Thiols Biotransformation and SafLager™ SH-45

Karlovac University of Applied Sciences 27. March. 2026

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Fermentis Area sales Manager

Headquarters (Lille)

Today, Lesaffre is...

TURNOVER

2.2 billion euros

EMPLOYEES

10,700

+ 70 nationalities

PRODUCTION SITES

69

in the world

1 bread out of 3 in the world made with Lesaffre yeast

APPLIED SCIENCE CENTERS

59

47 Baking Center™,
5 Culinary centers - Biospringer,
3 Fermentation nutrients labs - Procelys,
1 The Farm - Phileo,
1 Plant Care Center - Agrauxine,
1 Powder Studio® - LIS,
1 Green lab - Leaf.

R&D

10 CENTERS

570 EXPERTS

LESAFFRE IS BASED IN

+50 countries

OUR PRODUCTS ARE DISTRIBUTED IN

185 countries

+ 165 years

OF KNOW-HOW

Our fermentation know-how serves
4 business sectors...

Fermentis

FERMENTIS ACADEMY





We support the world of fermented beverages:

beer, wine, spirits, cider, neutral alcohol base, mead, coffee, ...

Yeasts, Bacteria, Yeast derivatives & Services:

Fermentis Campus & Improved Yeast Plant (Toll manufacturing)

Fermentis by Lesaffre

Yeast production (production plant Ghent)

- Belgium
- Mexico
- France
- Poland
- Chile

Fermentis Campus

- Fermentis HQ – Lille, France
- Global Presence- 120 country
- Applied Research

Fermentis Campus-Pilot plant

FERMENTIS ACADEMY

Fermentis by Lesaffre

Fermentis Academy

PROCESS CONTROL LABS

Fermentis Academy

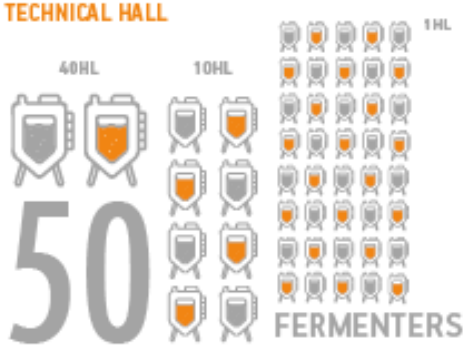
SENSORY ANALYSIS LAB

Fermentis Academy

APPLIED RESEARCH FACILITIES: BREWERY & LABS

FERMENTIS ACADEMY

TECHNICAL HALL



1 KASPAR SCHULZ BREWHOUSE

4 Hop dosing systems
1 Schulz hop rocket
Semi-automated system with one control center.

2  OPEN FERMENTERS 10HL

 HAMMER MILL

 MEURA 2001 MASH FILTER

 KEG LINE

 BARREL CAPACITY AGING ROOM

 BOTTLING LINE

PHYSICO CHEMISTRY LAB

 DENSITY METER

 ALCOLYZER

 CO_2/O_2 METER

MICROBIOLOGY LAB

 LAMINAR FLOW CABINET

 PLATING

 MICROSCOPE

SENSORY LAB

SENSORY ANALYSIS TASTING ROOM

17  BOXES AUTOMATIC & INDIVIDUAL

PREPARATION ROOM

+50 TRAINED **PANELISTS**

 **PRO** GLASSES

Content

Biotransformation

In beer brewing, *biotransformation* typically refers to **biological action by yeast** on flavor or aroma compounds, particularly from **hops** or other base ingredients, to **transform** into a **different molecule** with varying levels of intensities and **sensory characteristics**. It is a flavor active molecular centric process.

Review Paper Recommendation as Primer

Cerevisia 36 (2012) 125–132

Contents lists available at SciVerse ScienceDirect

Cerevisia

journal homepage: www.elsevier.com/locate/cerevisia and www.cerevisia.eu

Biotransformations of hop-derived aroma compounds by *Saccharomyces cerevisiae* upon fermentation

Tatiana Praet*, Filip Van Opstaele, Barbara Jaskula-Goiris, Guido Aerts, Luc De Cooman

KAHO St.-Lieven, Association K.U.Leuven, Department of Microbial and Molecular Systems (M2S), Leuven Food Science and Nutrition Research Centre (LFoRCe), Laboratory of Enzyme, Fermentation and Brewing Technology, Technology Campus, Gent, Belgium

What is the aroma potential of the hop?

The free aromatics hop compounds

All the hop aromas that are perceivable when extracted in the beer

The beer effect

Some beer aromatic compounds can enhance or decrease hoppy flavour. E.g. 4VG (clove like) will decrease hoppy perception

The yeast power (hidden hop potential)

Some hop compound cannot be perceived in the beer at their initial state. Their aromatic is hidden because they are linked to other molecules.

The hidden potential of hop

There are two families of compounds that can be released from hops:

Thiols:

Main descriptors: passion fruit, citrusy, peach,…

Unperceivable when bound to a cysteine or a glutathione

The ratio between already free and bound thiols depends on hop variety

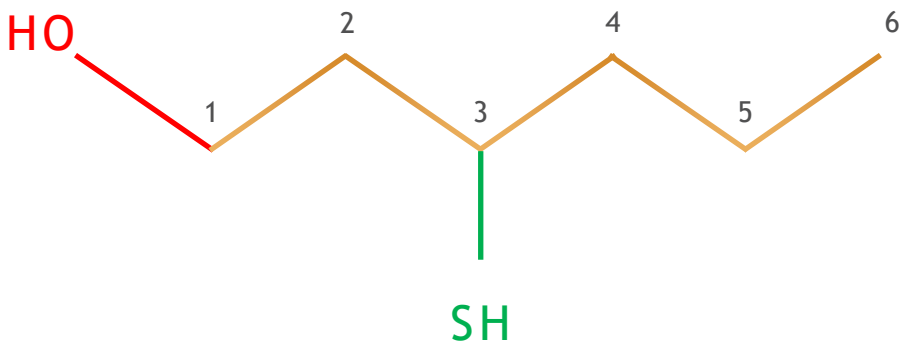
Terpenes:

Main descriptors: floral, rose-like, citrusy

Unperceivable when bound to a sugar chain

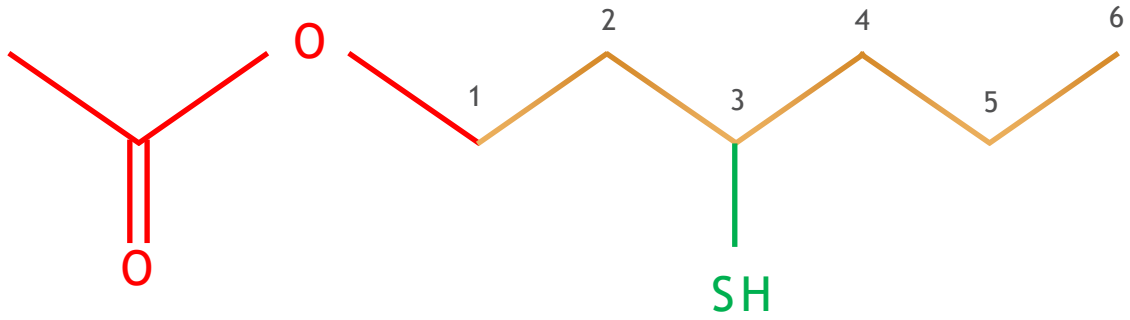
The ratio between already free and bound terpenes depends on hop variety

The Main Two Forms of Free Thiols



The 3-sulfanyl hexan-1-ol

In this thiol, the SH is linked to the 3rd carbon and the OH to the 1st carbon

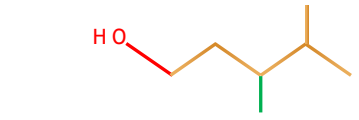
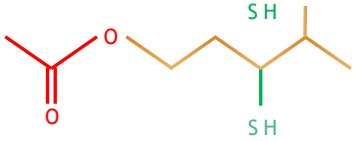
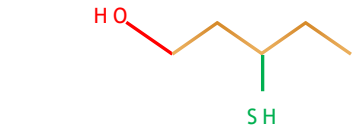


The 3-sulfanyl hexanyl acetate

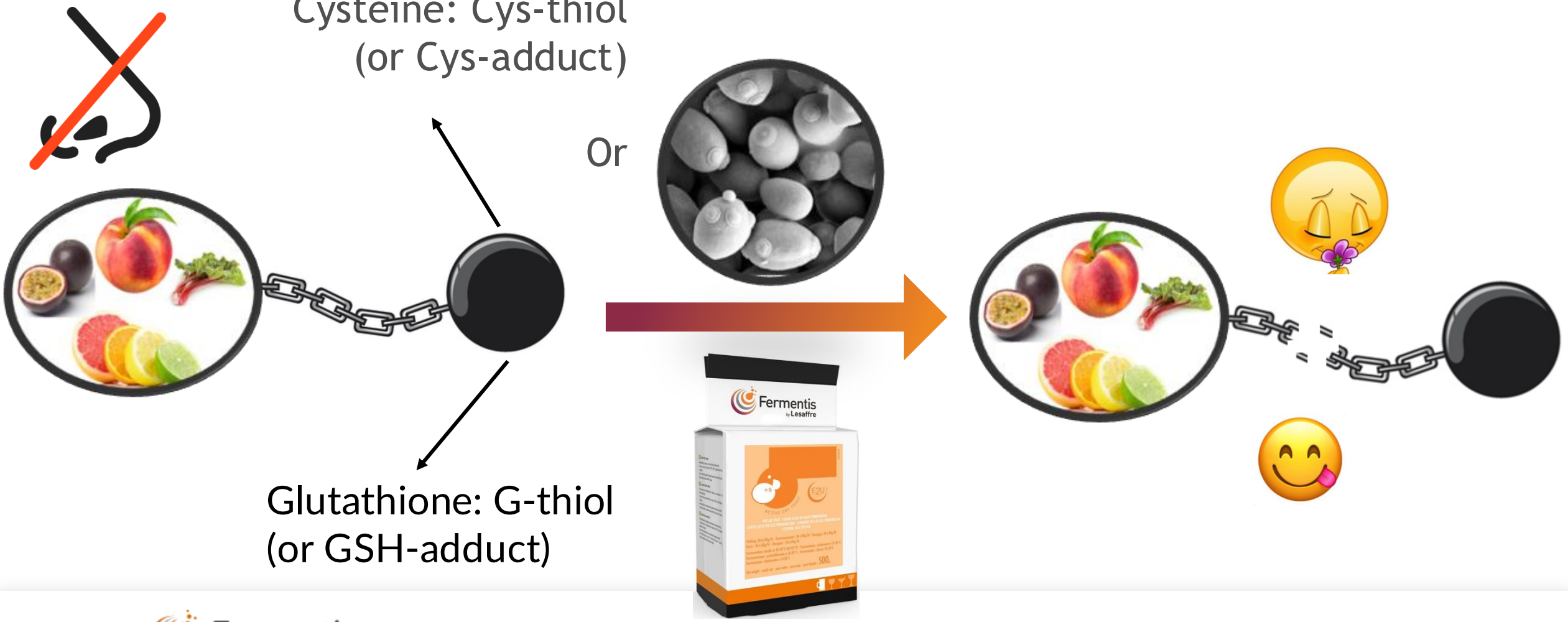
In this thiol, the SH is linked to the 3rd carbon and the acetate to the 1st carbon

The Thiols of This Study

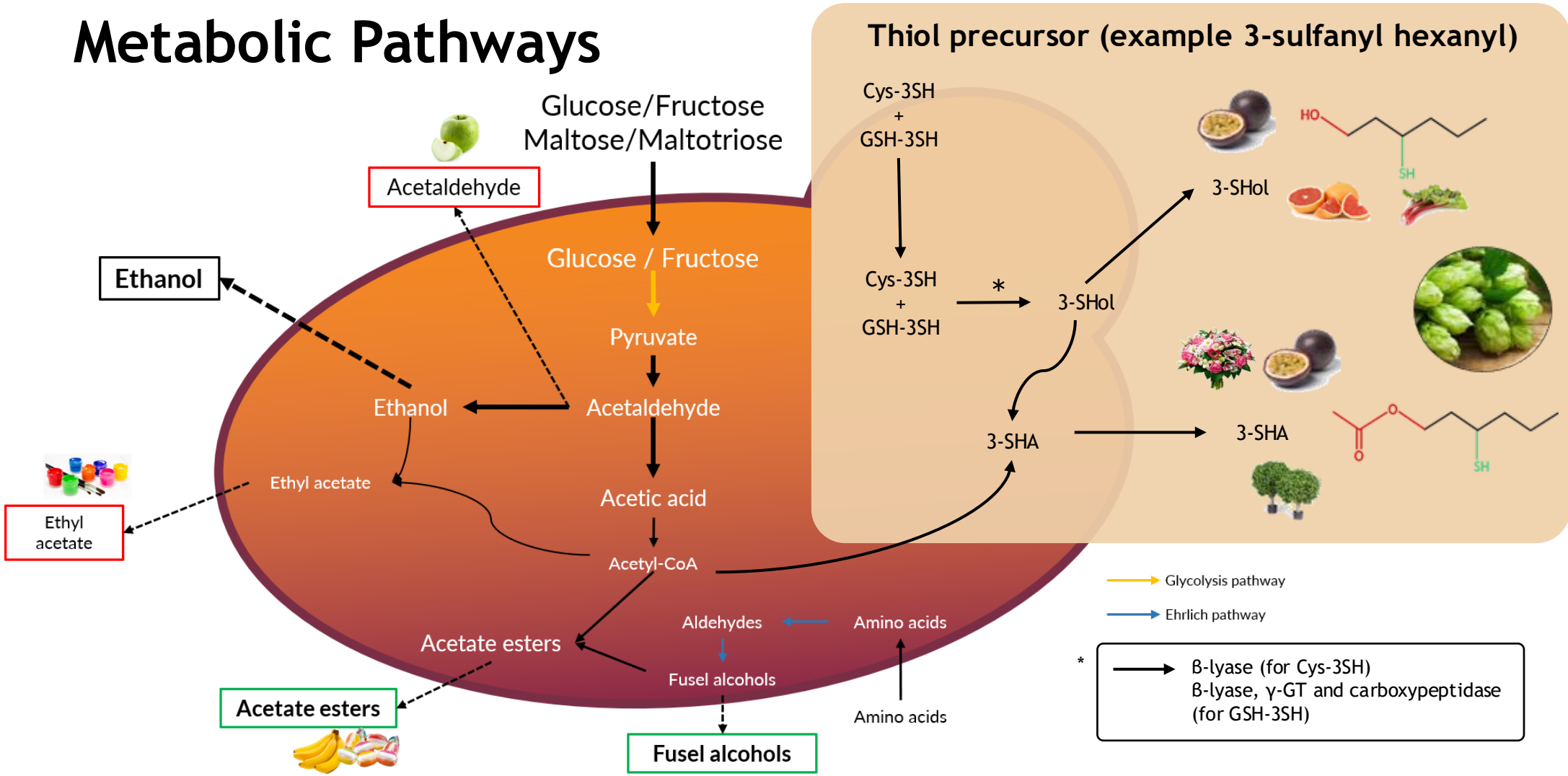
Pairs alcohol & acetate

Name	Structure	Aroma	Threshold (in beer)
3-sulfanylhexan-1-ol **3SHol** (or 3MH)			55 ng/L
3-sulfanylhexyl acetate **3SHA** (or 3MHA)			5 ng/L
3-sulfanyl-4-methylpentan-1-ol **3S4MPol**			70 ng/L
3-sulfanyl-4-methylpentyl acetate **3S4MPA**			160 ng/L
3-sulfanylpentan-1-ol **3SPol**			620 ng/L
3-sulfanylpentyl acetate **3SPA**			TBD

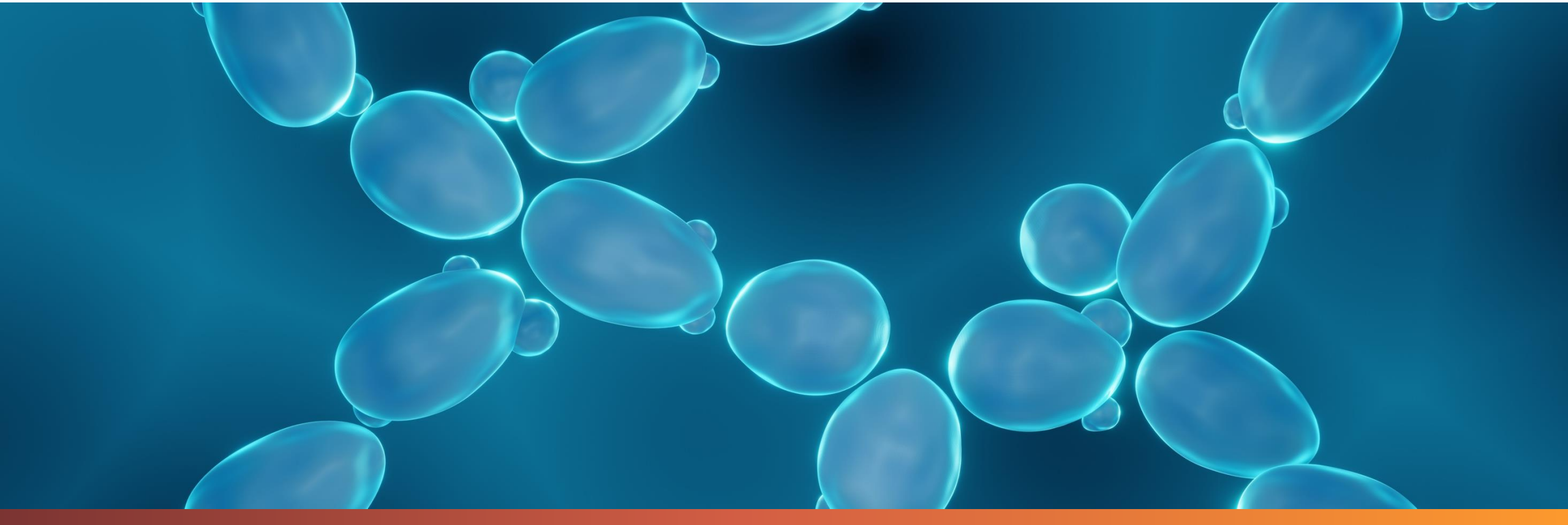
Bound and free thiols



Metabolic Pathways



2 | Biotransformation Trial



Materials and methods

UCLouvain
Louvain Institute of Biomolecular Science and Technology (LIBST)

INBr

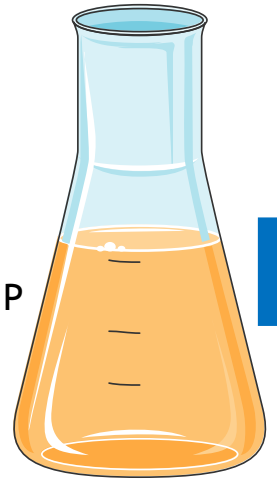
Precursors additions

1. G-3SHol ou Cys-3SHol
2. G-3SPol, 3S4MPol & 3SHol

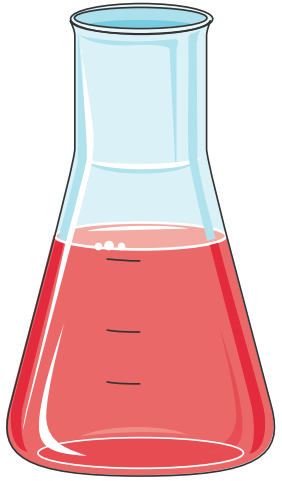
Pitching yeast at 50 g/hL

Each fermentation is with its own yeast strain (Ale, lager)

250 ml of wort at 15 °P



Fermentation
7 days at 24 °C



Maturation
3 days at 4 °C

Final Beer

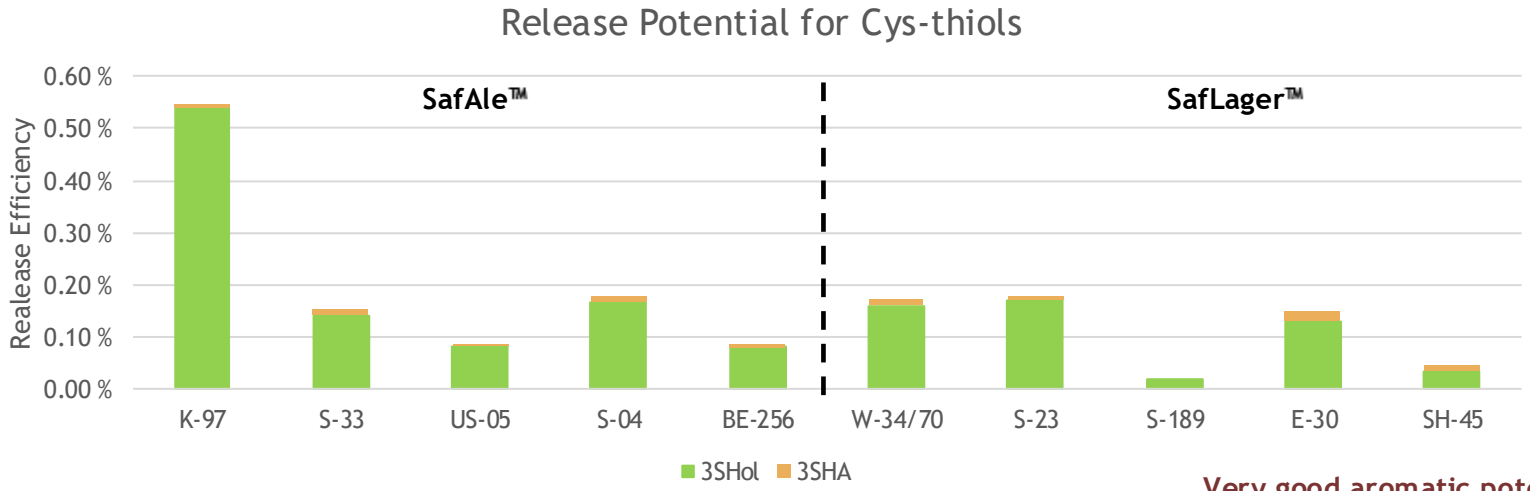
3 Results

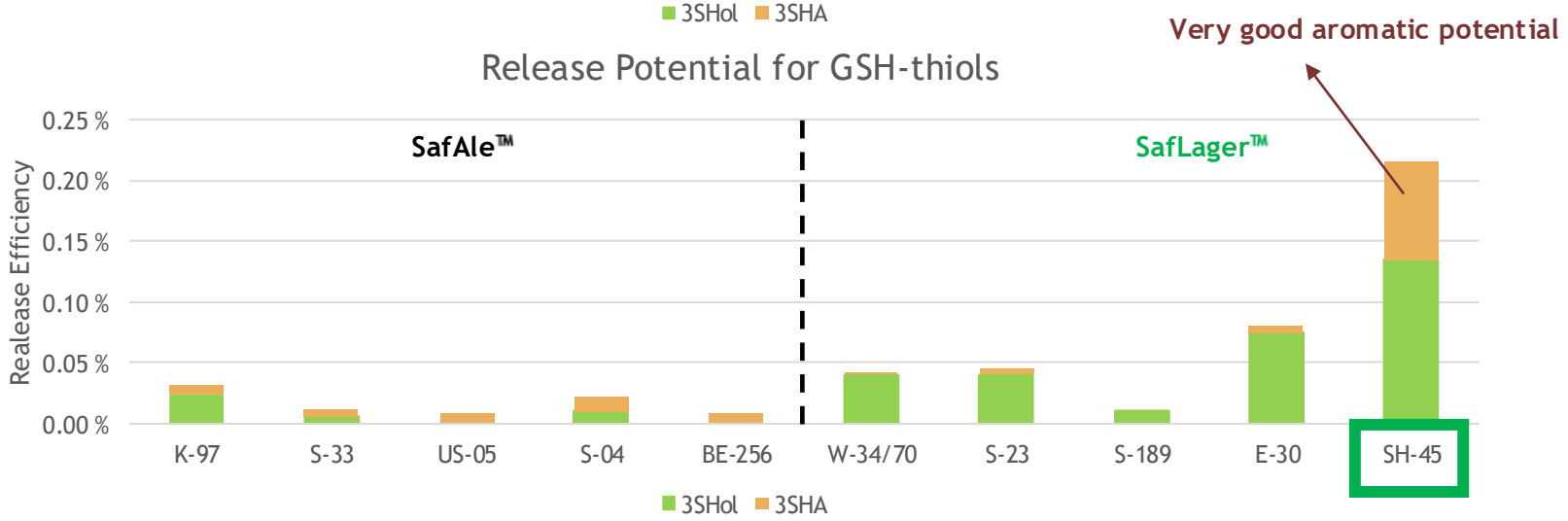
Conversion rate of 3SHol from Cys and GSH Precursors

SafAle™ K-97 = the highest thiol release from Cys-thiols

SafLager™ range is able to release more thiols from glutathionylated precursors than **SafAle™** range

SafLager™ SH-45 and to a lesser extent **SafAle™ S-04** and **SafLager™ E-30** = good ability to esterify the alcohol forms

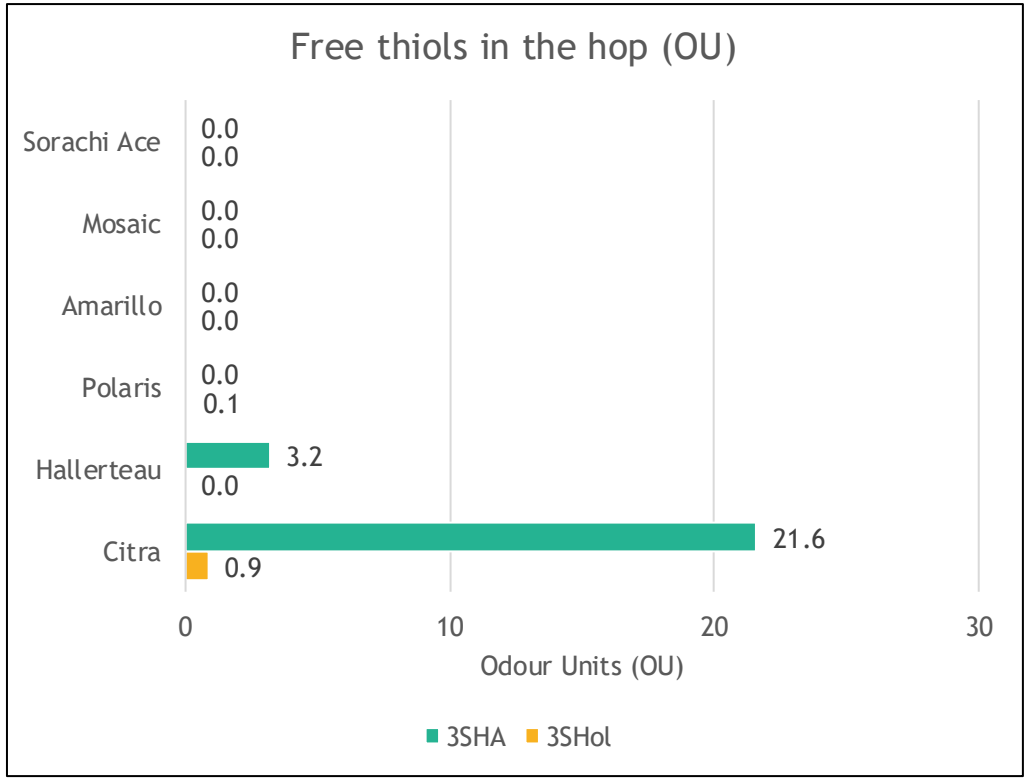


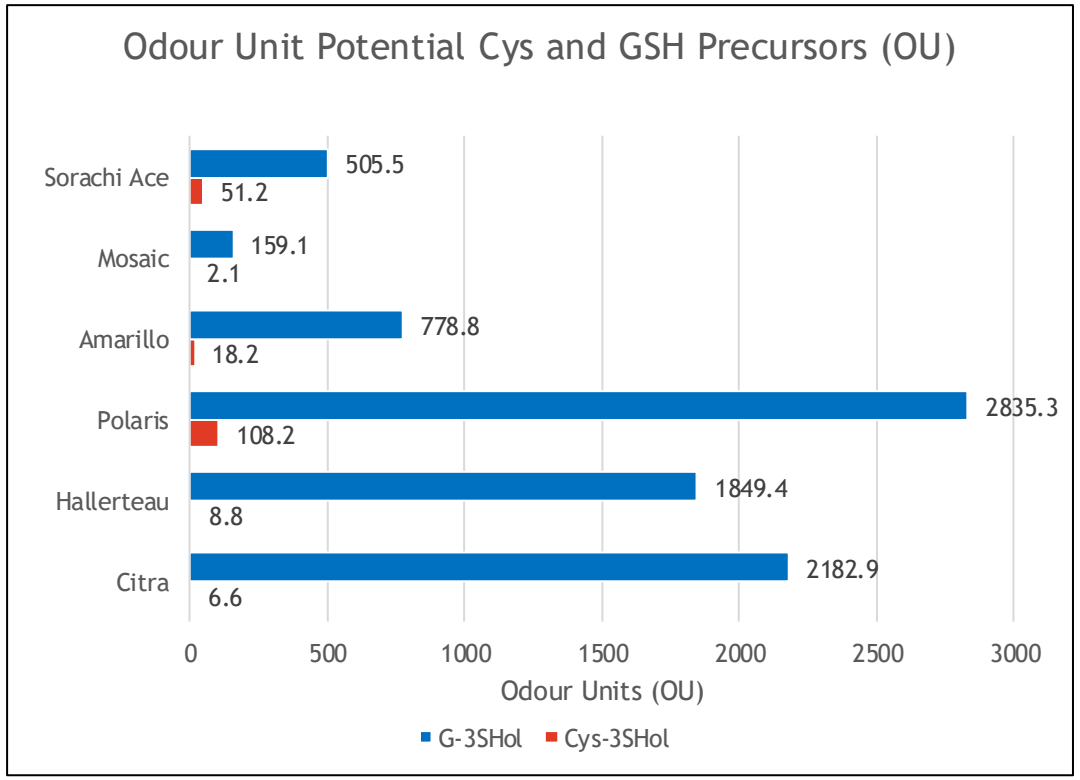


Hops potential (odour unit)
Without esterification

Citra and Hallertau Blanc have the highest odour unit of free 3SHA

Promising potential for all hops for G-3SHol; Polaris having the highest potential.

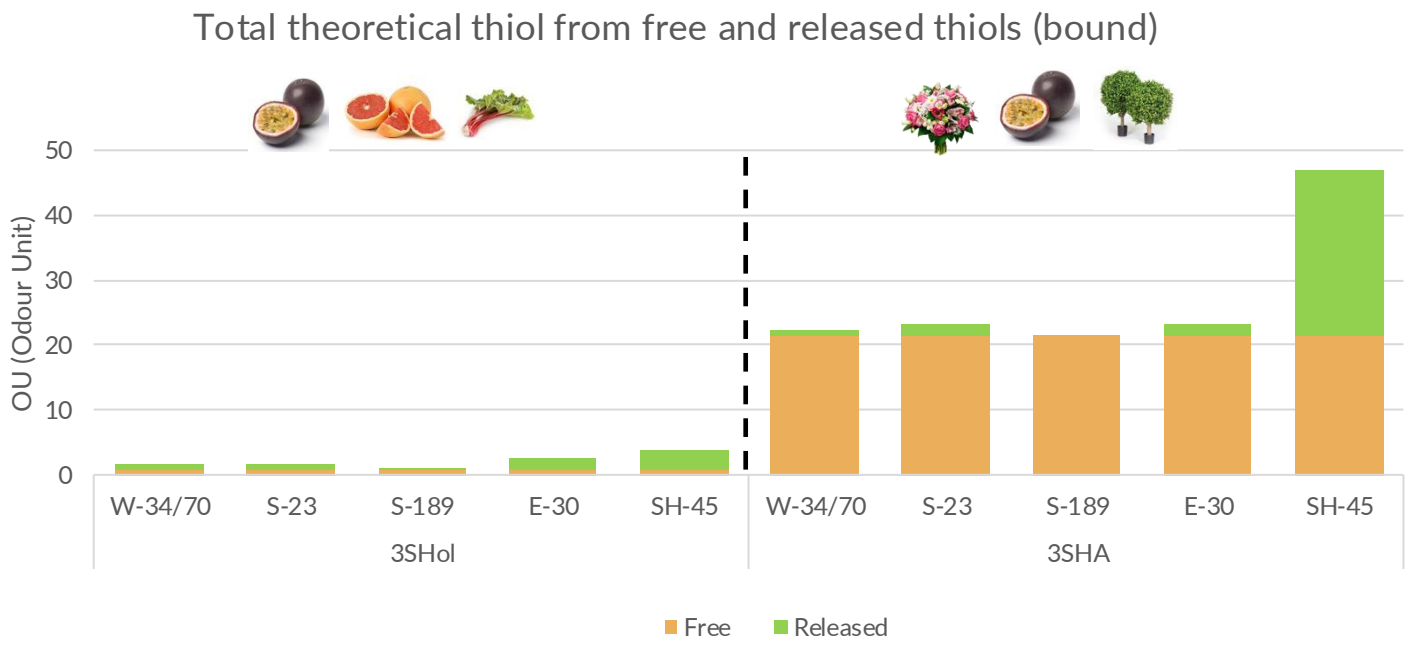




4 Results extrapolation

Expression of results in Odor Units (OU)
Citra (Cys- & GSH-adducts) - 400 g/hL

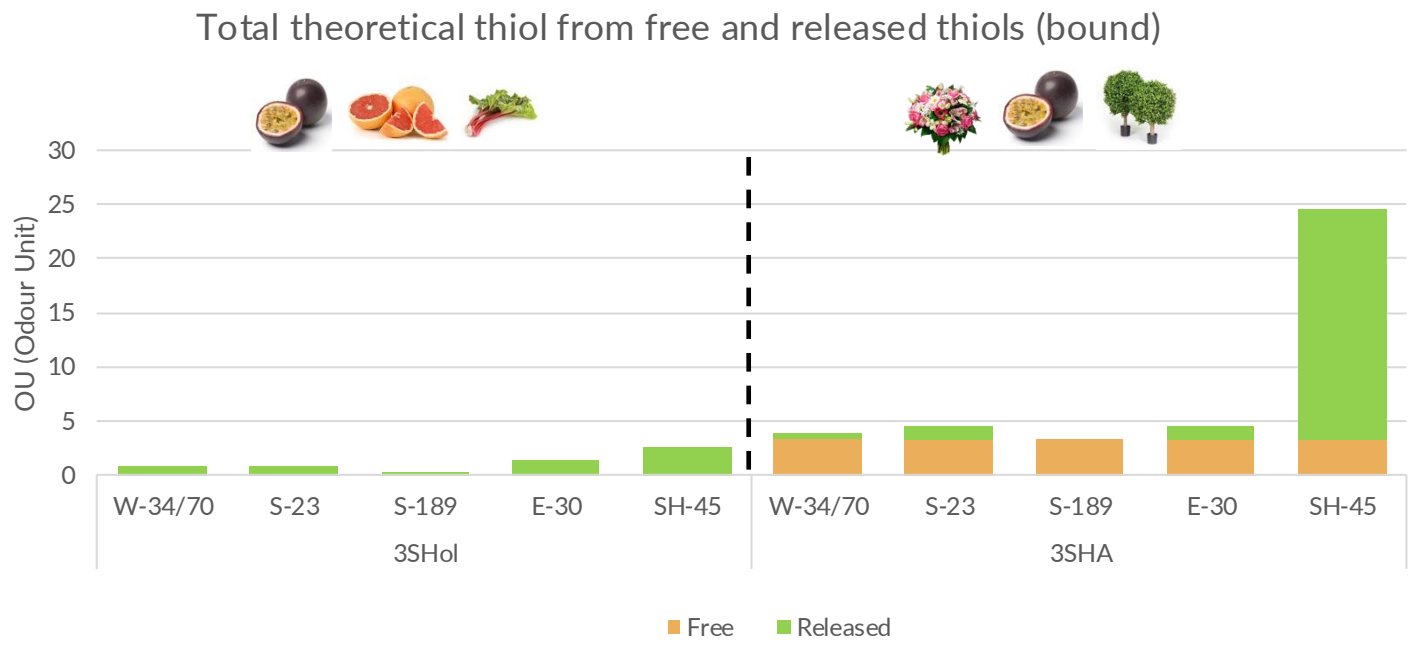
$$OU = \frac{\text{Compound concentration}}{\text{Compound perception threshold}}$$



SafLager™ SH-45 shows a higher activity to release bound thiols and esterify the alcoholic form.
The other lager yeast show very little activity to release bound thiols; most of the aromatic fraction comes from the free thiols.

Expression of results in Odor Units (OU)
Hallerteau Blanc (Cys- & GSH-adducts) 400 g/hL

$$OU = \frac{\text{Compound concentration}}{\text{Compound perception threshold}}$$



SafLager™ SH-45 shows a higher activity to release bound thiols and esterify the alcoholic form.
The other lager yeast show very little activity to release bound thiols.
Most of the thiols come from **SafLager™ SH-45** biotransformation

5 | Conclusion

NEW

The yeast for your hoppy lager!

Trained Fermentis Beer Pannel Tasting - Hoppy Lager

Wort

Brewing wort with 100 %pils malt
at 14.0 °P, target BU 22

Pitching rate

100 g/hl (Equivalent)

Fermentation

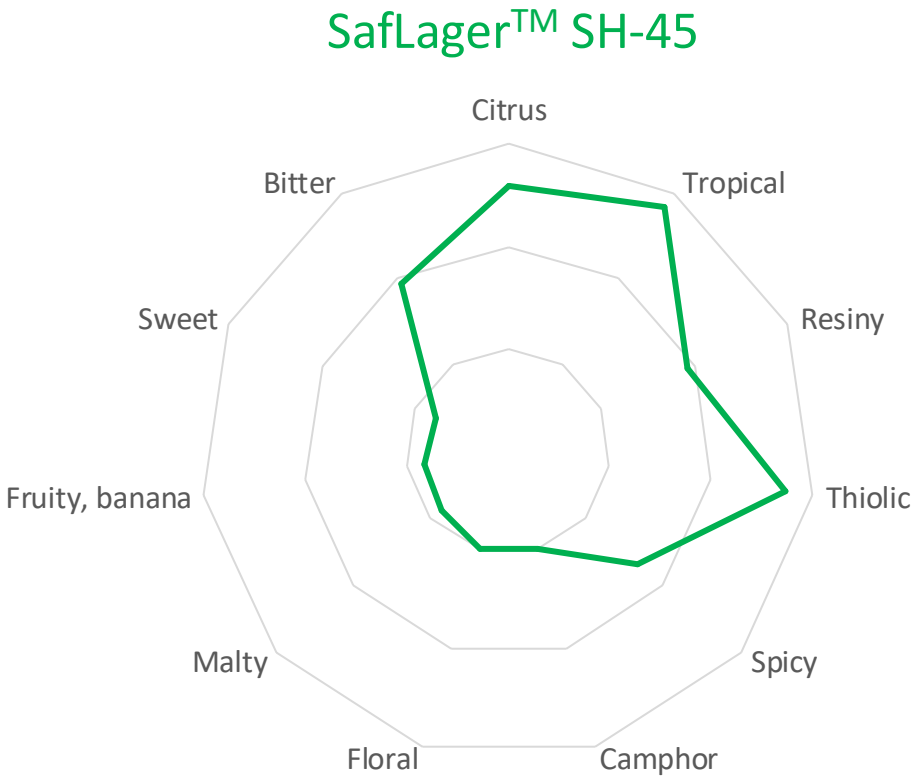
Temperature of 14°C,

free rise to 17°C at 50% of attenuation

Dry Hopping

Fermentation Day 2

Citra - Amarillo - Hallertau Blanc



A new dry yeast strain designed to amplify hop aromas and deliver a refreshing sensory experience.

Key Learnings

SafLager™ SH-45 is:

Medium attenuating yeast:
S. pastorianus

Ferments well at 14°C

Assimilate maltose &
partially Maltotriose

Pitching rate: ≈100g/hl
ADF between 77-82% on
standard wort

Produces medium fermentative
fruity character

Significant release and esterification of GSH-thiols

Conclusion

These new SafLager™ SH-45 shows :

- A high ability to release free thiols from glutathionylated precursors. To the contrary from SafAle™ range, SafLager™ SH-45 has a poor ability to release thiols from Cysteinylated precursors.
- A biotransformation potential from hop mainly GSH precursors since it’s in higher concentration compared to the Cys precursors.
- A high thiol esterification activity particularly form the GSH precursors. The ester form has a lower threshold than the alcoholic form.
- You will brew better hoppy lagers with SH-45!

Acknowledgment

UCLouvain
Louvain Institute of Biomolecular Science and Technology (LIBST)

Ph.D. Student Romain Christiaens
&
Prof. Sonia Collin

Thank you for your attention!

Fermentis by Lesaffre

www.fermentis.com