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Low SO2 Winemaking

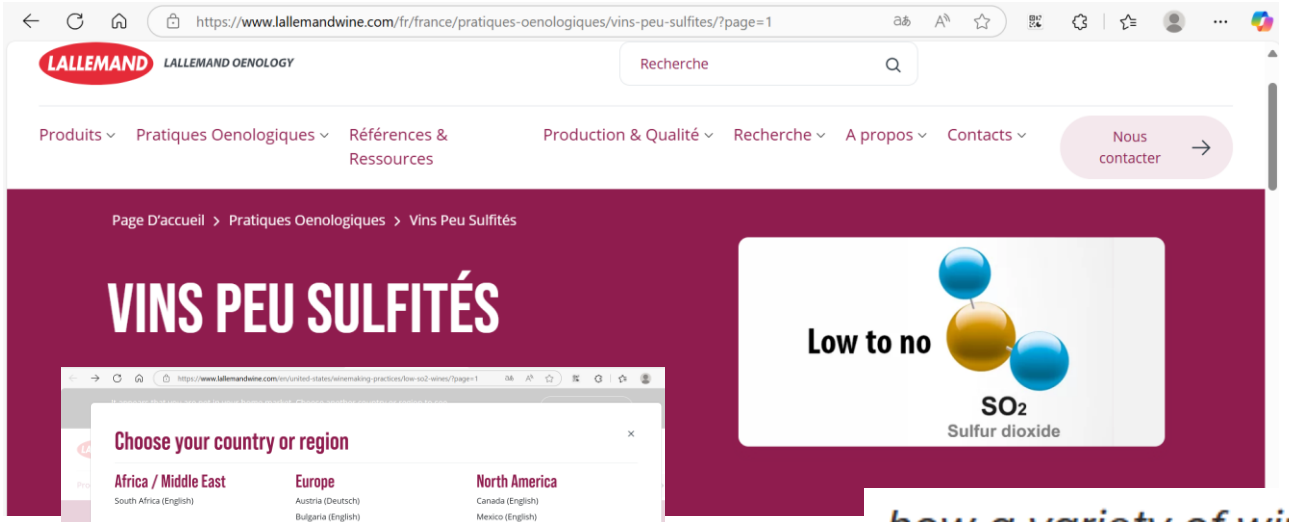
2025 Episode #1

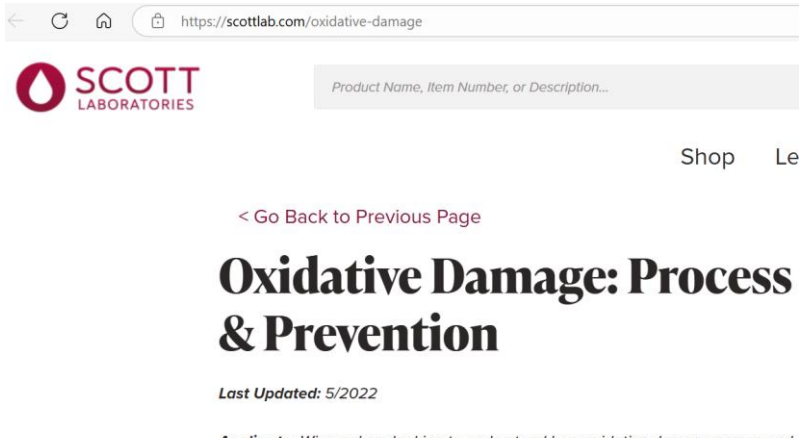
~ Aroma protection and longevity ~

2025年6月13日（金）　セティ株式会社主催webinar

セティ株式会社
食品原料課　清水　慶

世界各国のワイン業界における市場要請





how a variety of winemaking tools prevent it. This article offers options for preventing oxidation while reducing the use of SO_2.

https://www.lallemandwine.com/fr/france/pratiques-oenologiques/vins-peu-sulfites/?page=1

https://scottlab.com/oxidative-damage

ワイン醸造技術における新たな挑戦 ver. 2025

Webinar Episode #1

Webinar Episode #2

Webinar Episode #3

Low SO2 Wine making プロトコル例

工程／タイミング	目的	適用製品	添加レート例	メカニズム
 ぶどう破砕時	酸化劣化抑制	Glutastar	30g/hL	不活性酵母由来のグルタチオンとその類縁物質により･･･ 1. 香気成分の保護 2. 褐変抑制
 破砕直後のもろみ	酸化劣化抑制 変敗菌抑制	INITIA	10-20g/hL	生菌によるもろみ中の溶存酸素の消費、銅イオン減少と栄養消費により･･･ 1. 香気成分の保護 2. 褐変抑制 3. 変敗菌の増長抑制
 酵母接種	亜硫酸効率向上	ICV OPALE2.0 PERSY SENSY ICV OKAY	25g/hL	亜硫酸に結合し不活化する成分（アセトアルデヒド）や亜硫酸そのものの産生が極めて少ない菌株
Co-inoculation	変敗菌抑制	MBR各種 (*O.oeni*)	1g/hL	もろみの早期占有
	変敗菌抑制	ML PRIME (*L. plantarum*)	10-20g/hL	もろみの早期占有
 おり下げ	変敗菌抑制	Bactiless	20-50g/hL	変敗菌数の減少と吸着除去 （乳酸菌、酢酸菌）
	変敗菌抑制	No Brett Inside	4-10g/hL	変敗菌数の減少と吸着除去 （ブレタノマイセス）

ご注意事項

・現状では依然、必要最低限の亜硫酸添加はなされるべきとの考え方に依ります。

・本プロトコル例は、今後技術的知見の蓄積により改良更新される可能性がございます。

・本プロトコル例をご活用の際は、予め小試験等で有用性をご確認のうえ慎重にご導入下さい。

・例示される各製品について、本来の法的用途を前提に副次的用途が記載されている場合もございます。

弊社カタログ2025, p3-4

SPECIFIC YEAST DERIVATIVES

Content

I) Origin and impact of oxygen in must and wine

II) Improve naturally the wine nucleophilic content

III) Evidence of antioxidant activity

IV) Field results

1) 酸素の由来と果汁／ワインへの影響
2) 酵母由来の成分による酸化防止の試み
3) 酸化防止機能の証左
4) 現場検証

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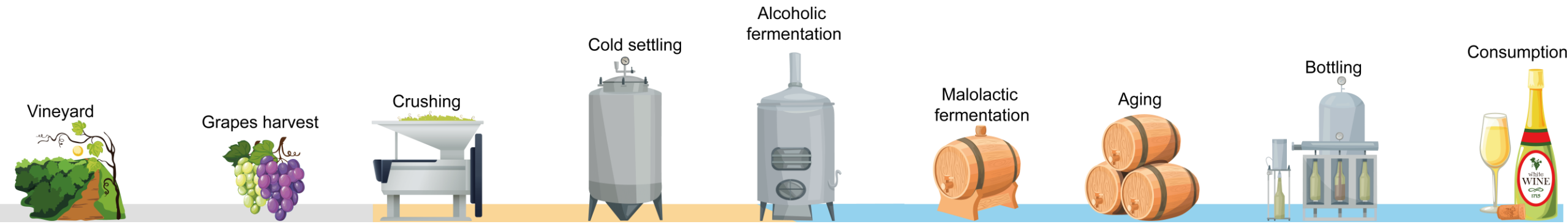
Original by culture

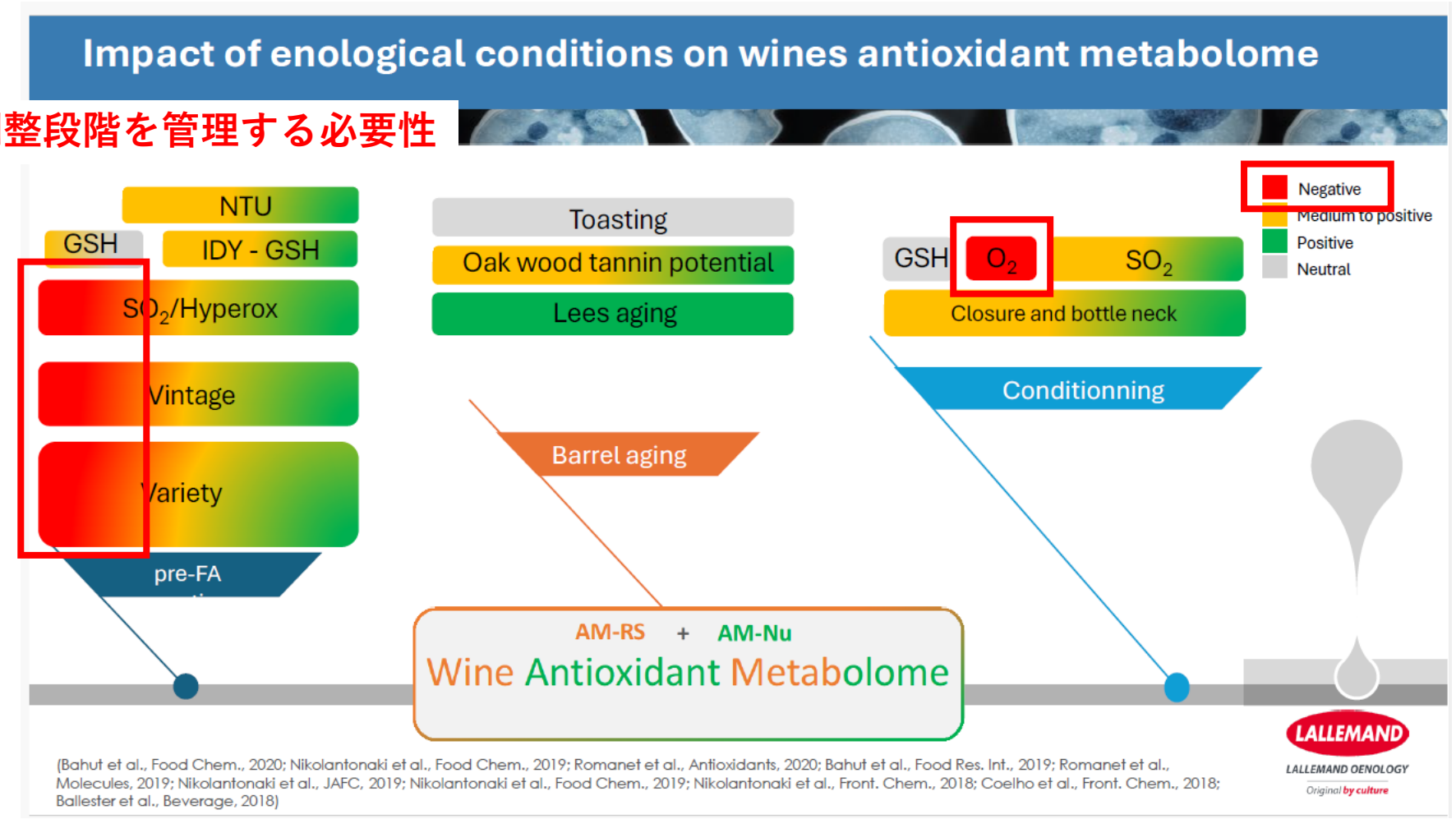


I) Origin and impact of oxygen in must and wine

酸化的に働く各成分はどこからきて、どのように果汁とワインに影響するのか？

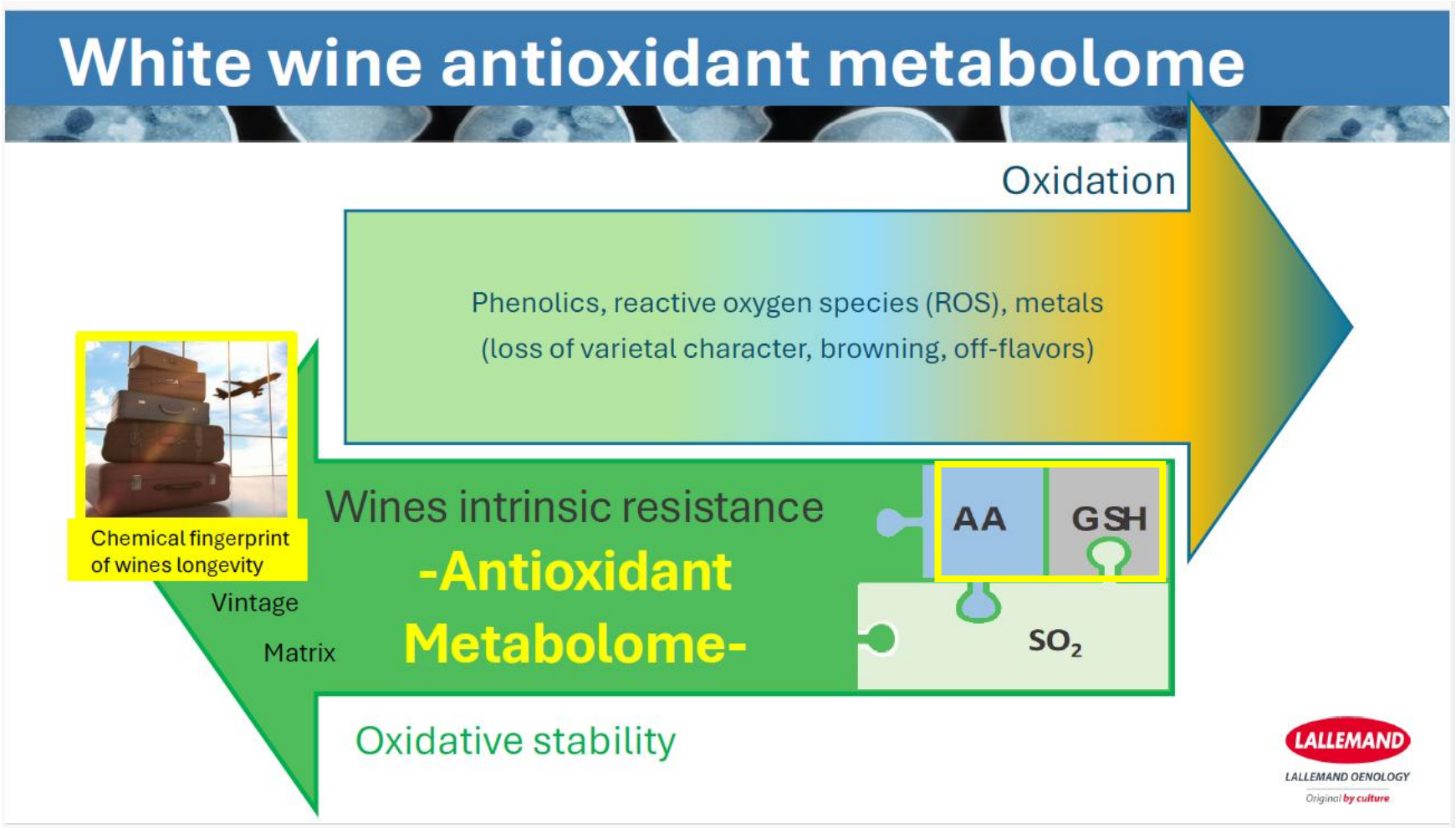
ワインの酸化還元に影響を及ぼす諸因子の俯瞰図

果汁調整段階を管理する必要性

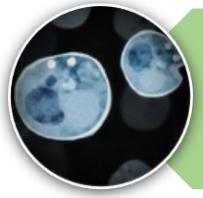


Nikolantonaki, SYD school 2025, Dijon

ワイン中に本来備わっている抗酸化物質

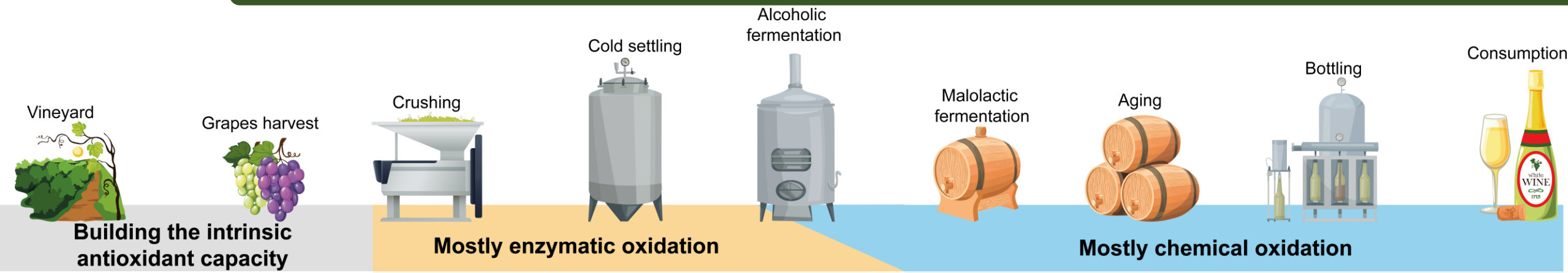


Nikolantonaki, SYD school 2025, Dijon



Manage oxidation in winemaking

Formal chemistry



Must browning

Early loss of protective compounds

Appearance of off-flavours

Loss of varietal aromas

Wine browning

« Antioxidants » for oenologist

Compounds or practices limiting the appearance of wine damages

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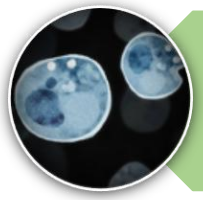
Original by culture

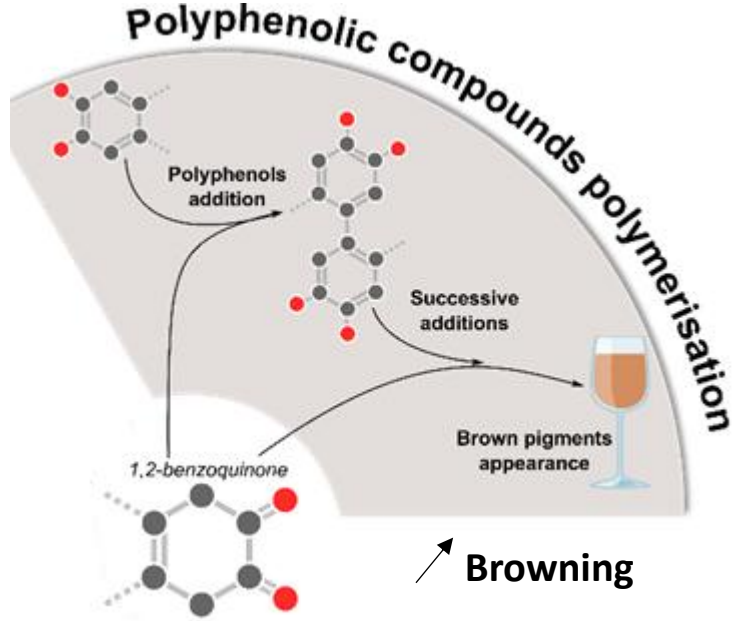


Manage oxidation in winemaking

Oxidative damage on wine

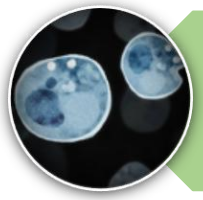
Main mechanisms leading to wine defects

- ***Polymerization*** of quinones with other phenolic compounds
  => browning



キノンと他のフェノール成分の重合　→　褐変

Browning



Manage oxidation in winemaking

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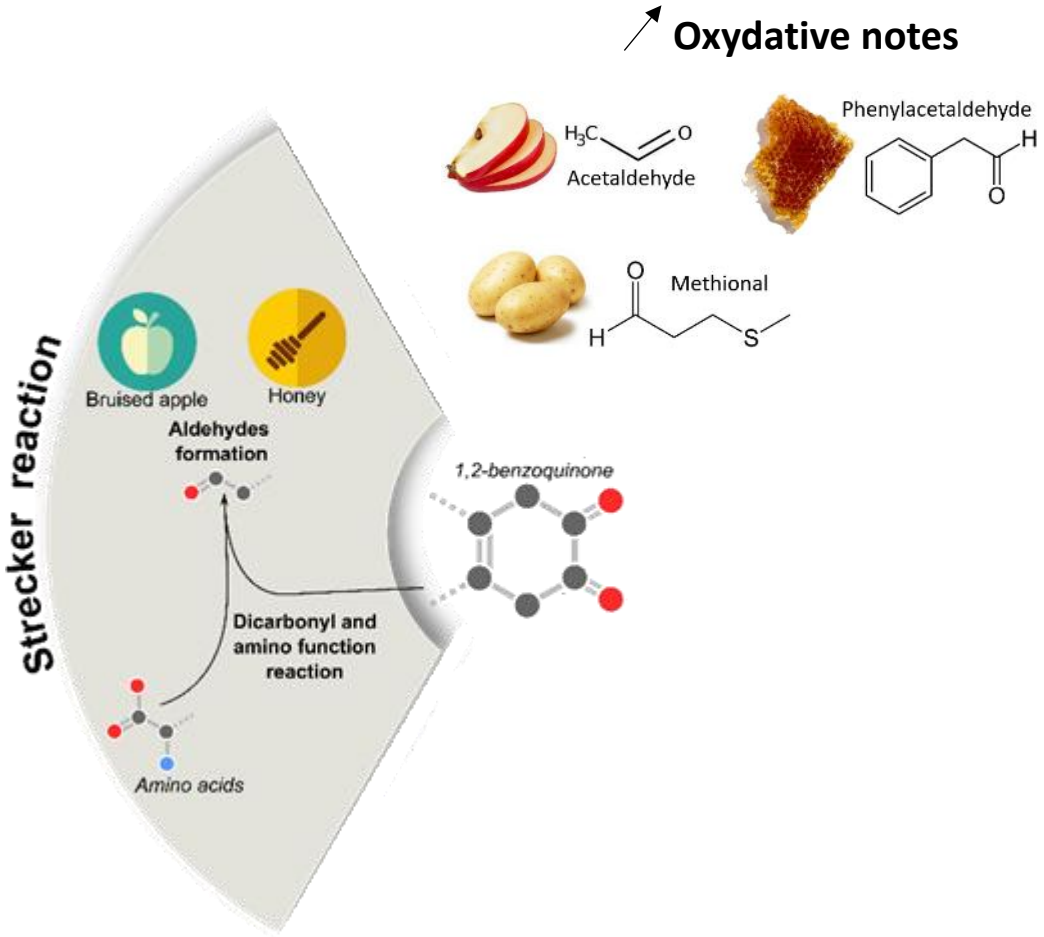
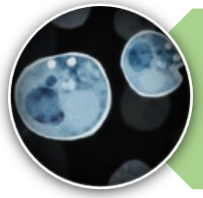
  => unwanted aromas at high concentration



キノン＋アミノ酸＝ストレッカー反応

→　閾値を超える不快臭成分の精製



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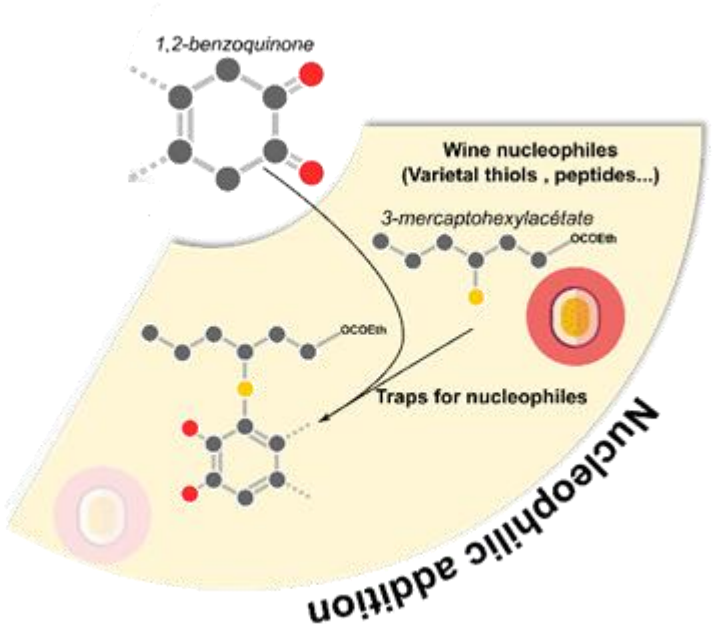
- ***Trapping varietal thiols***
  => reduction of global aromatic quality

品種特徴香（チオール）の補足
→　香りの質の減退



Volatile thiols

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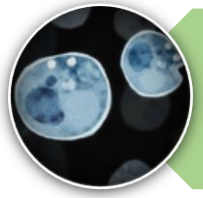
Original by culture



Manage oxidation in winemaking

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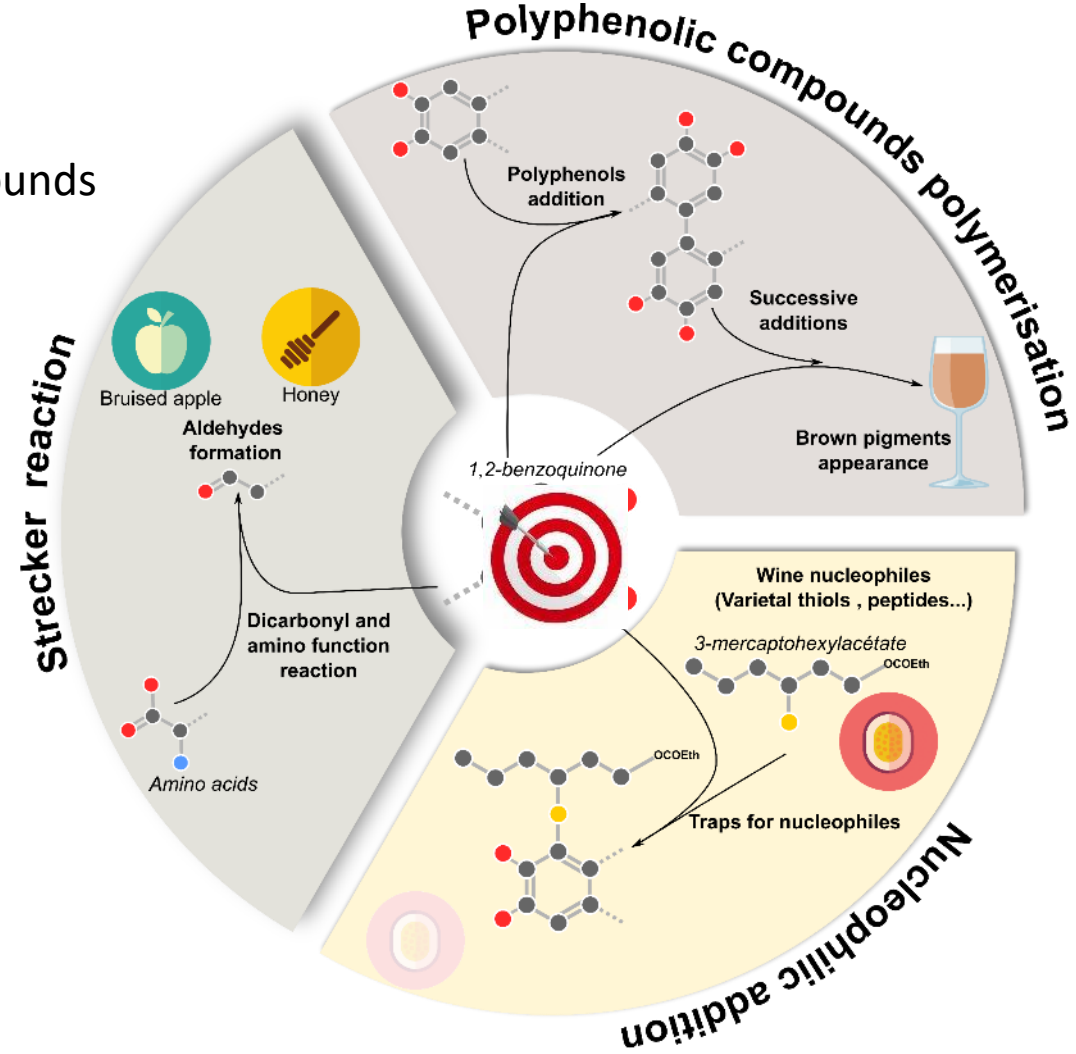
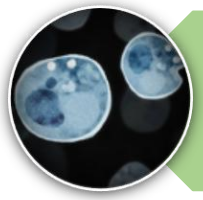


・褐変
・不快臭生成
・品種特徴香の減退

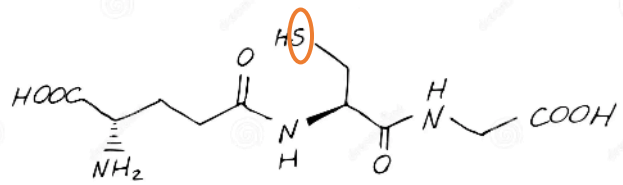


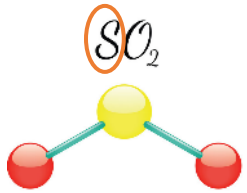
Manage oxidation in winemaking

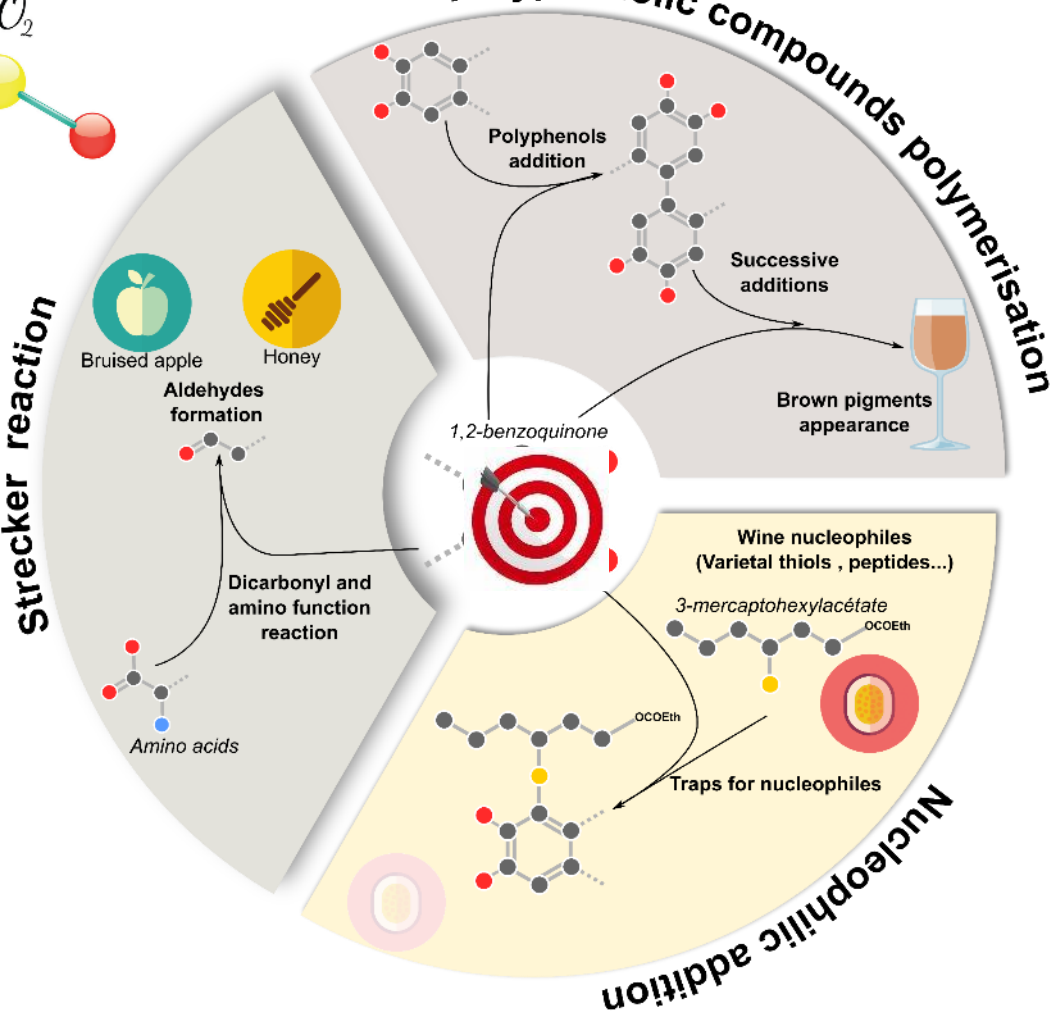
Tools available to target quinones

- Traditionnally, **sulfites (SO_2)** are used as antioxidant compound to reduce quinones
- But other compounds are also able to trap quinones, such as **glutathion (GSH)**, in its reductive form

Glutathion







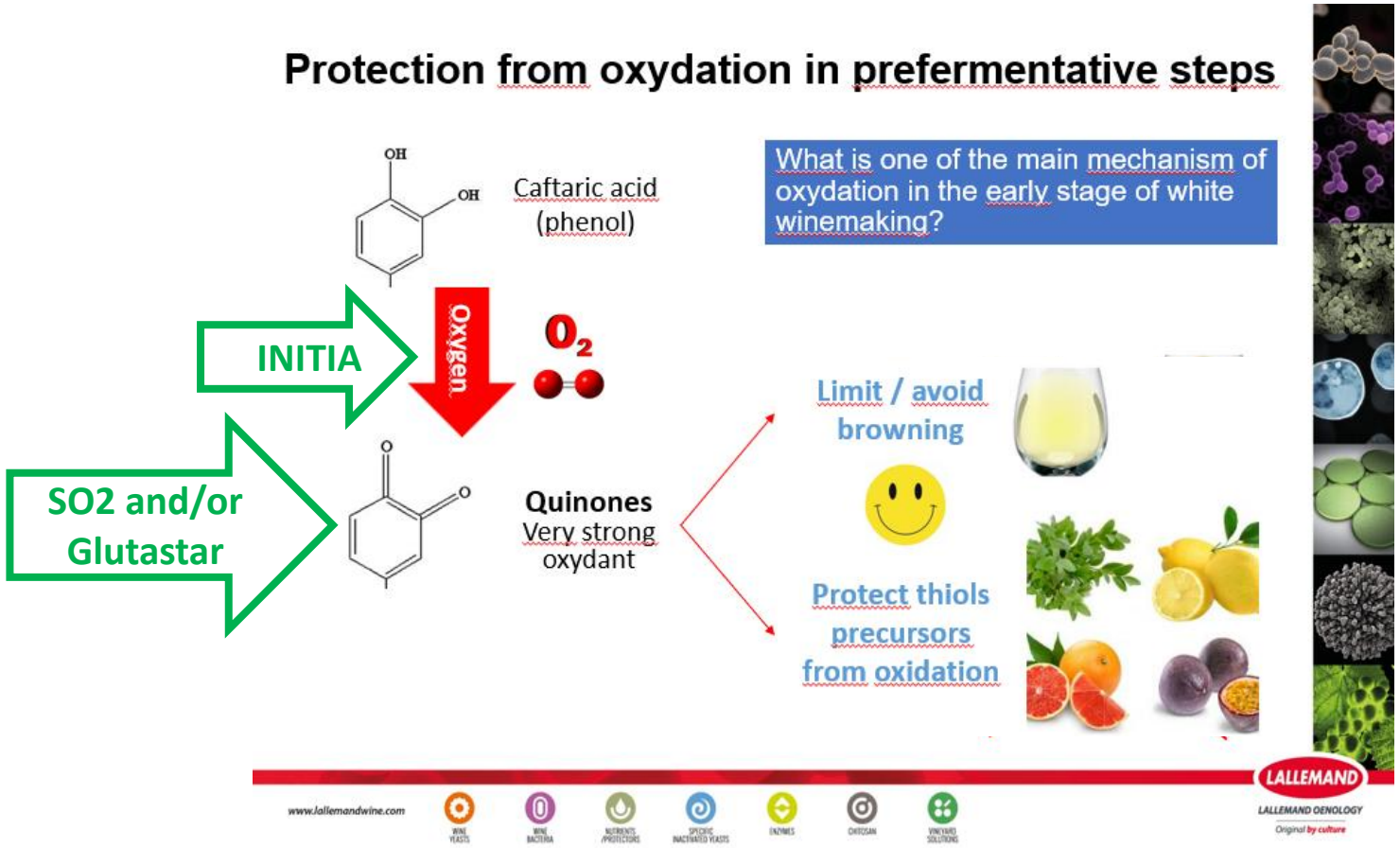
キノンの捕捉者

旧来はSO2

↓

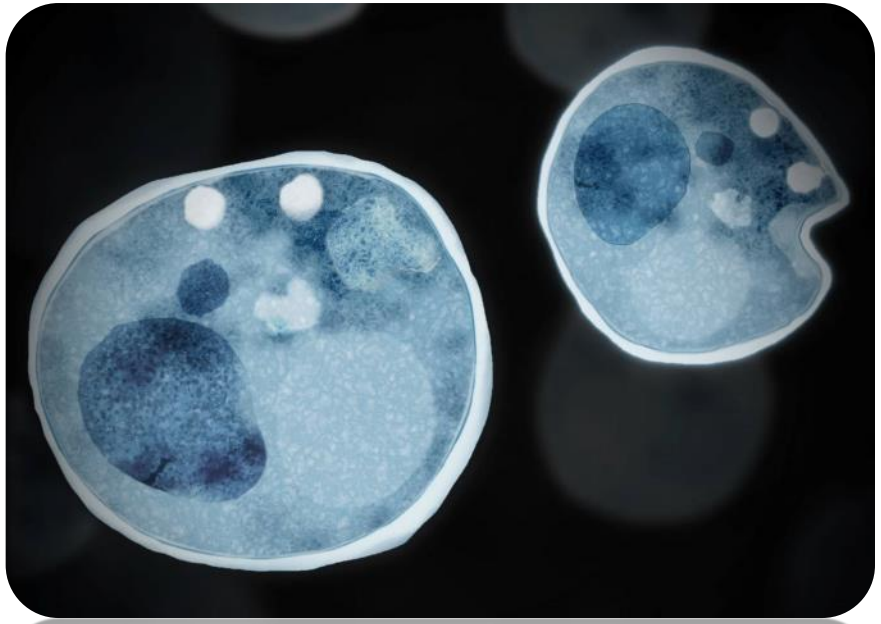
New＝還元型のグルタチオン

グルタスター／亜硫酸、INITIA（non-SC酵母）の異なる作用点



Dumont, Bastien and Harrop, Lallemand Inc. internal conf. 2019 Osloを一部改変

SPECIFIC
YEAST DERIVATIVES



II) Improve naturally the wine nucleophilic content

Specific Yeast Derivatives (SYD) naturally rich in glutathione,
and much more…

抗酸化物質群を豊富に含む不活性酵母を利用し、SO2使用量を減らせないか？

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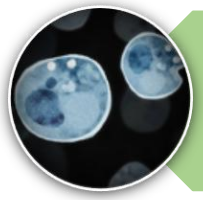
Original by culture



SYD process in brief

Metabolic scale

Saccharomyces cerevisiae metabolic network

CHO
CHOS
CHON
CHONS

Few metabolites proposed in literature to monitor glutathione accumulation

GSH

SPECIFIC YEAST DERIVATIVES

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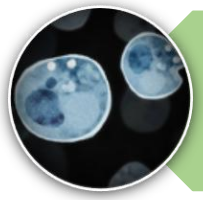
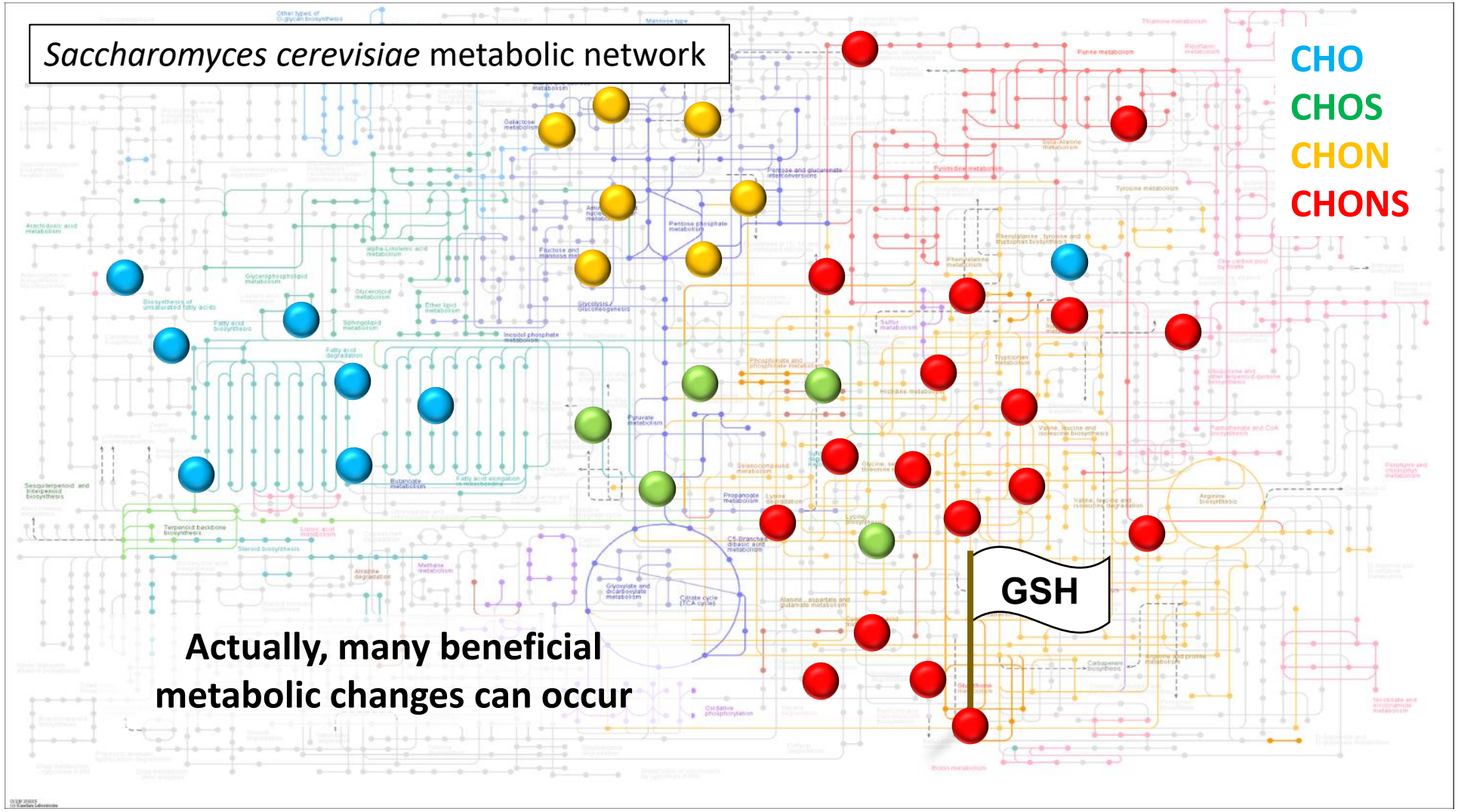
Original by culture



SYD process in brief

Metabolic scale



SPECIFIC YEAST DERIVATIVES

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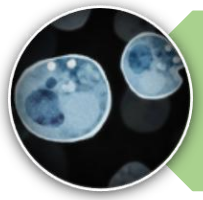
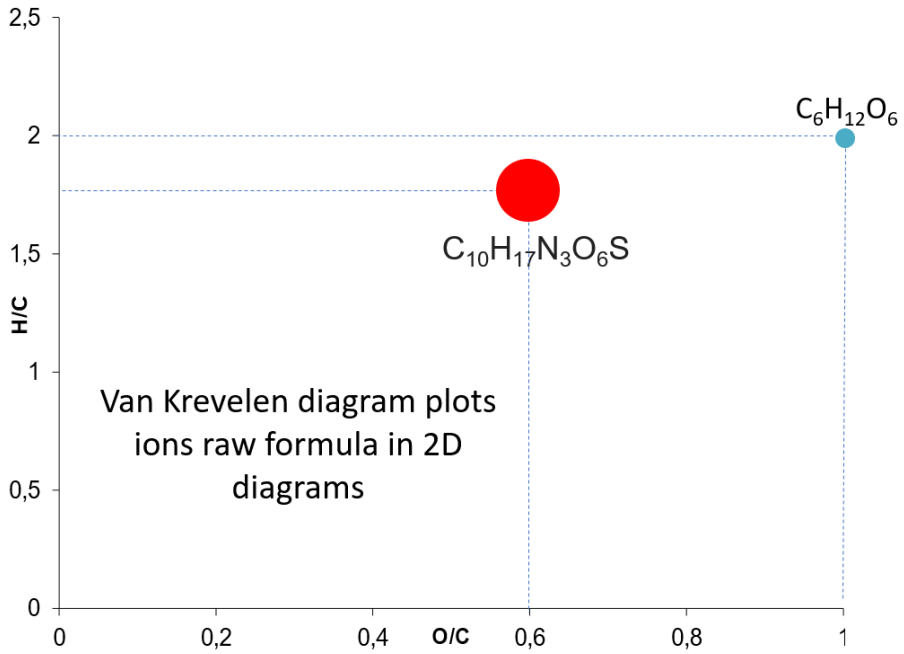
Original by culture



Metabolomic fingerprint

SPECIFIC YEAST DERIVATIVES

- **Metabolomics: analytical method aimed to describe a set of samples based on their chemical composition (metabolites)**
  - Ultra HPLC with a high-resolution mass spectrophometer
  - It can give the fingerprint of different products according to their elementary compositions in C, H, O, S, N



メタボロミクス分析で
試料中の成分分布を明らかに

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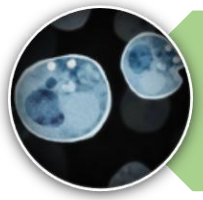
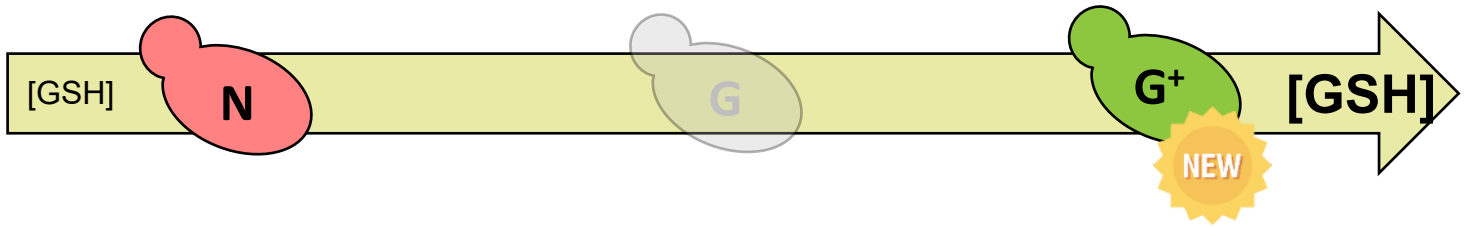
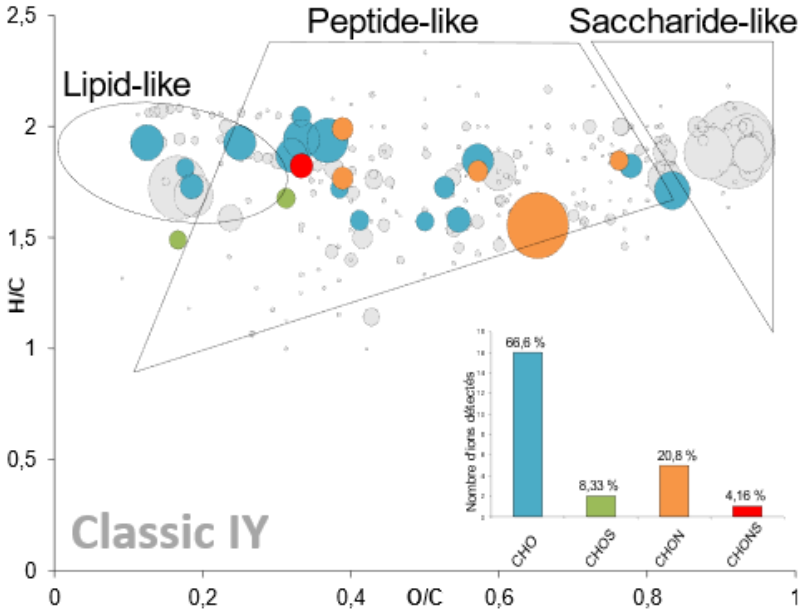
Original by culture

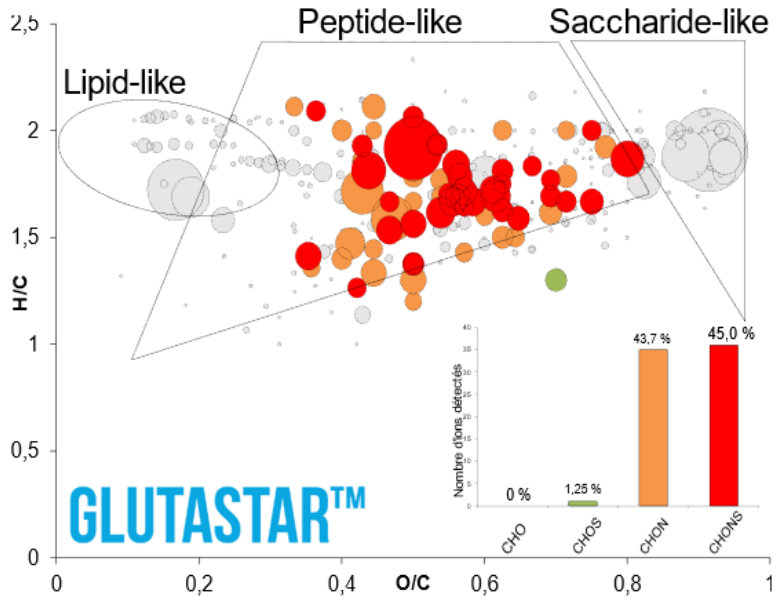


Metabolomic fingerprint

Diversity of glutathione co-accumulated compounds







- Glutastar brings more “peptide-like” metabolites
- Higher diversity in CHONS is partially explain by a **better integration of sulfur containing amino acids in peptides**
- This abundance of **free sulfur** could **improve the nucleophilic activity of this SYD**

➡ **Better protection against oxydation**

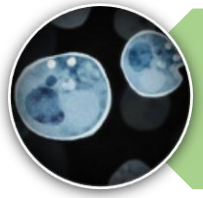
Bahut *et al.*, (2020)

グルタスターにはペプチド様成分の分布が多い

II) Evidence of antioxidant activity

Evaluate the antioxidant capacity of inactivated yeasts in wine like condition

ワイン液相模倣条件での抗酸化能評価



Take home message

- Reduced glutathione (**GSH**) can react with quinones and **protect must and from oxidation** (preventing browning and loss of aromas)
- Beyond GSH, **other specific peptides can also have an antioxidant activity**
- **Thanks to its unique composition (GSH + other specific peptides), GLUTASTAR™ is the SYD with the highest antioxidant activity**

GSHのみならず、
その他のペプチド群も高含有
↑
メタボロミクスにより妥当性検証済み

=Only-In-Class!

Antioxidant activity ⟷ **GSH + other specific peptides**

GLUTASTAR™

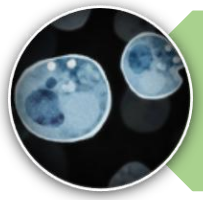
Abundance & diversity of these specific peptides

High protection of white and rosé wines against oxidation




IV) Field results

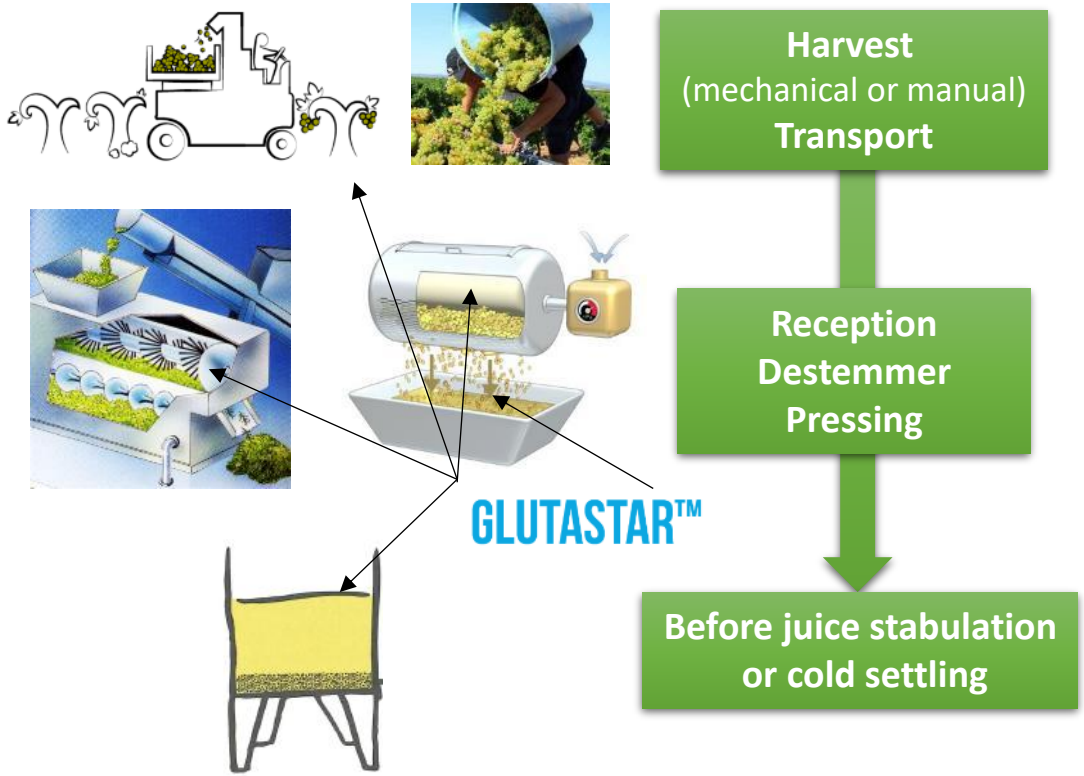
GLUTASTAR™: a high protection of white and rosé wines against oxidation

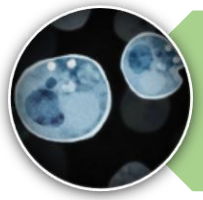


How do we use Glutastar?

- Recommended dosage: 20 to 40 g/hL
- Suspend in 10 times its weight of water or must and add to the must
- **Add at the earliest stage in winemaking process**
- **An excellent tool in the context of low SO_2 protocols**

When? At the earliest stage in winemaking process

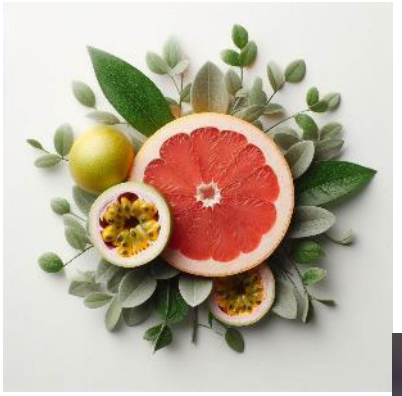


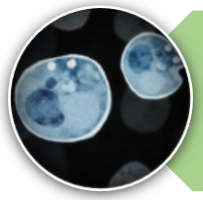


Field results

Positive impact on aromas (volatiles thiols)

- Volatile thiols: contribute to the **aromatic complexity and intensity** of the wines
- Main thiols: 3MH (grapefruit aroma), 3MHA (passion fruit) and 4MMP (boxtree aromas)
- And also: a **good marker of oxidation**!

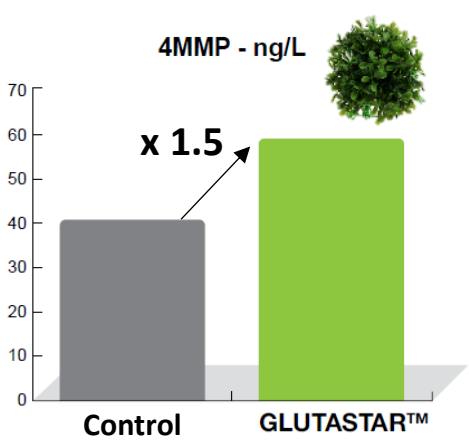


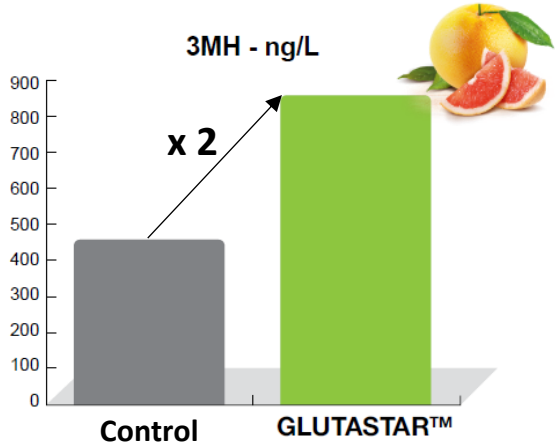


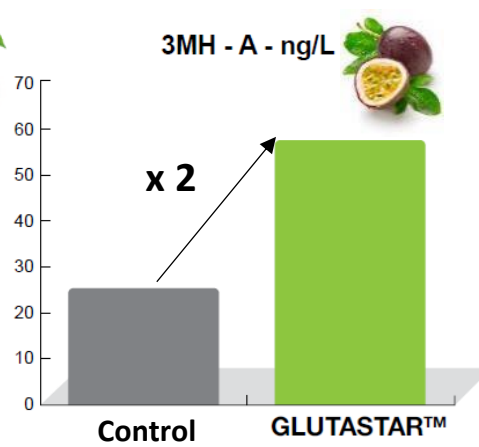
Field results

Positive impact on aromas (volatiles thiols)

Sauvignon blanc (Loire Valley, France)
Addition of 30 g/hL of GLUTASTAR on must before a prefermentative maceration (8 days at 4°C)

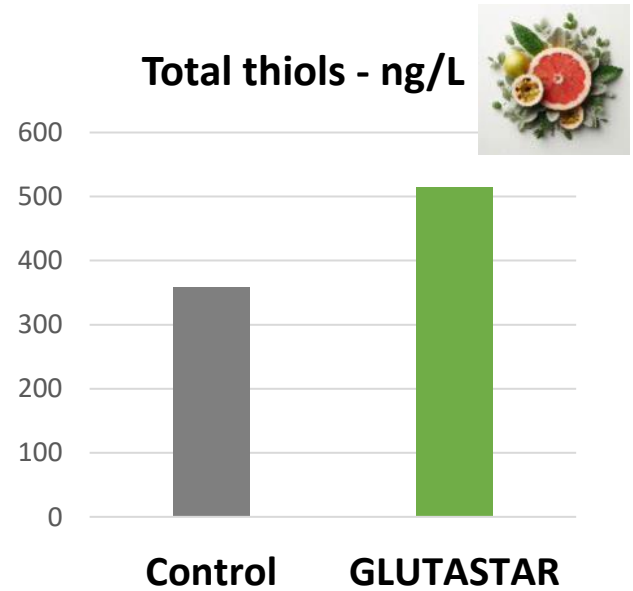






Thiols analysis in bottled wines

Sauvignon blanc (Loire Valley, France)
Addition of 30 g/hL of GLUTASTAR on the free run juice of the press



SPECIFIC YEAST DERIVATIVES

LALLEMAND
LALLEMAND OENOLOGY
Original by culture

Field results

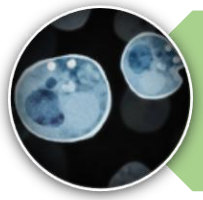
Positive impact on color in white wines

Chardonnay (California, United-States)

Addition of 30 g/hL of GLUTASTAR in the free run juice of the press

Gruner Vetliner (Austria)
Premium quality winery

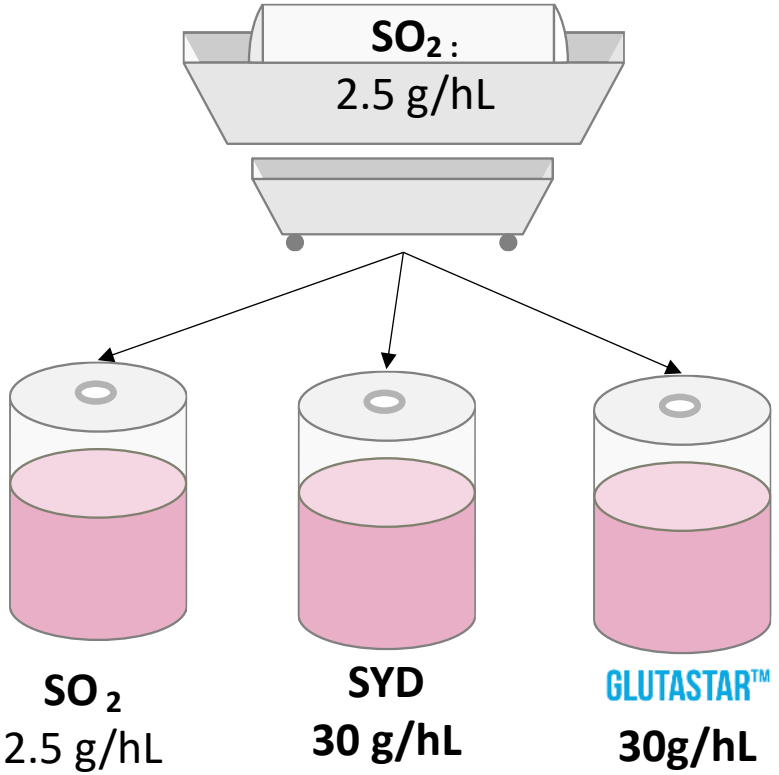
Thanks to GLUTASTAR™, we could limit oxydation and preserve the color



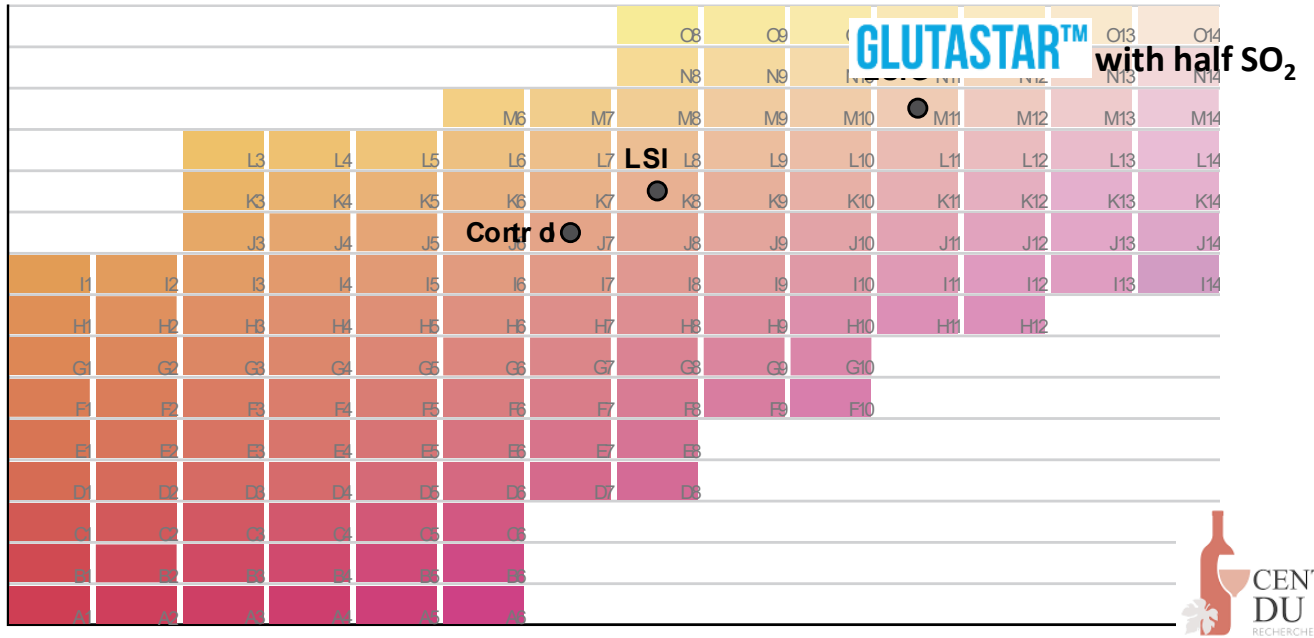
Field results

Positive impact on color in rosé wines

Cinsault rosé (Provence, France) - Low SO_2 protocol

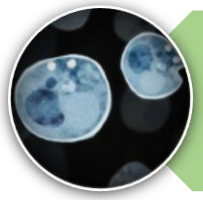


Visual monitoring of the rosé wine after bottling



Thanks to GLUTASTAR™, we could divided SO_2 addition by two while preserving wine color

グルタスター添加により、色調劣化を避けつつ亜硫酸の半量分割添加可能

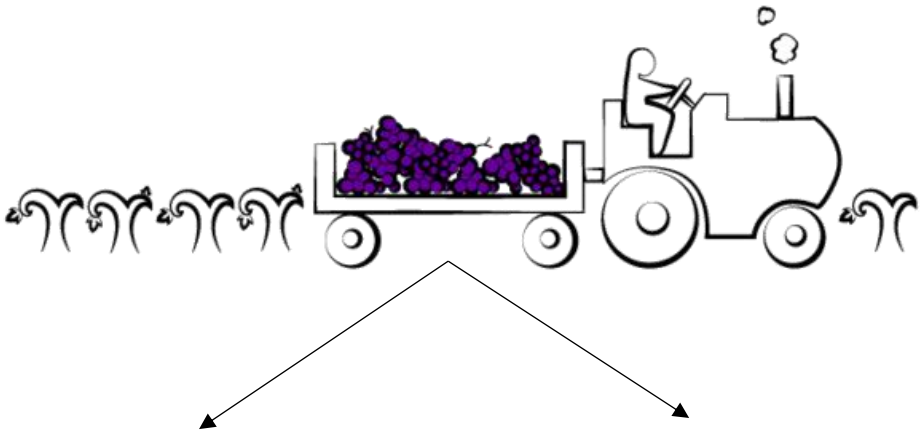


Field results

Positive impact on color in rosé wines

Grenach rosé (Provence, France) - Low SO_2 protocol

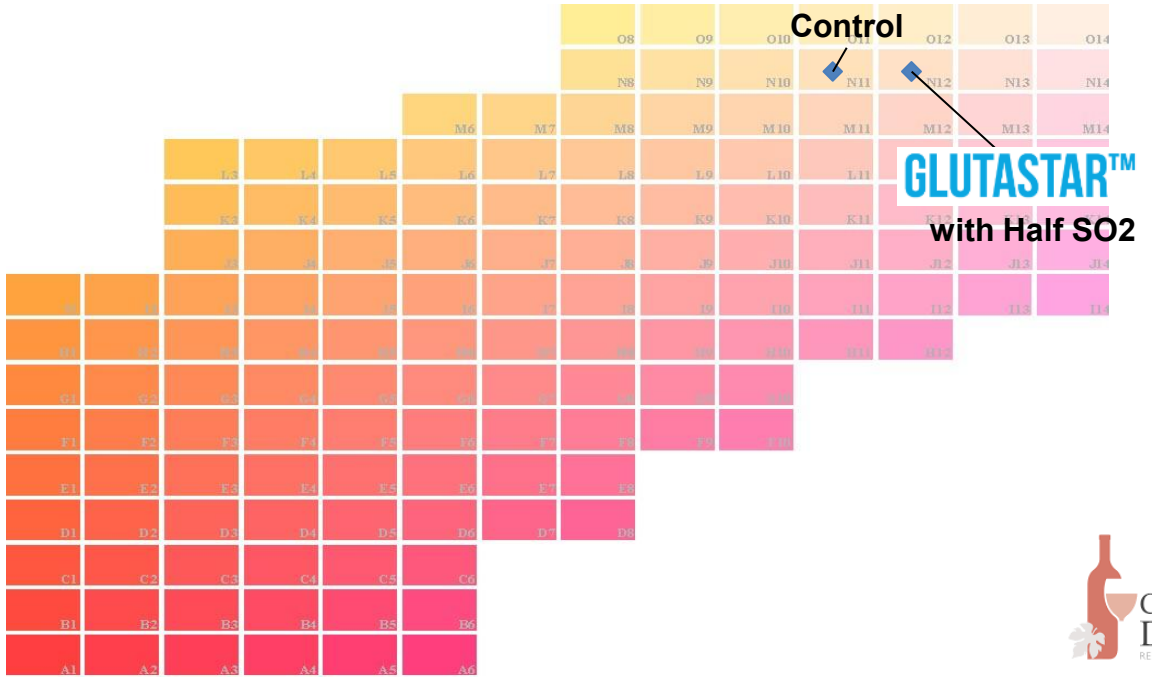
Harvesting machine & transport



5 g/hL **SO_2**

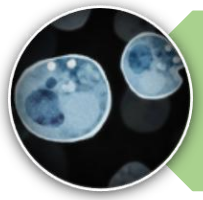
2.5 g/hL **SO_2**
+ 30 g/hL GLUTASTAR™

Visual monitoring of the rosé wine after bottling



Thanks to GLUTASTAR™, we could divided SO_2 addition by two while preserving wine color

先述のサンソ—ロゼ色調試験と同様に良好な結果



Field results

Positive impact on tasting

Chardonnay (IUVV, Burgundy, France) - Low SO_2 protocol

Manual harvest

Pressing

Settling (24h at 15°C)

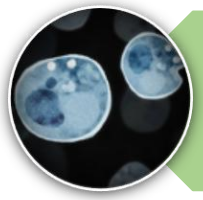
AF & MLF (1hL)

Chardonnay		
SO_2 = 2.5 g/hL **In the free run juice of the press**		
After settling		
SO_2 = 2.5 g/hL		**GLUTASTAR 30 g/hL**
25 g/hL Lalvin QA23 + 20 g/hL Fermaid O @T0 + 20 g/hL Fermaid E Blanc @1/3		
Lalvin VP41 seq. inoc		

Analysis end Alcoholic Fermentation

	Full SO_2	Half SO_2	Half SO_2 + GLUTASTAR™
TAV % v/v	11.7	11.6	11.9
G+F	**3**	**3.6**	**<1**
TA (g/L)	8.5	8.5	8.5
pH	**3.02**	**3.06**	**3.06**
VA (g/L H2SO4)	0.23	0.26	0.25
Free SO2 (mg/L)	8	7	8
Total SO2 (mg/L)	**41**	**22**	**19**

Less total SO_2 in final wines

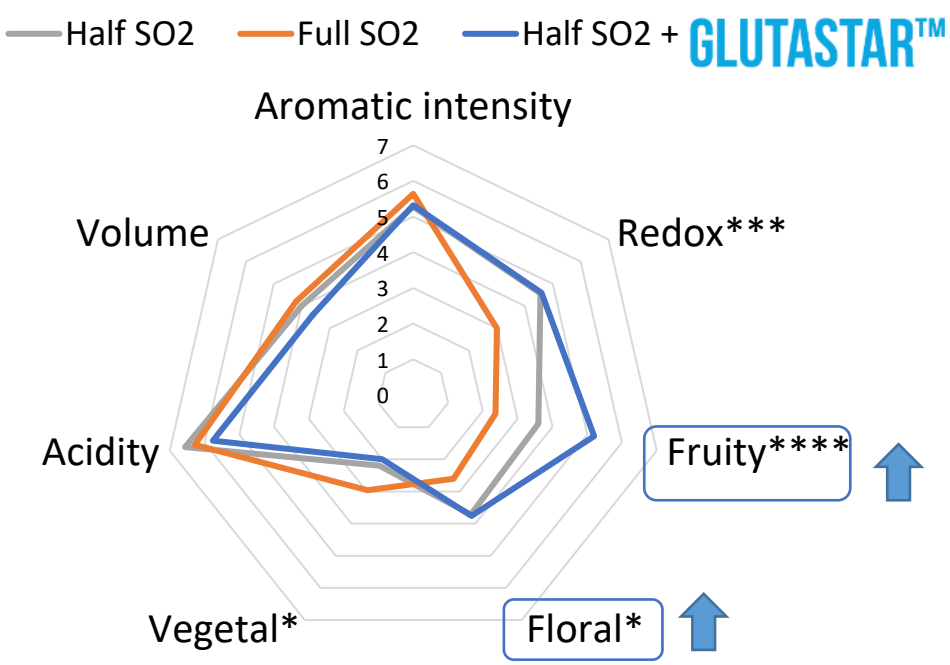


Field results

Positive impact on tasting

Chardonnay (IUVV, Burgundy, France) - Low SO_2 protocol

Sensorial analysis (IUVV, 25 tasters)



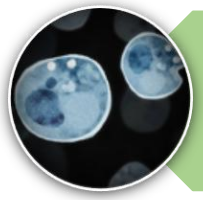
- Triangular tasting:
  3 wines significantly different
- Wine "Half SO™ + GLUTASTAR™":
  more fruity and floral notes,
  less reductive and less vegetal

ポジティブな香り↑
ネガティブな香り↓

Significant at
* 10% - ** 5% - *** 1% - **** 0.5%

SPECIFIC YEAST DERIVATIVES

LALLEMAND OENOLOGY
Original by culture



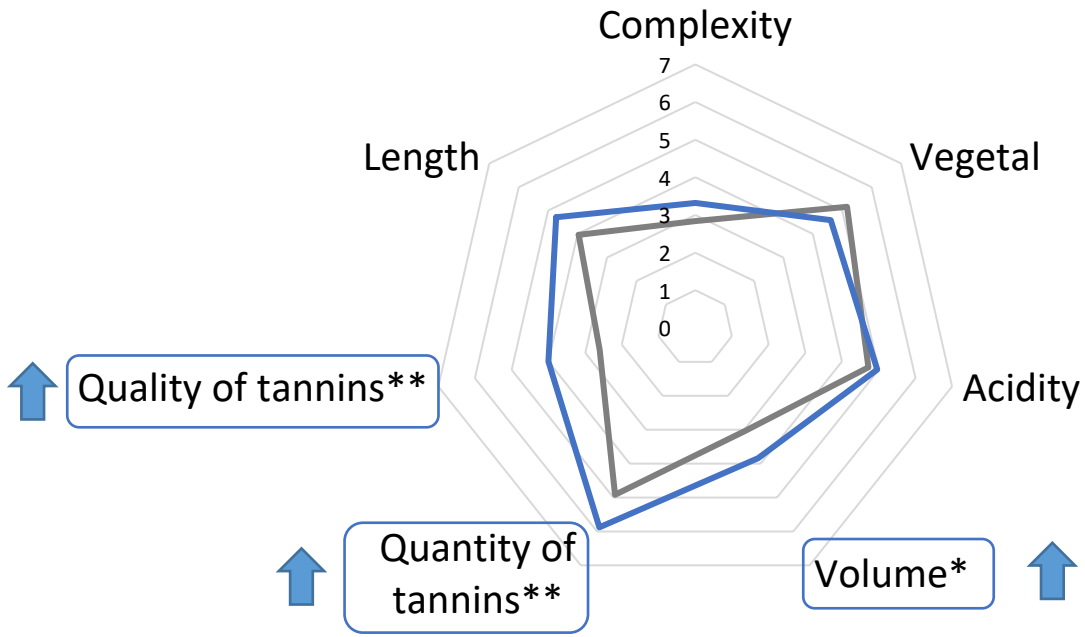
Field results

Positive impact on tasting

Pinot noir (IUVV, Burgundy, France)

Sensorial analysis (IUVV, 25 tasters)

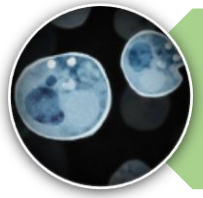
—Control 5g/hL SO2(Full dose) —GLUTASTAR™ +2.5g/hL SO2(Half dose)



Significant at
* 10% - ** 5%

- Triangular tasting:
  2 wines significantly different
- Wine "GLUTASTAR™":
  more volume, better structure with more fine tannins
- GLUTASTAR™ **also have a positive impact on red wines**

← フレッシュな赤造りにも応用可能



Take home message

SPECIFIC YEAST DERIVATIVES

GLUTASTAR
GET SUPREME HIGH POWER

The king of natural antioxidants

- Exclusive antioxidant peptides
- High reduced glutathione
- Contributes polysaccharides

Prevents oxidation

- Blocks free radicals
- Reduces risk of browning

Wines of higher quality

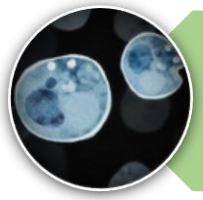
- Wines with more intensity and complexity
- More volatile thiols
- Stability of esters
- More color stability

亜硫酸使用量減のための新ツール

Recommended from prefermentative stages

- Effective in must
- Cold storage on solids
- Low/no sulfur winemaking

LALLEMAND
LALLEMAND OENOLOGY
Original by culture



Glutastar: part of a fresh and Aromatic white winemaking protocol

SPECIFIC YEAST DERIVATIVES

Ensure the alcoholic fermentation and **drive the sensorial profile of your wines** with a dedicated protocol

より健全な発酵を担保し溶存酸素を確実に消費

Prefermentative stages

GLUTASTAR™

Alcoholic fermentation

Selected wine yeast & Protection

GO-FERM™ STEROL FLASH

SAUVY™

Alcoholic fermentation

Yeast nutrients

FERMAID O™

Stimula™ Sauvignon blanc

LALLEMAND

LALLEMAND OENOLOGY

Original by culture

Glutastar FAQ

Q1: Glutastarを発酵終盤に添加する方法は技術的観点から推奨されますか？
A1: いいえ、破砕時の添加をお勧めします。破砕時の果汁は素早く酸化します。
工程の初めから終わりまでもろみを保護する意図です。

Q2: Glutastarを破砕時に添加する場合、AF終了以降の酸化防止策はどうすべきですか？
A2: 現時点の日本では従来通りの亜硫酸添加が最良の選択です。

Q3: Glutastarを破砕時に添加する場合、デブルバージュ工程に特段の注意点はありますか？
A3: いいえ、通常通りで結構です。グルタスターに含まれる関与成分は速やかに果汁中に移行し機能します。

Q4: H2SやSO2を産生しやすい菌株と含硫ペプチドを豊富に含むGlutastarの組み合わせは危険ではないですか？
A4: ご安心ください。上市前後の各種妥当性検証においてご指摘の問題は確認されていません。