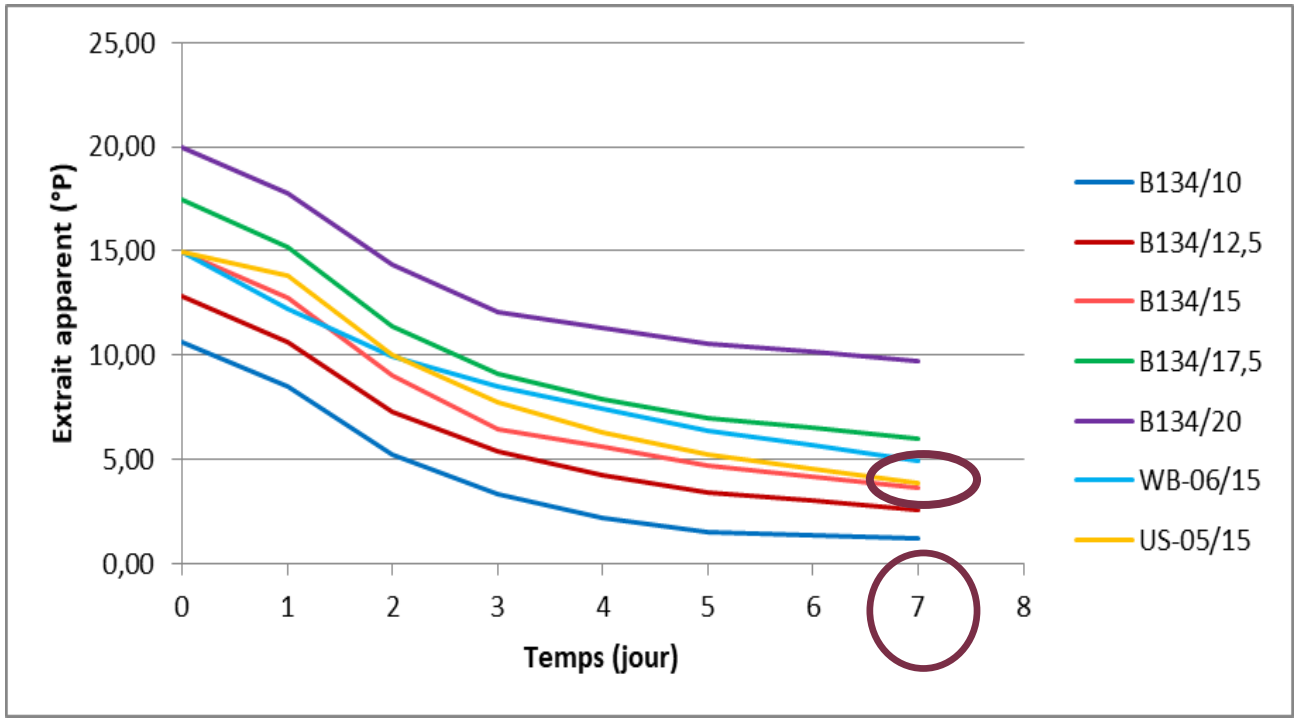
# @ DAY 7



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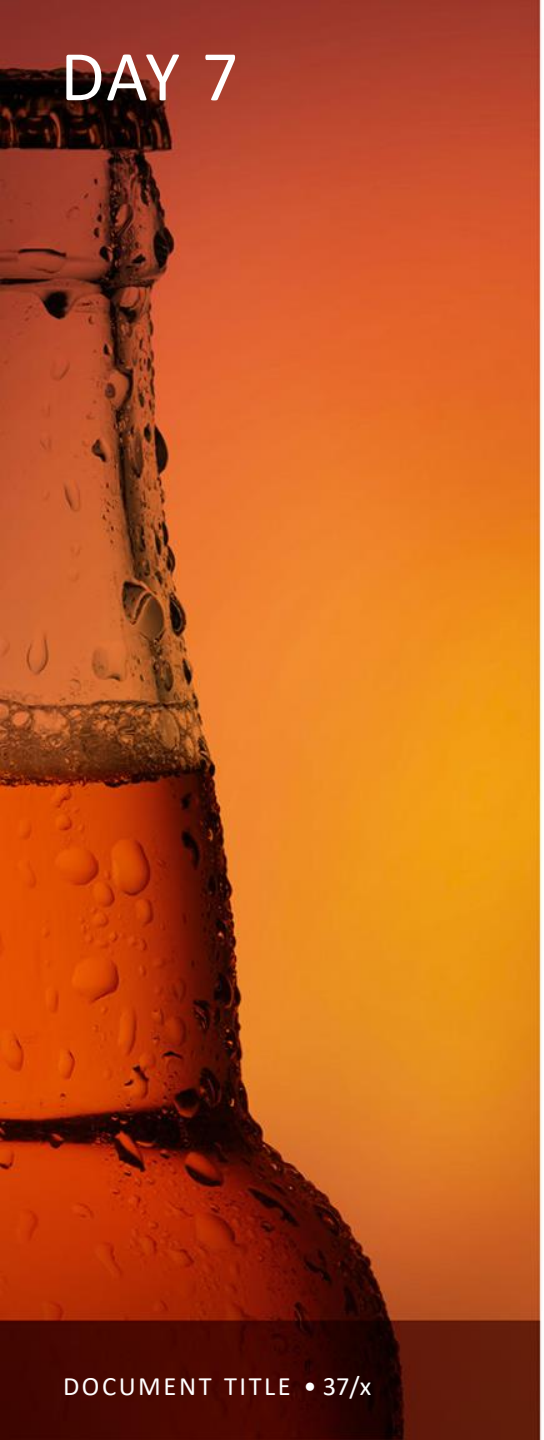
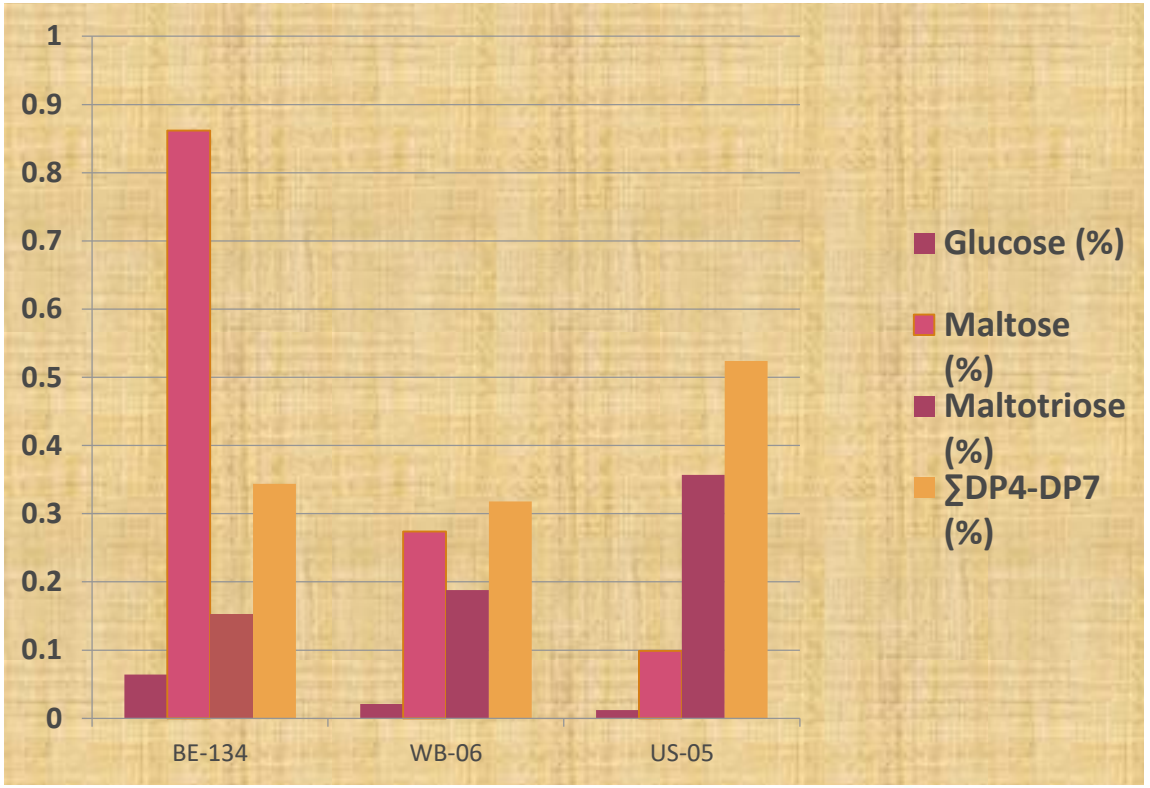



# YEAST COMPARISON: RESIDUAL SUGARS

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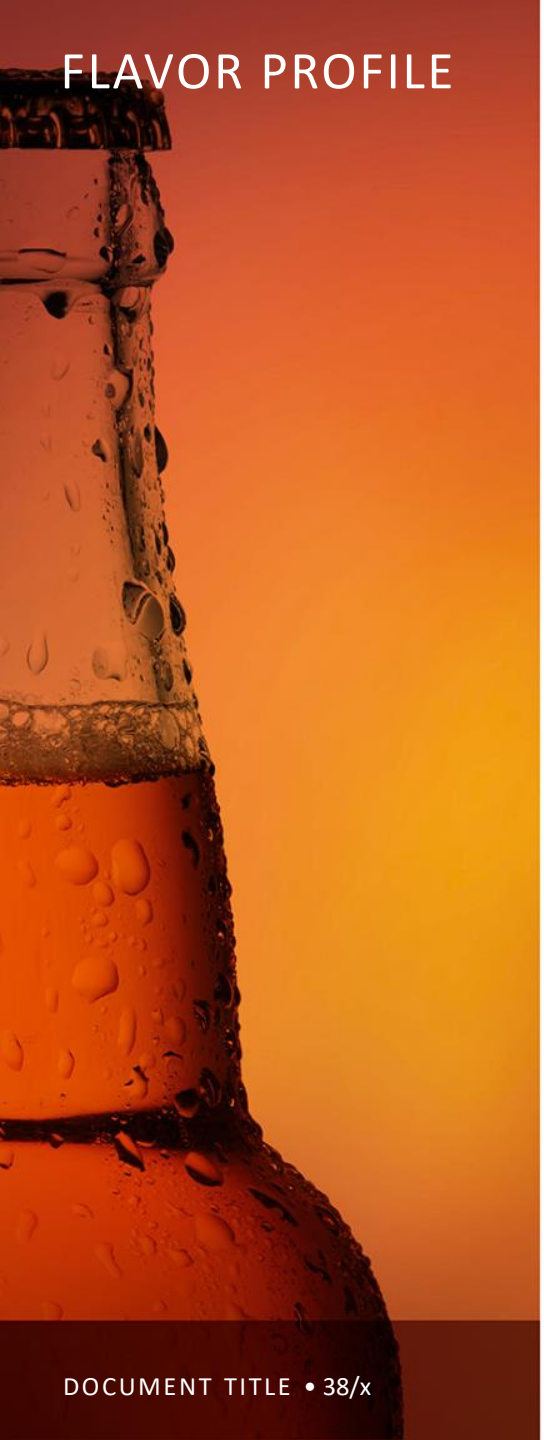
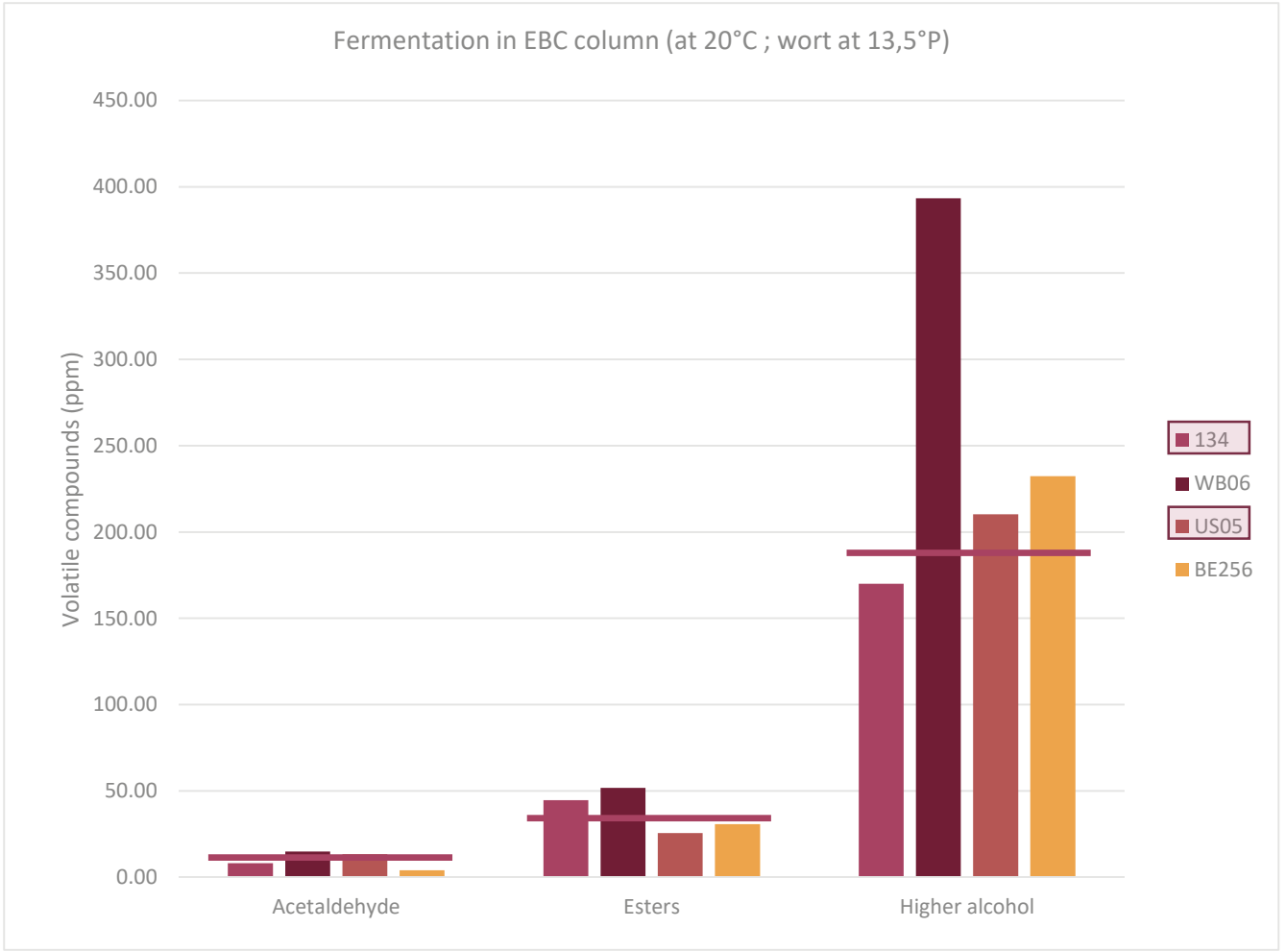
# FLAVOR PROFILE



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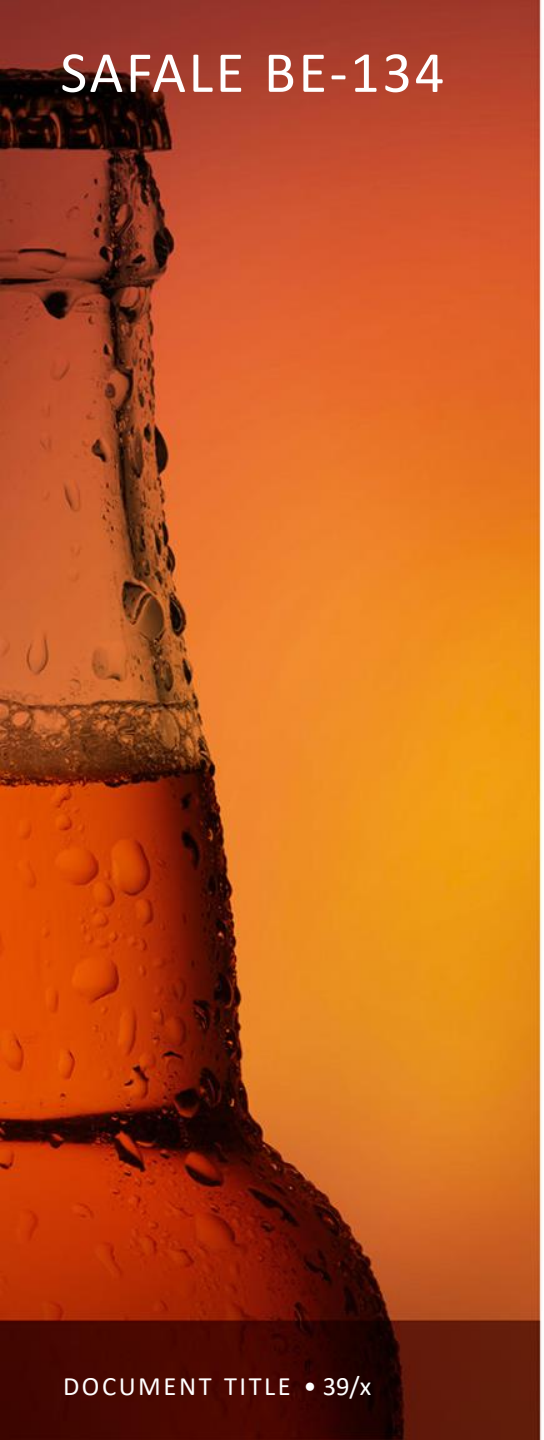
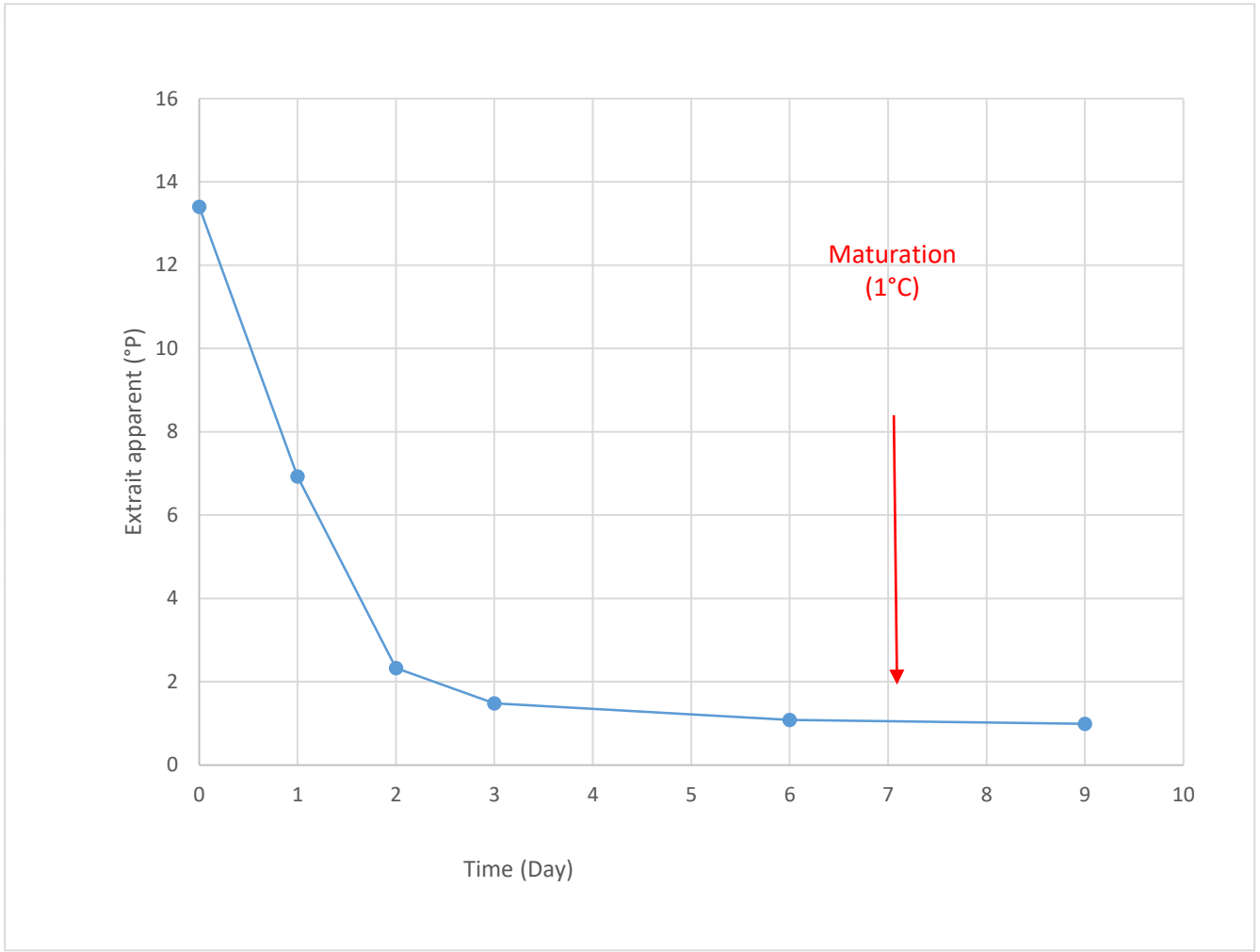
# SAFALE BE-134



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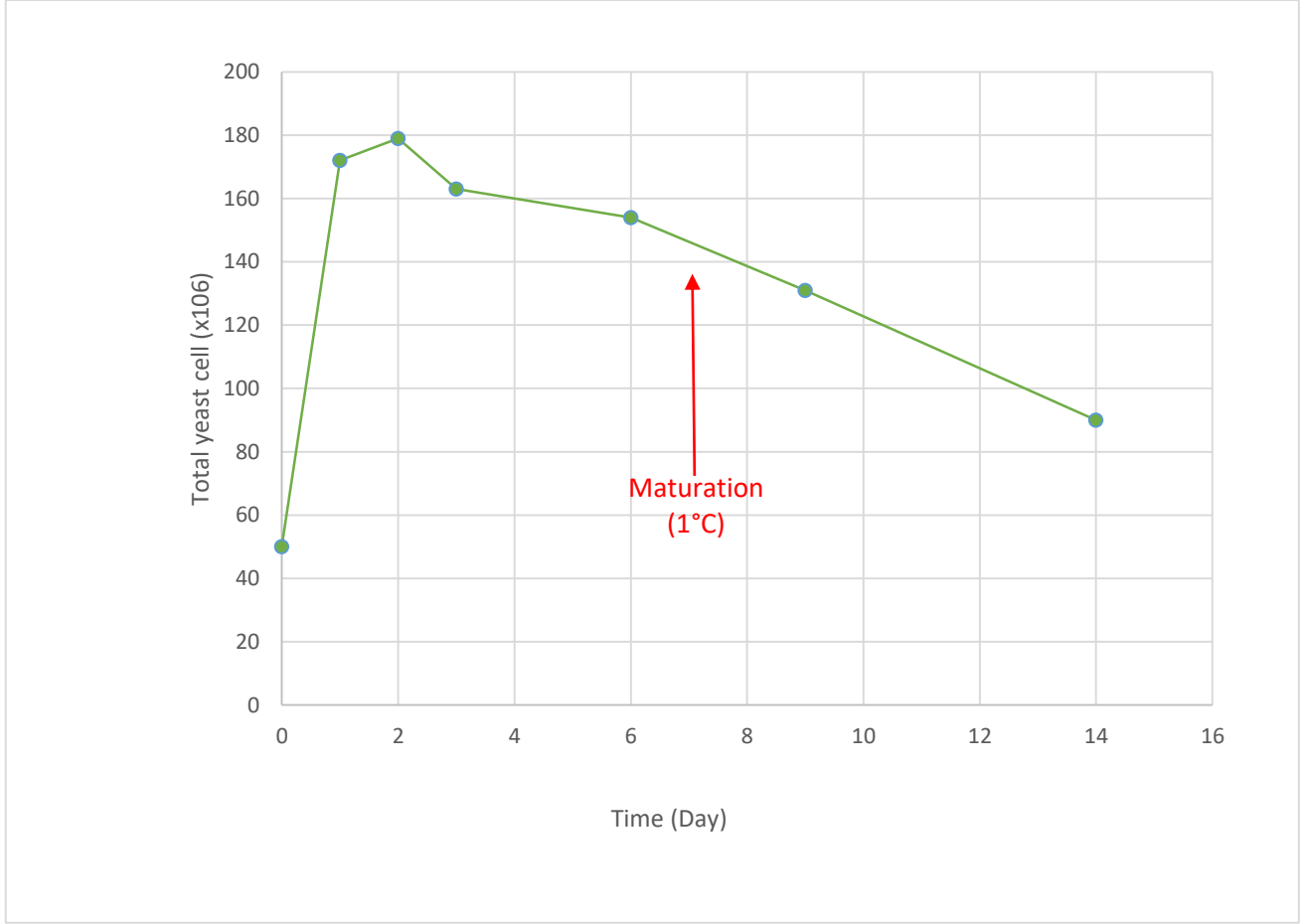
# CELL COUNT – BE-134



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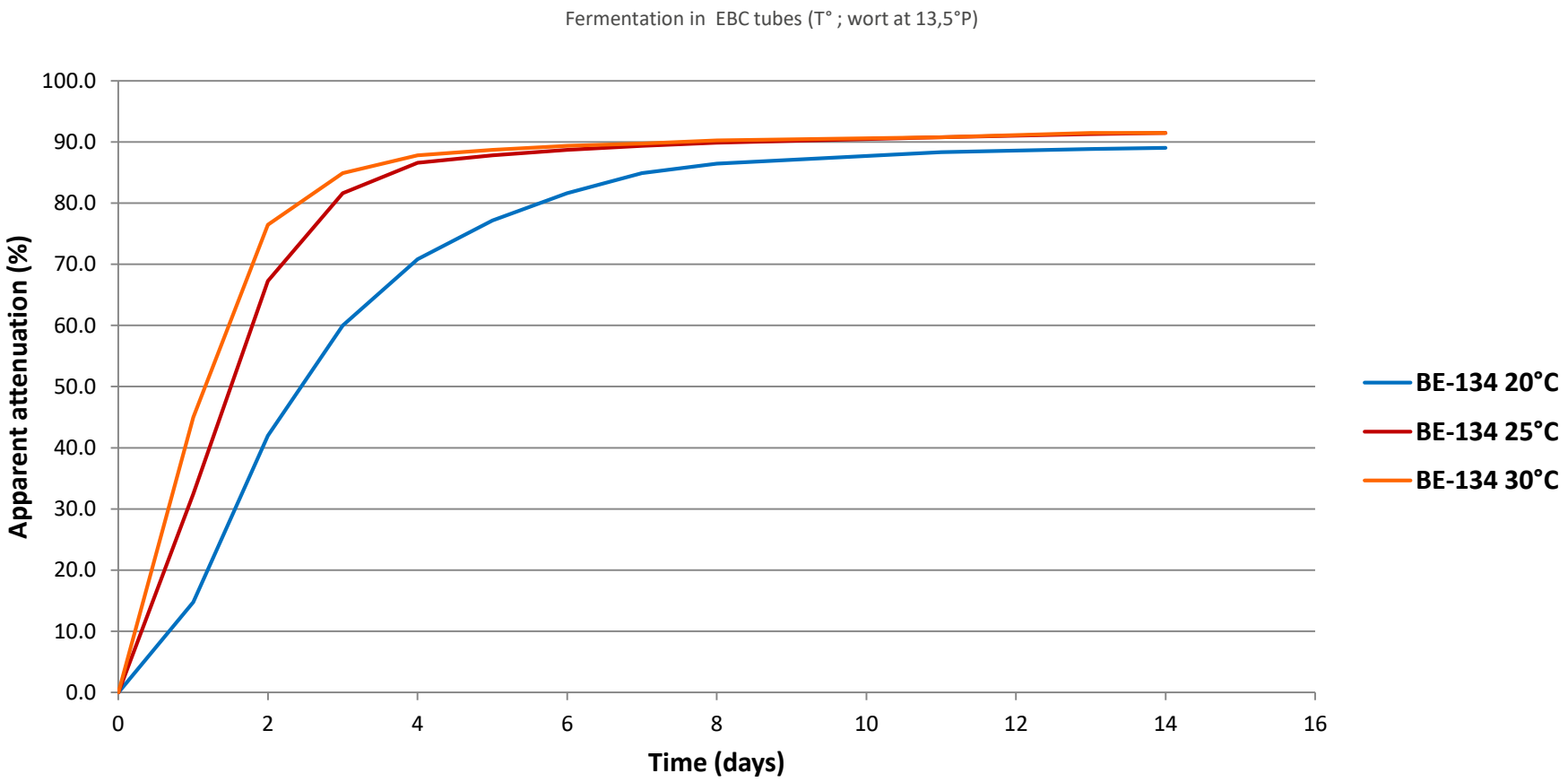
# YEAST COMPARISON: KINETIC BE-134



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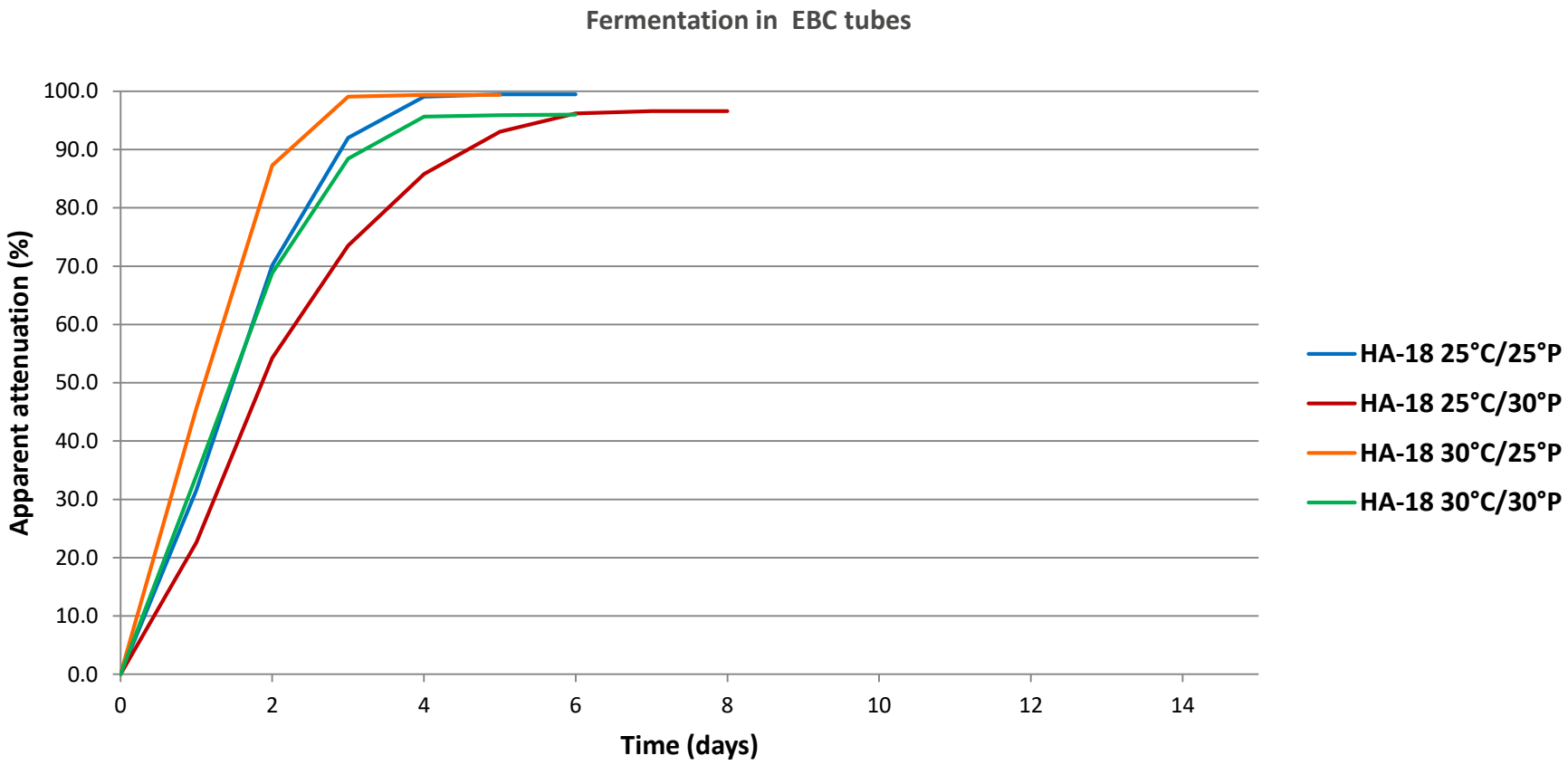
# CONDITIONS COMPARISON: KINETIC HA-18



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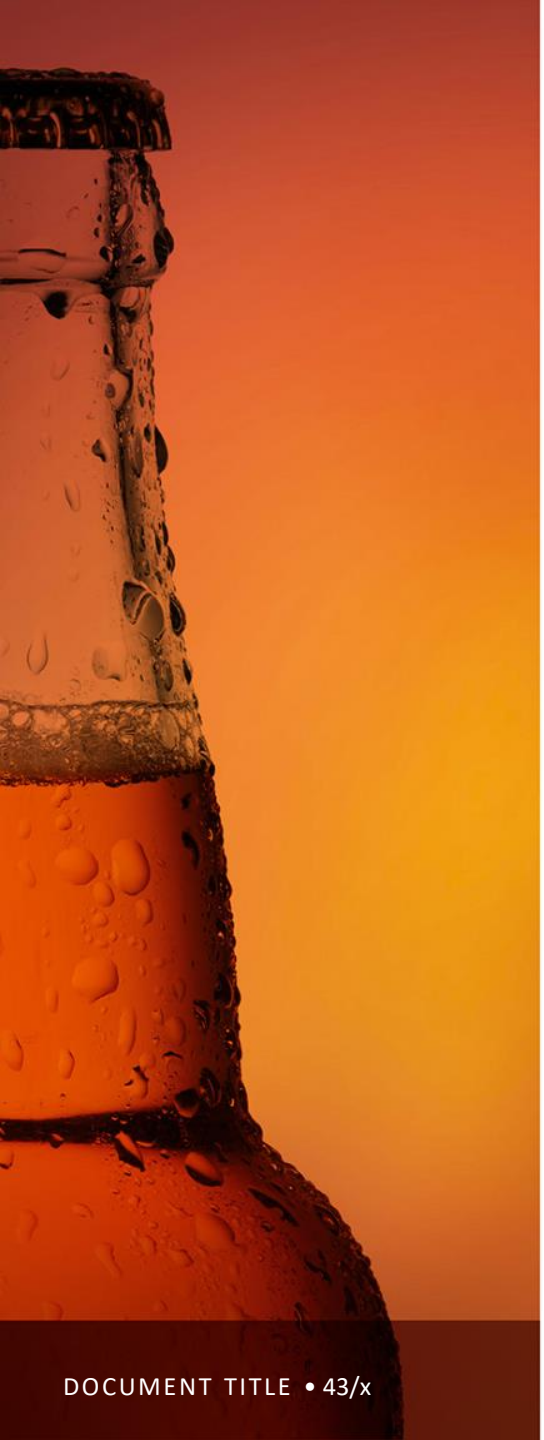

# THEORETICAL SCENARIO

S. cerevisiae and
var. diastaticus



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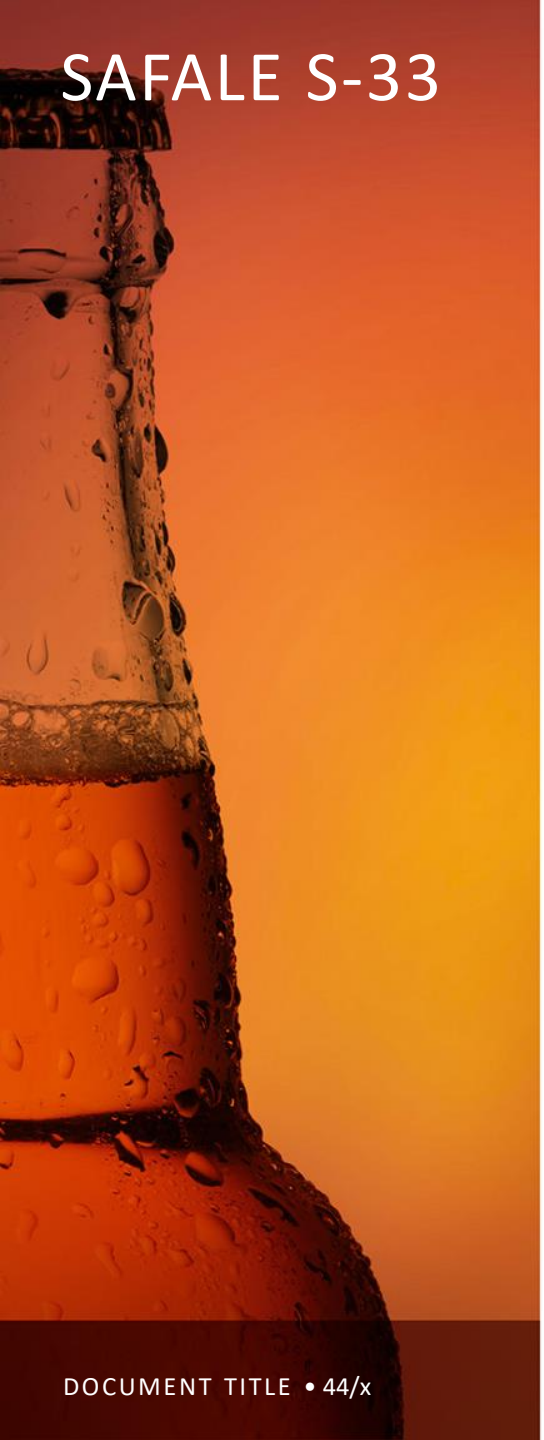
# SAFALE S-33



| | Maltotriosa (g/L) inicial | Maltotriosa (g/L) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| S 33 13,5° | 12.70 | 7.64 | 5.06 | 39.8% | 2.59 |
| S 33 18° | 14.60 | 12.16 | 2.44 | 16.7% | 1.25 |
| S 33 17,5+5° | 16.21 | 16.33 | -0.12 | -0.7% | -0.06 |
| S 33 22,5° | 15.12 | 13.10 | 2.02 | 13.4% | 1.03 |

| | Maltosa (g/L) inicial | Maltosa (g/L) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| S 33 13,5° | 69.76 | 7.64 | 62.12 | 89.0% | 31.74 |
| S 33 18° | 93.43 | 10.16 | 83.27 | 89.1% | 42.55 |
| S 33 17,5+5° | 87.32 | 9.33 | 77.99 | 89.3% | 39.85 |
| S 33 22,5° | 117.74 | 13.10 | 104.64 | 88.9% | 53.47 |

| | Sacarosa (g/L) inicial | Sacarosa (g/L) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| S 33 13,5° | 4.78 | 1.20 | 3.58 | 74.9% | 1.83 |
| S 33 18° | 6.56 | 2.34 | 4.22 | 64.3% | 2.16 |
| S 33 17,5+5° | 54.12 | 1.09 | 53.03 | 98.0% | 27.10 |
| S 33 22,5° | 8.31 | 5.99 | 2.32 | 27.9% | 1.19 |

| | Monosacáridos (g/l) inicial | Monosacáridos (g/l) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| S 33 13,5° | 17.66 | - | 17.66 | 100.0% | 9.02 |
| S 33 18° | 22.95 | - | 22.95 | 100.0% | 11.73 |
| S 33 17,5+5° | 19.57 | - | 19.57 | 100.0% | 10.00 |
| S 33 22,5° | 28.57 | - | 28.57 | 100.0% | 14.60 |

| | Azúcares totales (g/L) inicial | Azúcares totales (g/L) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| S 33 13,5° | 104.90 | 16.48 | 88.42 | 84.3% | 45.18 |
| S 33 18° | 137.54 | 24.66 | 112.88 | 82.1% | 57.68 |
| S 33 17,5+5° | 177.22 | 26.75 | 150.47 | 84.9% | 76.89 |
| S 33 22,5° | 169.74 | 32.19 | 137.55 | 81.0% | 70.29 |



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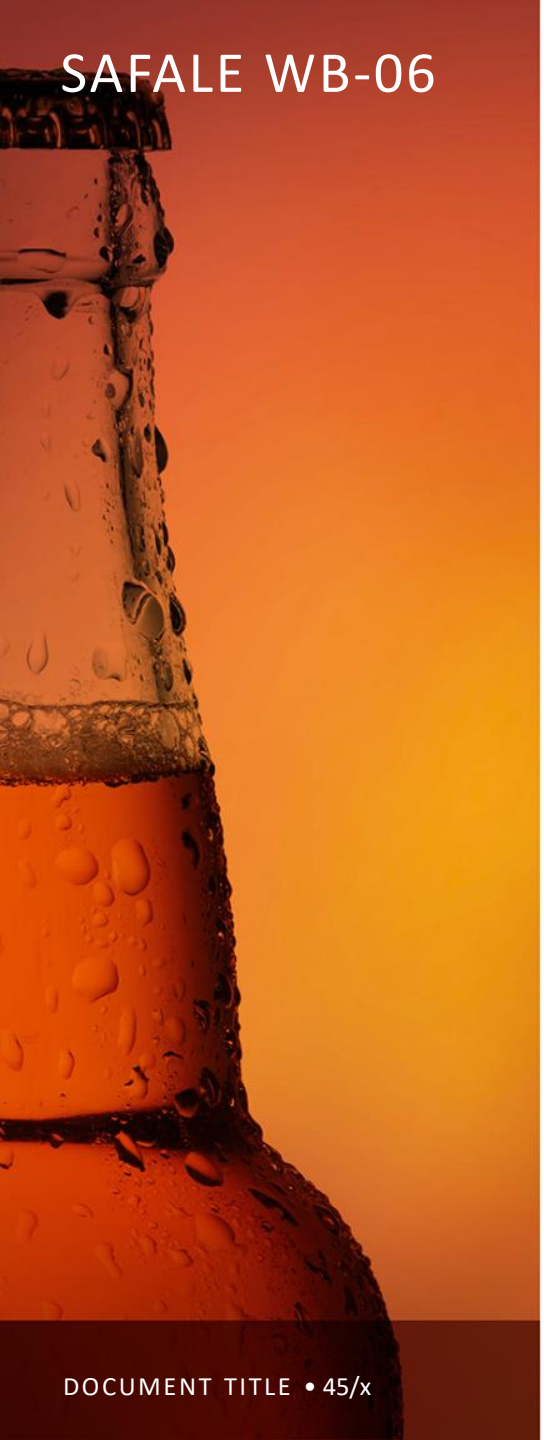
# SAFALE WB-06



| | Maltotriosa (g/L) inicial | Maltotriosa (g/L) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| WB 06 13,5° | 12.03 | - | 12.03 | 100.0% | 6.15 |
| WB 06 18° | 13.03 | - | 13.03 | 100.0% | 6.66 |
| WB 06 17,5+5° | 15.44 | 5.45 | 9.99 | 64.7% | 5.10 |
| WB 06 22,5° | 17.11 | - | 17.11 | 100.0% | 8.74 |

| | Maltosa (g/L) inicial | Maltosa (g/L) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| WB 06 13,5° | 72.14 | - | 72.14 | 100.0% | 36.86 |
| WB 06 18° | 92.73 | - | 92.73 | 100.0% | 47.39 |
| WB 06 17,5+5° | 88.45 | - | 88.45 | 100.0% | 45.20 |
| WB 06 22,5° | 113.54 | - | 113.54 | 100.0% | 58.02 |

| | Sacarosa (g/L) inicial | Sacarosa (g/L) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| WB 06 13,5° | 5.17 | - | 5.17 | 100.0% | 2.64 |
| WB 06 18° | 6.56 | - | 6.56 | 100.0% | 3.35 |
| WB 06 17,5+5° | 53.87 | - | 53.87 | 100.0% | 27.53 |
| WB 06 22,5° | 7.74 | - | 7.74 | 100.0% | 3.96 |

| | Monosacáridos (g/l) inicial | Monosacáridos (g/l) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| WB 06 13,5° | 19.12 | - | 19.12 | 100.0% | 9.77 |
| WB 06 18° | 21.26 | - | 21.26 | 100.0% | 10.86 |
| WB 06 17,5+5° | 18.85 | - | 18.85 | 100.0% | 9.63 |
| WB 06 22,5° | 23.08 | - | 23.08 | 100.0% | 11.79 |

| | Azúcares totales (g/L) inicial | Azúcares totales (g/L) final | Consumo (g/L) | % de utilización | Alcohol potencial (g/L) |
|---|---|---|---|---|---|
| WB 06 13,5° | 108.46 | - | 108.46 | 100.0% | 55.42 |
| WB 06 18° | 133.58 | - | 133.58 | 100.0% | 68.26 |
| WB 06 17,5+5° | 176.61 | 5.45 | 171.16 | 96.9% | 87.46 |
| WB 06 22,5° | 161.47 | - | 161.47 | 100.0% | 82.51 |



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# MOST FERMENTIS STRAINS

Ales

13,5 - 18°P

| | Maltose | Maltotriose | Sacarose |
|---|---|---|---|
| S-04 | +++++ | ++ | +++ |
| US-05 | ++++++ | ++++ | +++++ |
| K-97 | ++++++ | +++++ | +++ |
| T-58 | +++++ | ++ | ++++ |
| S-33 | +++++ | ++ | +++ |
| WB-06 | ++++++ | ++++++ | ++++++ |

22,5 °P

| | Maltose | Maltotriose | Sacarose |
|---|---|---|---|
| S-04 | +++++ | + | +++++ |
| US-05 | ++++++ | + | +++ |
| K-97 | +++++ | +++++ | ++++++ |
| T-58 | +++++ | + | ++++ |
| S-33 | +++++ | + | ++ |
| WB-06 | ++++++ | ++++++ | ++++++ |

17,5+5°P

| | Maltose | Maltotriose | Sacarose |
|---|---|---|---|
| S-04 | +++++ | + | +++++ |
| US-05 | +++++ | + | ++++++ |
| K-97 | +++++ | ++++ | ++++ |
| T-58 | ++++++ | + | ++++++ |
| S-33 | +++++ | + | ++++++ |
| WB-06 | ++++++ | +++ | ++++++ |

Lagers

| | Maltose | Maltotriose | Sacarose |
|---|---|---|---|
| S-23 | ++++++ | ++++ | ++++ |
| S-189 | ++++++ | +++++ | +++++ |
| W 34/70 | ++++++ | +++++ | +++++ |

| | Maltose | Maltotriose | Sacarose |
|---|---|---|---|
| S-23 | ++++++ | ++++ | +++ |
| S-189 | ++++++ | ++++ | +++++ |
| W 34/70 | ++++++ | ++++ | ++++ |

| | Maltose | Maltotriose | Sacarose |
|---|---|---|---|
| S-23 | +++++ | +++ | +++++ |
| S-189 | +++++ | + | ++++++ |
| W 34/70 | +++++ | + | ++++++ |

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Thank you for your attention!

Any questions?

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