SCETI Supported by LALLEMAND

DENIS
MAISON FONDÉE EN 1862

Low SO2 Winemaking

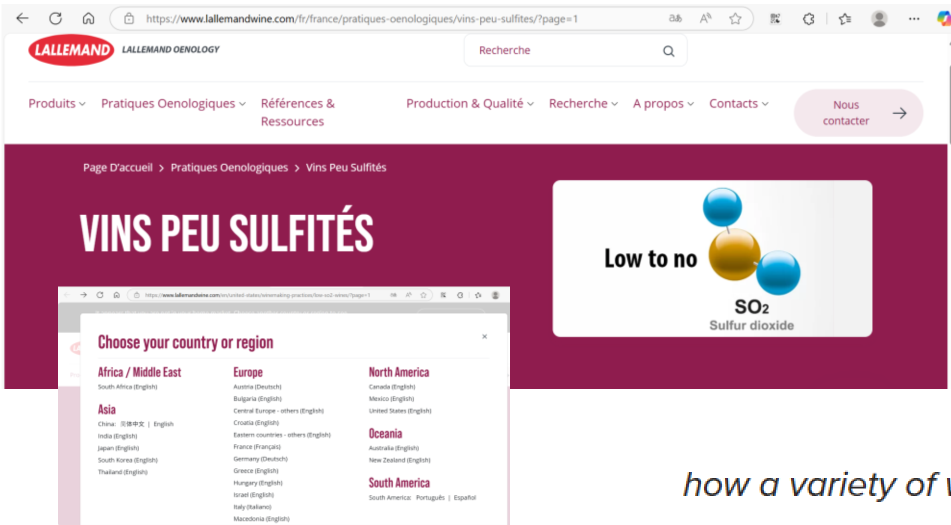
2025 Episode #3

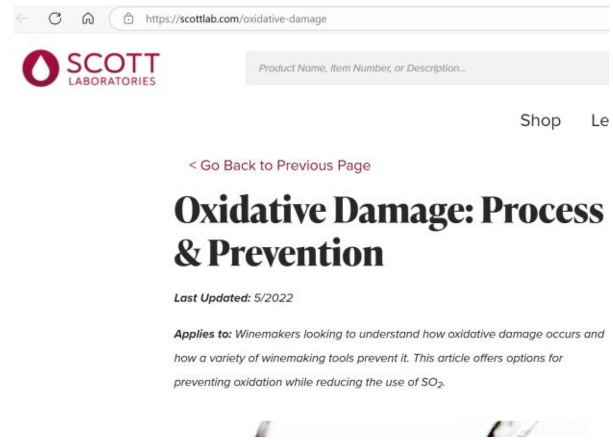
~ Tackling “protocolization” ~

2025年7月4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。

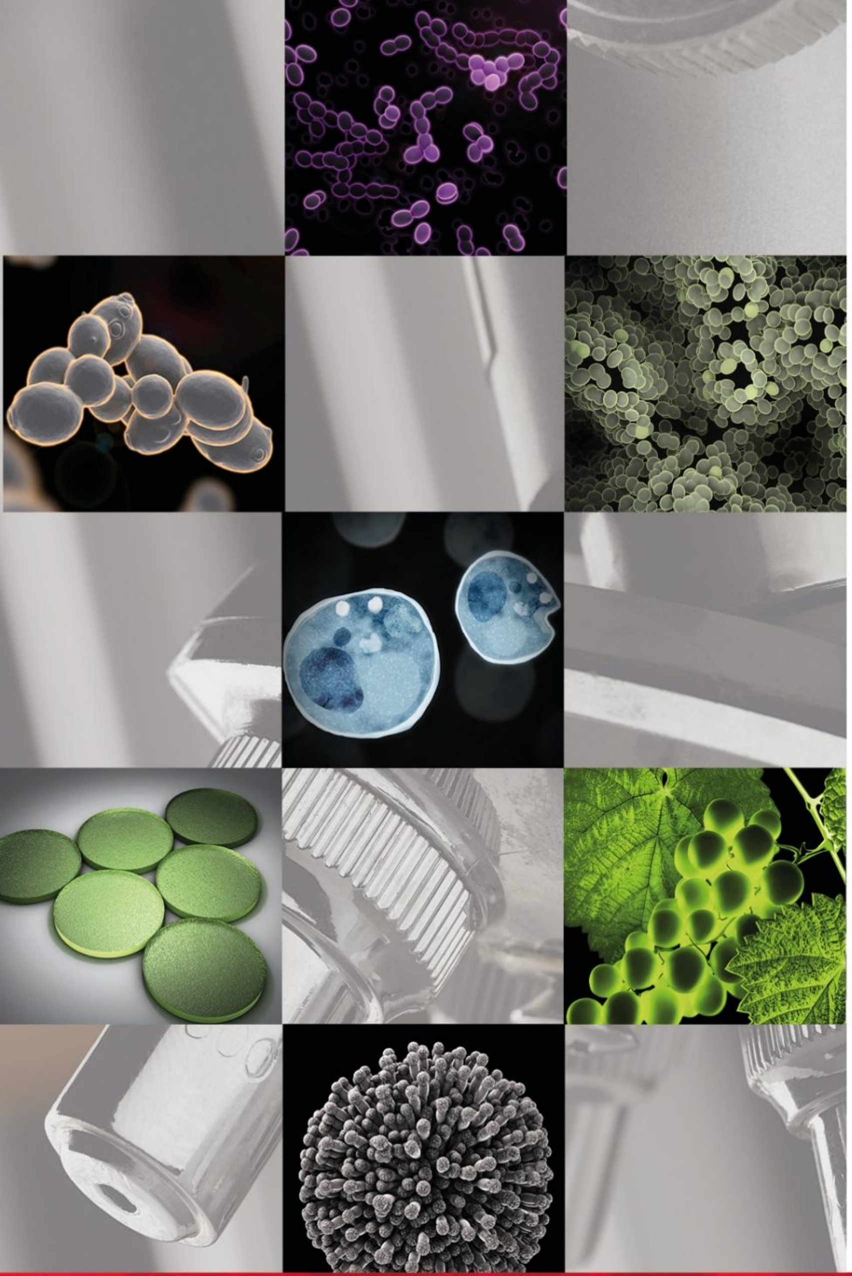
・本プロトコル例は、今後技術的知見の蓄積により改良更新される可能性がございます。

・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

DENIS SCETI
MAISON FONDÉE EN 1862



Biological strategies to reduce chemical inputs during winemaking

Ver. Oslo 2019
x
localization into Japan 2025

Ann Dumont, M.Sc.
Marion Bastien Ing. Oenologue
Sam Harrop MW

A real challenge for all the wine professionals

Reducing chemical intrants in winemaking
is a real challenge for the wine industry,
from **a market**

「ケミカル使用量減」

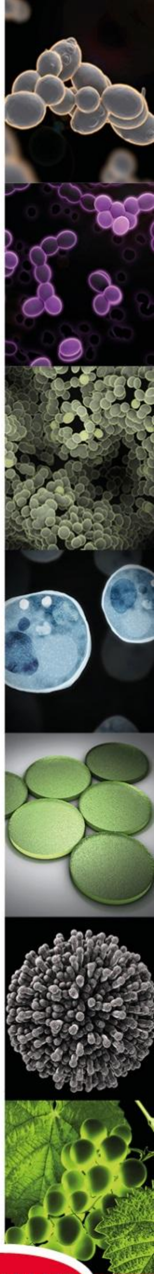
と

「品質の維持向上」

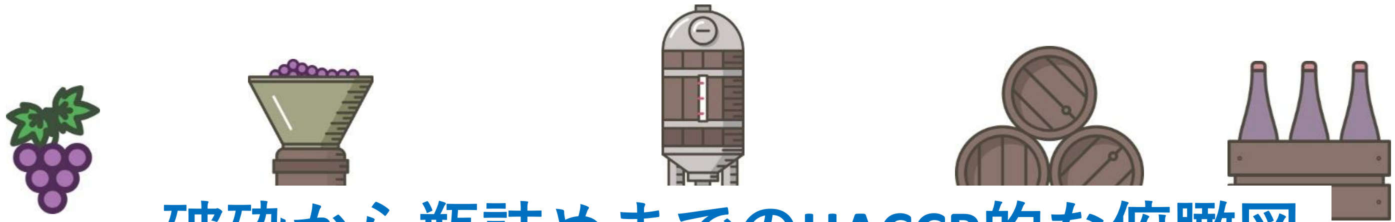
from **a technical** point of view,

の両立

to respect the right balance, to respect the ter

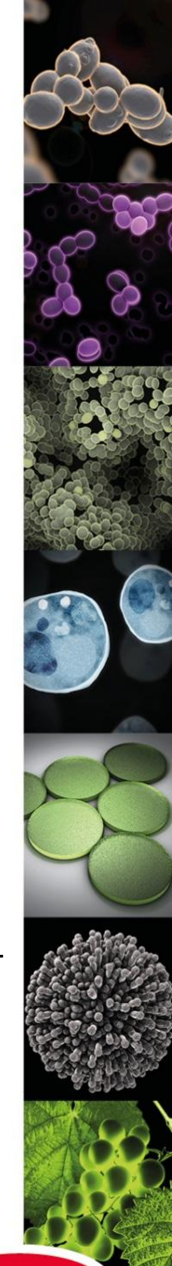


Overview of winemaking steps & risk management



破砕から瓶詰めまでのHACCP的な俯瞰図

	Pre steps Fermentations management	Correction & Stabilization	Fining & Aging Storage & Transport
Main risks to manage	Oxydation Microbiological spoilage Fermentation issues	Oxydation Microbial contamination Reduction	Proteic stability Tartaric stability Quality improvement Oxydation Microbial contamination
Main chemical intrants	SO_2 Ascorbic acid Diammonium Phosphate, ammonium sulfate	SO_2 Acids (tartaric, citric, lactic, etc.) Salts (calcium carbonate, potassium salts) Copper sulfate or citrate	SO_2 PVPP CMC Salts Metatartaric acid



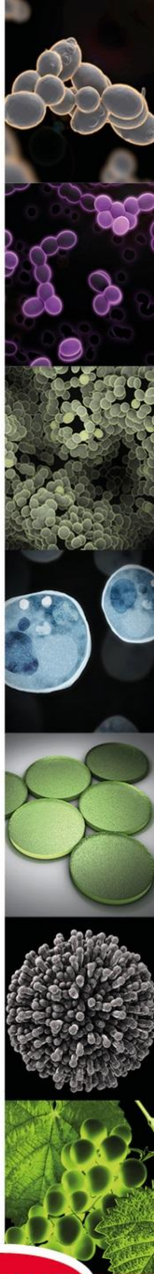
Overview of winemaking steps & risk management

Prefermentative steps

Fermentations management

Challenge n°1 : oxydation

Main risks to manage	Oxydation Microbiological spoilage Fermentation issues
Main chemical intrants	SO_2 Ascorbic acid Diammonium Phosphate, ammonium sulfate



Overview of winemaking steps & risk management

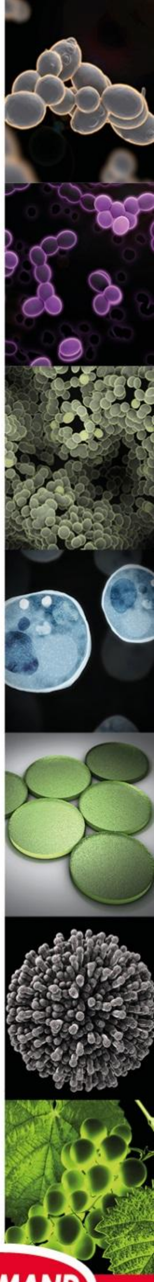
Prefermentative steps

Fermentations management

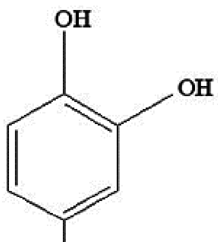
Challenge n°1 : oxydation

Challenge n°2 : microbiological spoilage/contamination

Main risks to manage	Oxydation Microbiological spoilage Fermentation issues
Main chemical intrants	SO_2 Ascorbic acid Diammonium Phosphate, ammonium sulfate



Protection from oxydation in prefermentative steps

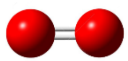


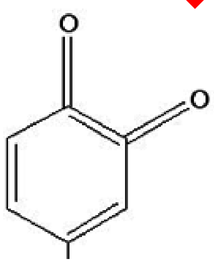
Caftaric acid
(phenol)

What is one of the main mechanism of oxydation in the early stage of white winemaking?

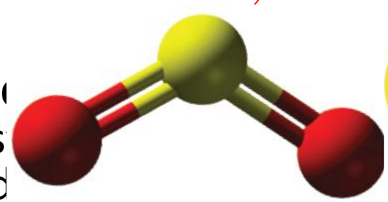
INITIA™

O_2

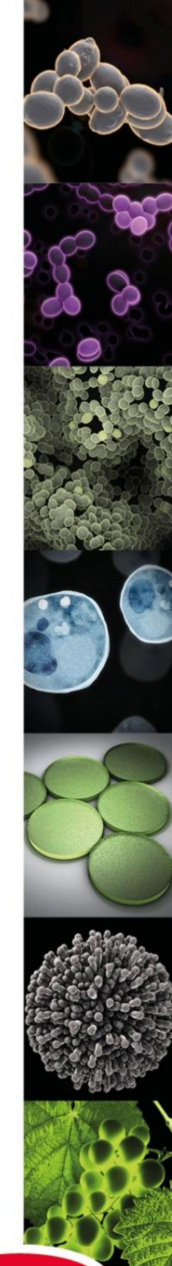




Quin
Very s
oxyd



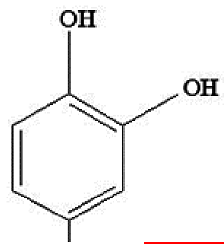
Browning



GLUTASTAR™

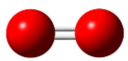
Thiols precursors oxidation

Protection from oxydation in prefermentative steps

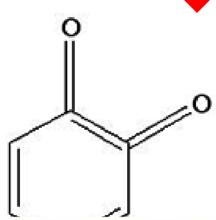


Caftaric acid (phenol)

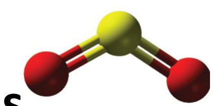
INITIA™



O_2



Quinones

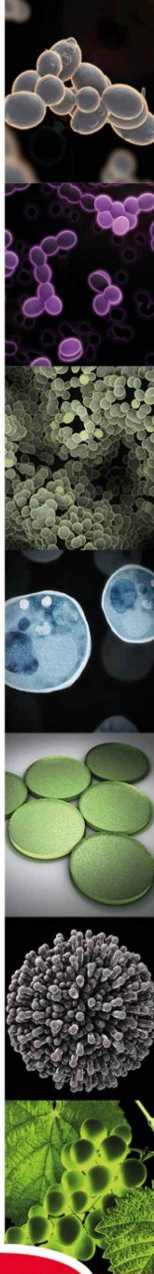


GLUTASTAR™

- Glutathion = natural tripeptide present in grapes AND yeast
- Reduced glutathion (GSH) = strongest natural antioxidant compound in wine (the lowest redox potential)

Limit / avoid browning

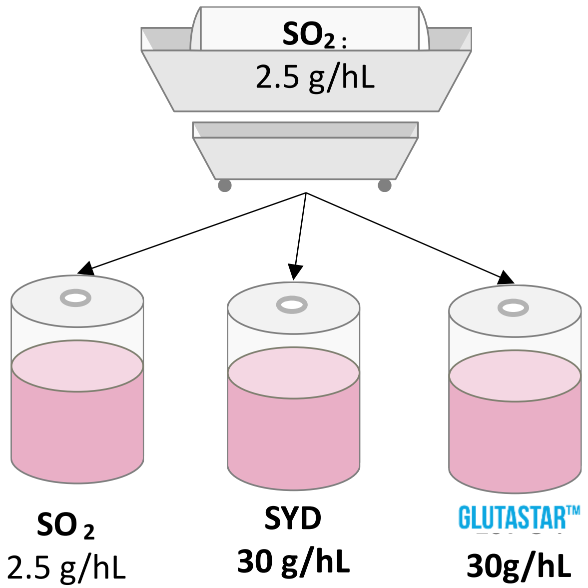
Protect thiols precursors from oxidation



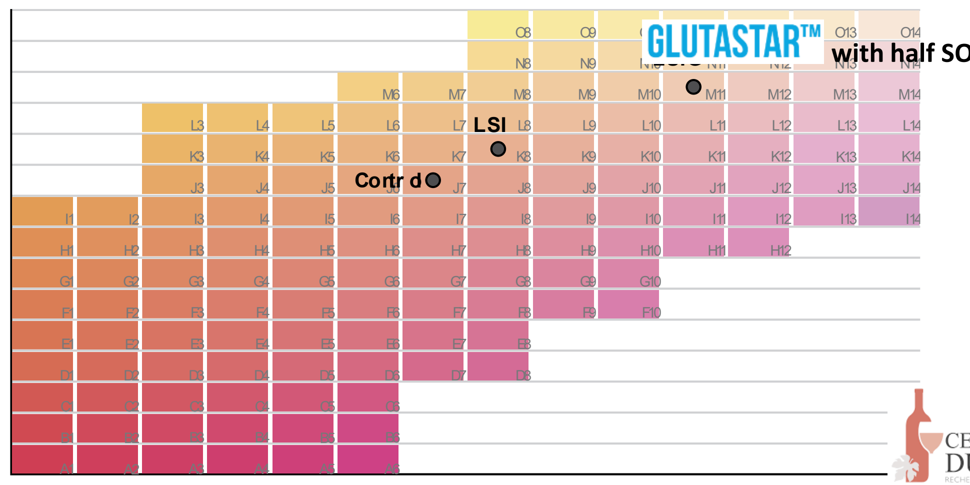
Field results

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

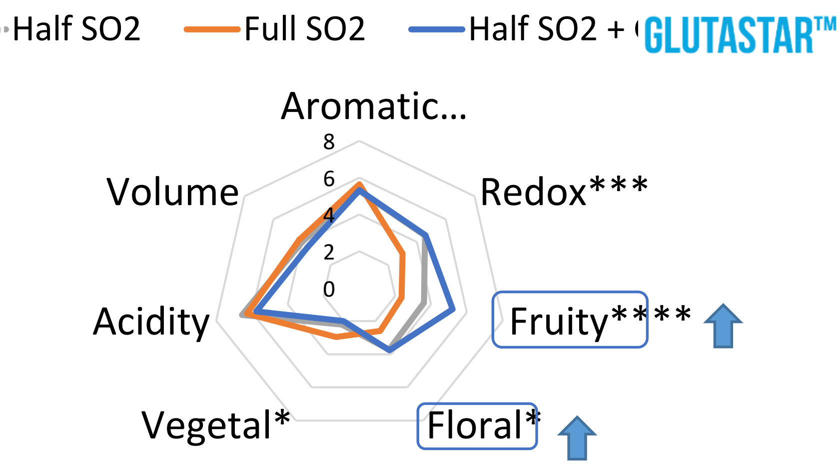
グルタスター添加により、色調劣化を避けつつ亜硫酸の半量分割添加可能

Field results

Positive impact on tasting

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

Sensorial analysis (IUVV, 25 tasters)



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

- 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↓

Field results

Positive impact on tasting

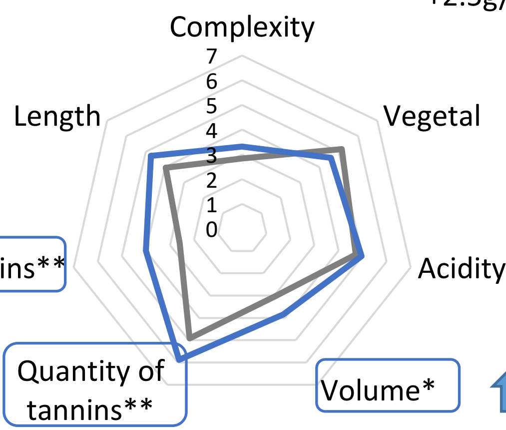
Pinot noir (IUVV, Burgundy, France)

sorial analysis (IUVV, 25 tasters)

Control — Glutastar

5g/hL SO2(Full dose)

GLUTASTAR™ +2.5g/hL SO2(Half dose)

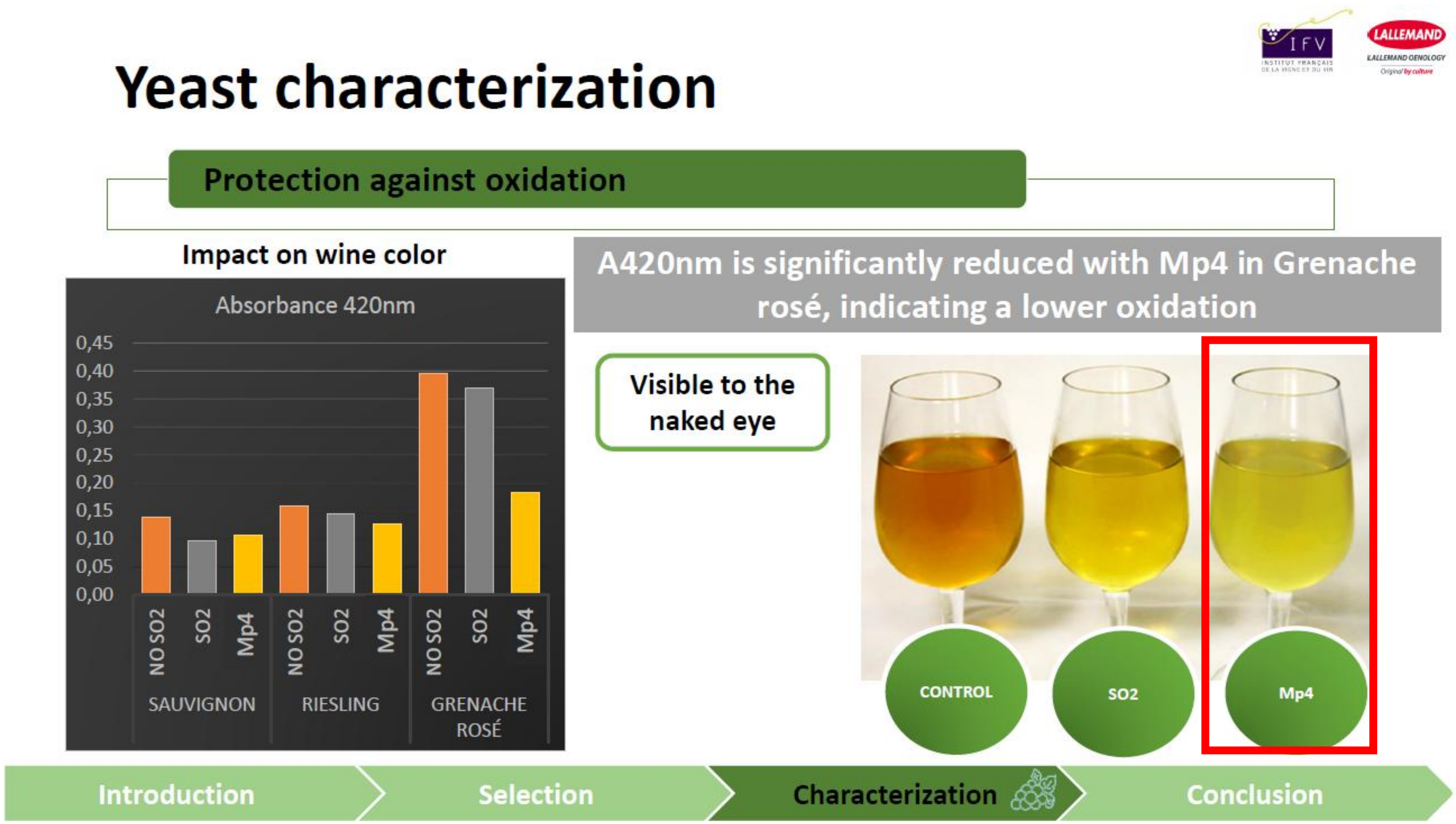


Significant at
* 10% - ** 5%

- 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

Mp4(INITIA)の酸化防止機能確認試験：色調



Cf. SB trial at 8C for 24h（カタログ2025 p22）

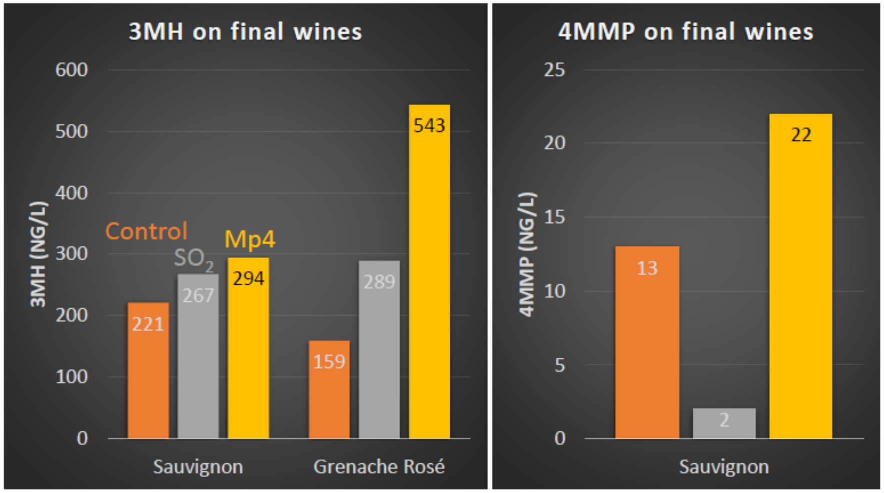
Deroite, ASEV 2022, San Diego

Mp4(INITIA)の酸化防止機能確認試験：チオール

Yeast characterization

Protection against oxidation

Impact final thiols concentration in wines



Better thiols preservation with Mp4

Introduction | Selection | **Characterization** | Conclusion

Deroite, ASEV 2022, San Diego

Mp4(INITIA)　変敗菌制圧効果

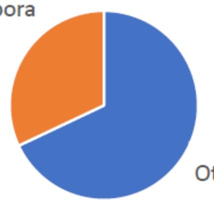
Yeast characterization

powerful antimicrobial action

Pilot trial Chardonnay 2020 (Sicarex, France)
No SO_2 winemaking

Yeast Population in the must:

Hanseniaspora 32%



Other yeasts 68%

Mp4: 10 g/hL

5 days of cold stabulation at 10°C

No SO_2, no bioprotection

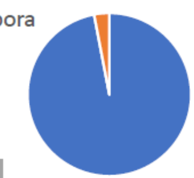
Hanseniaspora 50%

Other yeasts 50%

変敗菌残存 3% vs 100%

Mp4

Hanseniaspora 3%



97% Mp4

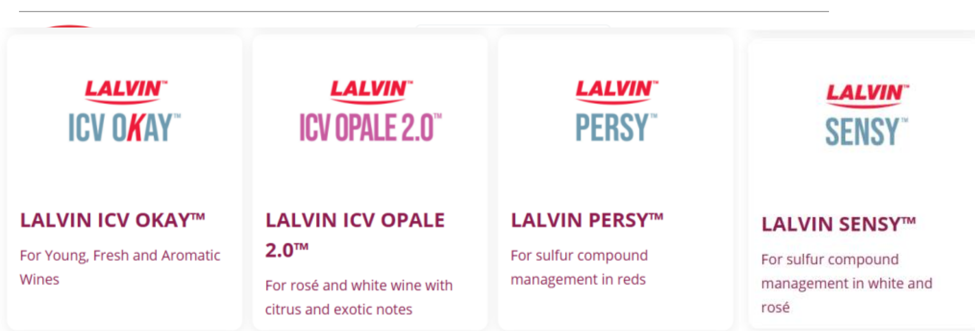
Viable *Hanseniaspora* percentage decreases with Mp4 bioprotection

Deroite, ASEV 2022, San Diego

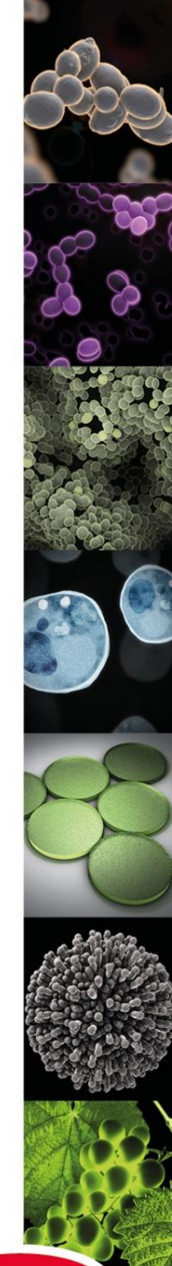
Protection from oxydation in prefermentative steps

- Another way to limit oxydation:
  - Yeast consumes oxygen
  - Early yeast inoculation can decrease dissolved oxygen in early steps
  - New applications and research

選抜酵母の「早期／適時」接種による溶存酸素消費



https://www.lallemandwine.com/en/united-states/winemaking-practices/low-so2-wines/



Pro… …bes

LALVIN ICV OKAY

LALVIN ICV OPALE 2.0

LALVIN PERSY

LALVIN SENSY

亜硫酸半減も酵母適時接種による変敗菌抑制 vs 野生

citrus and exotic notes

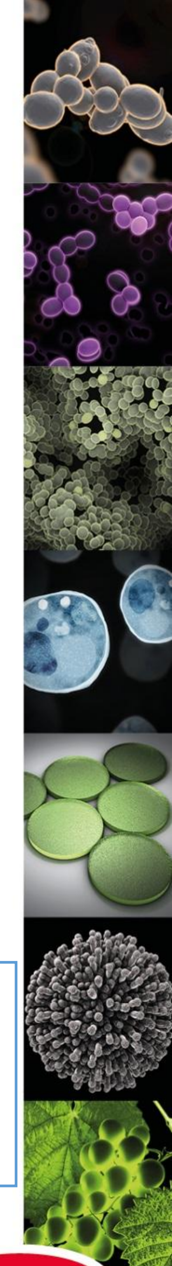
rosé

	Low sulfites (3,7 g/hL SO_2) NO yeast addition	Normal sulfites (7,5 g/hL SO_2) NO yeast addition	Low sulfites (3,7 g/hL SO_2) + Yeast addition
Brettanomyces end of AF (CFU/mL)	40 000	3 000	700
Volatile phenols end of AF (µg/L)	94	12	17
Volatile phenols end of MLF (µg/L)	467	68	75

Source: IFV

Even significant SO_2 addition will not prevent completely *Brettanomyces* contamination

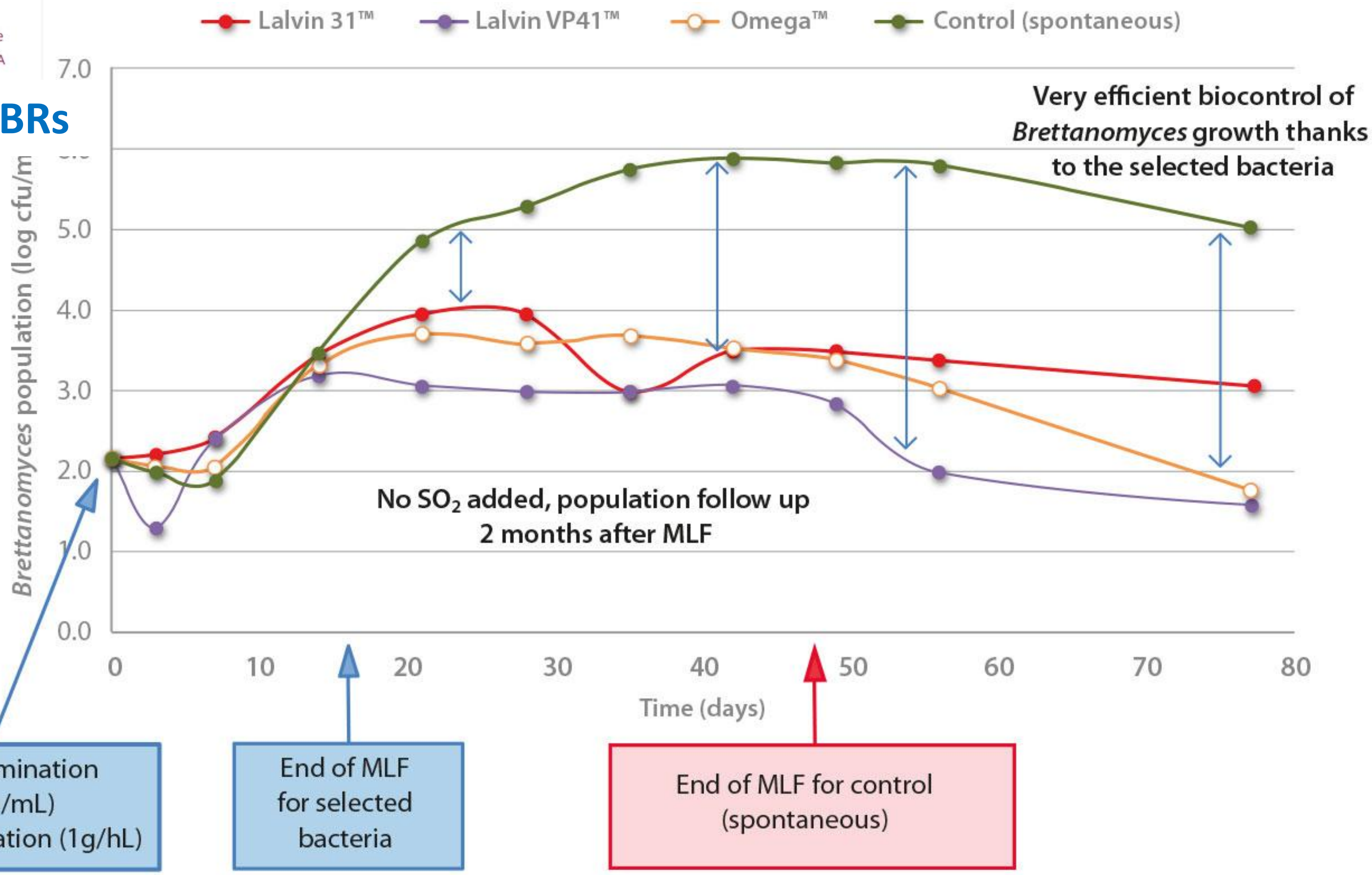
Only early yeast inoculation coupled with a half-dose of sulphiting is effective

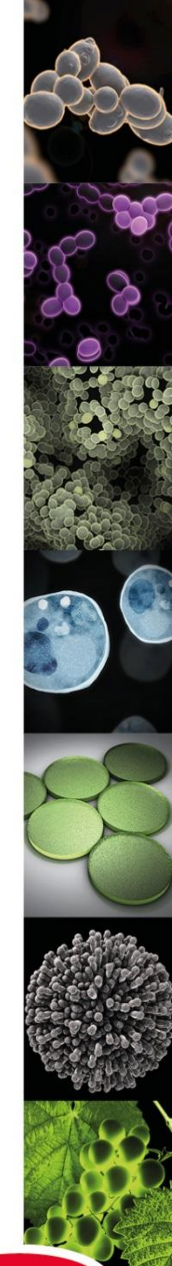


Protection versus spoilage microbes

Early wine bacteria inoculation

& *O.oeni* MBRs





Overview of winemaking steps & risk management

Prefermentative steps

Fermentations management

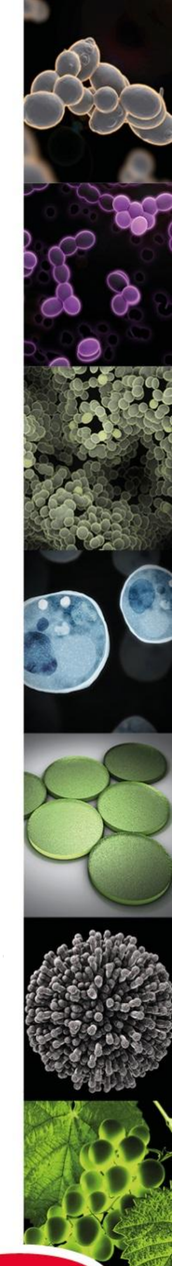
Main risks to manage	Oxydation Microbiological spoilage Fermentation issues
Main chemical intrants	SO_2 Ascorbic acid Diammonium Phosphate, ammonium sulfate

Challenge n°1 : oxydation

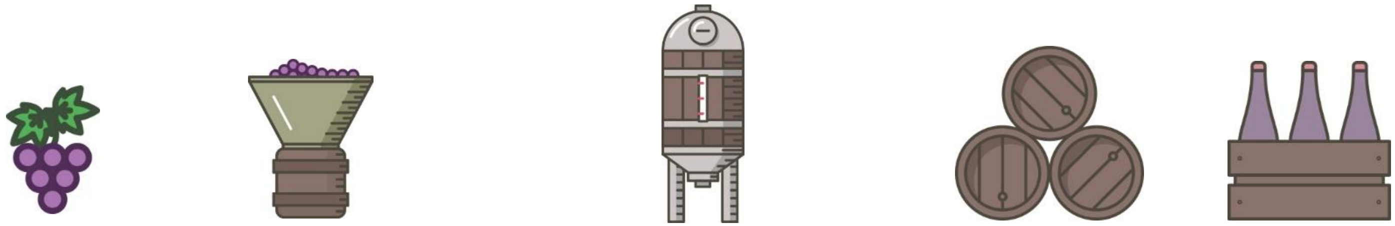
Challenge n°2 : microbiological spoilage/contamination

Challenge n°3 : fermentation issues

香味質を向上させる
亜硫酸の効きを良くする＝減量



Overview of winemaking steps & risk management



Prefermentative steps

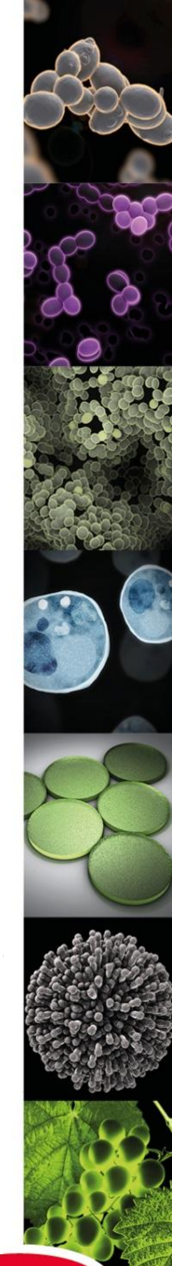
Fermentations management

Correction & Stabilization

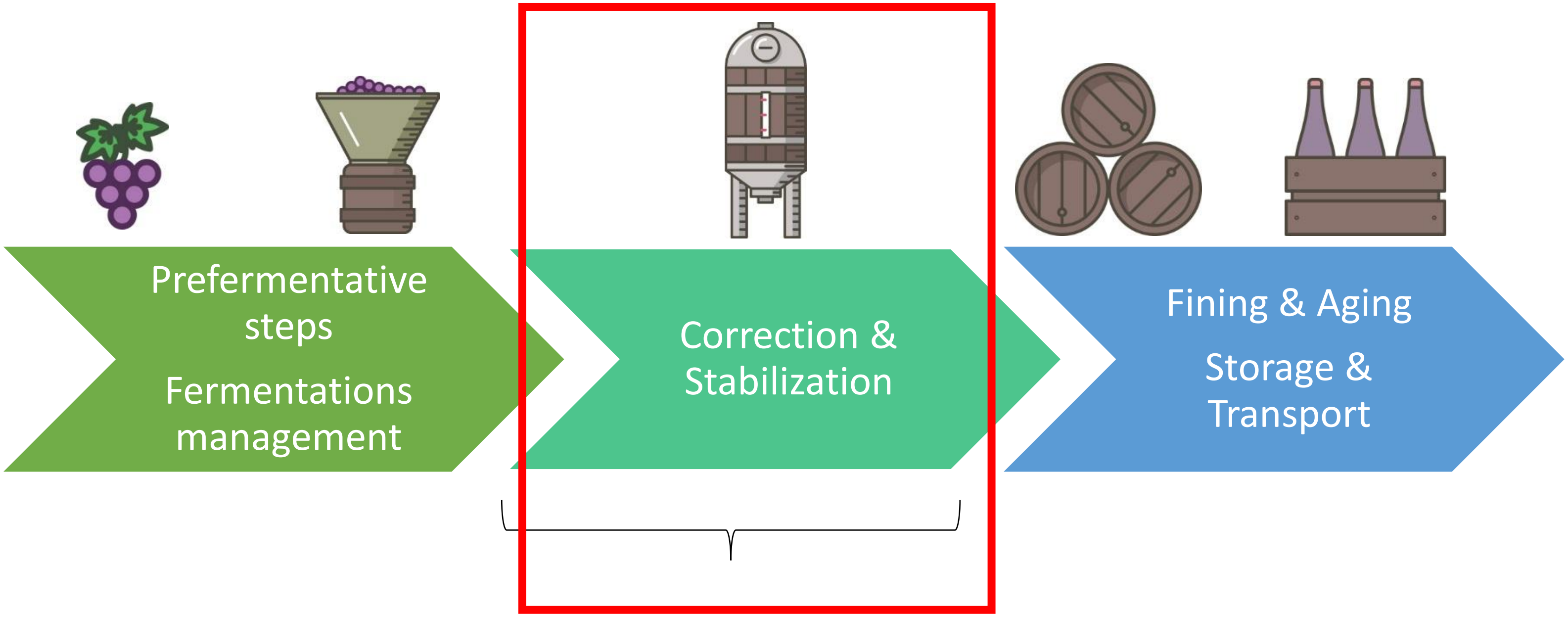
Fining & Aging

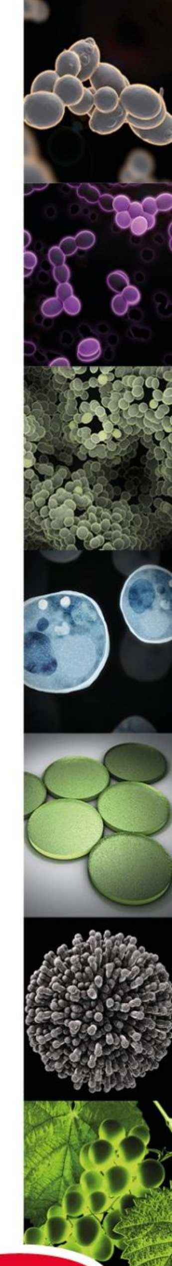
Storage & Transport

Main risks to manage		Oxydation Microbial contamination Reduction	
Main chemical intrants		SO_2 Acids (tartaric, citric, lactic, etc.) Salts (calcium carbonate, potassium salts) Copper sulfate or citrate	



Overview of winemaking steps & risk management





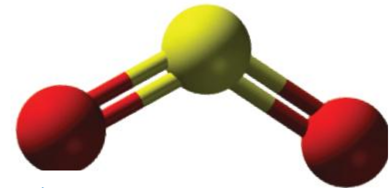
Reduce SO_2

Manage acidity

発酵完了後の亜硫酸添加量を最小化する

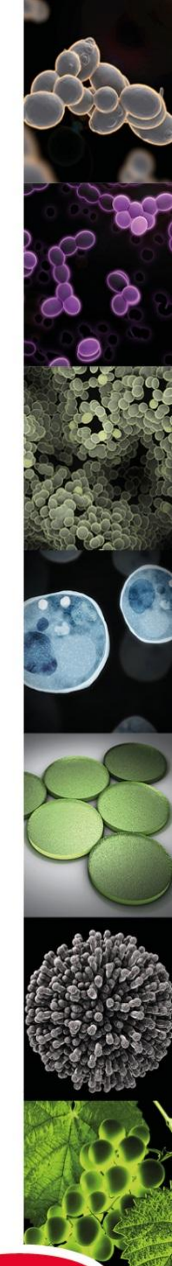
Manage off-flavours

Stabilization at the end of fermentations

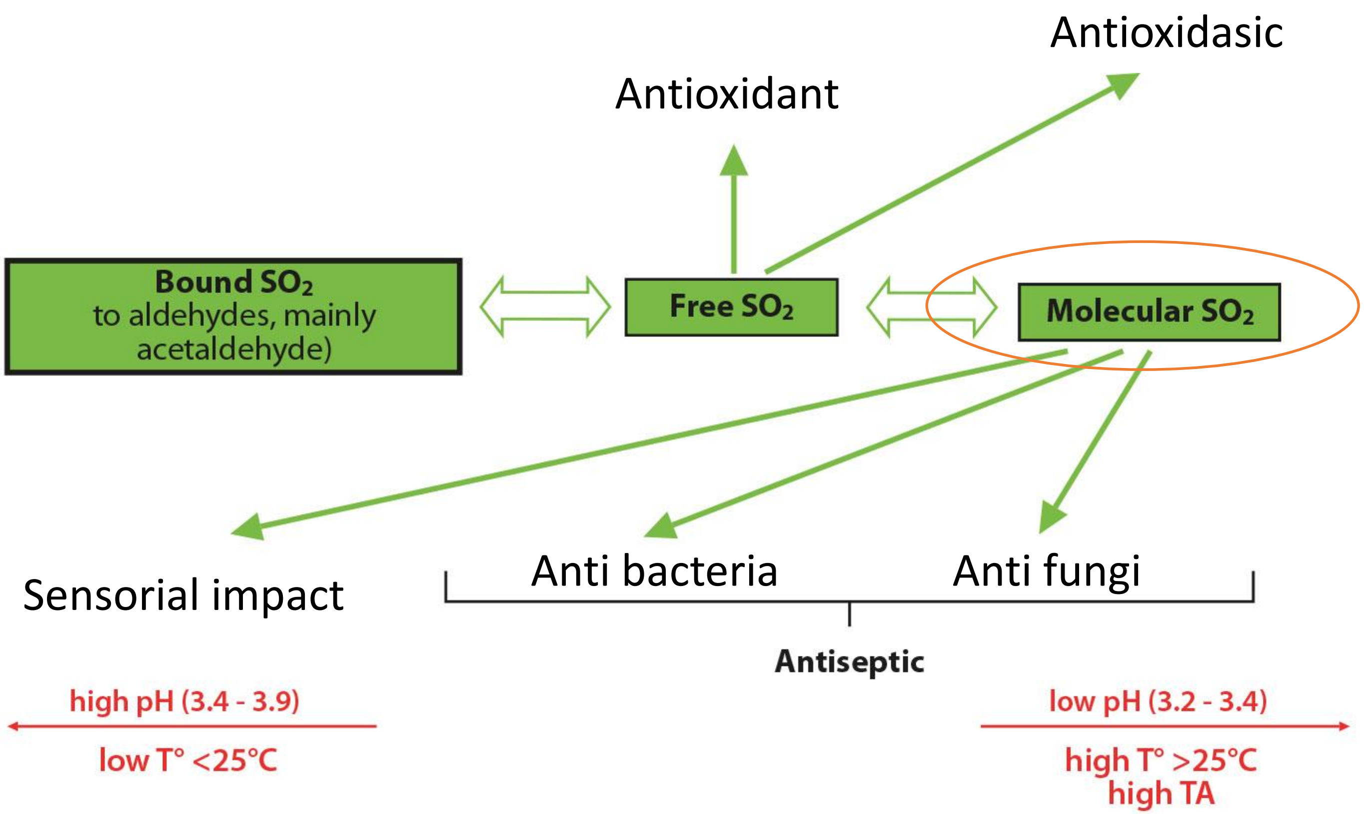


- Why reduce SO_2?
  - T SO2による望ましい香味のマスキングを避けるため
  - T 健康を害する成分の摂取を最小化する
  - T 市場の要請に応える
  - T （必要な場合、MLFを促進するため） nes, etc.)

- How to reduce SO_2?
  1. B 亜硫酸の効きを良くする ency
  2. By using biological alternatives

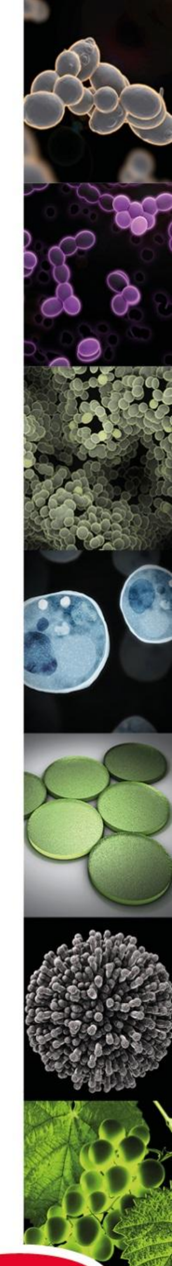


SO_2 in wine: a quick reminder



Limit binding to increase active form of SO_2

Manage pH

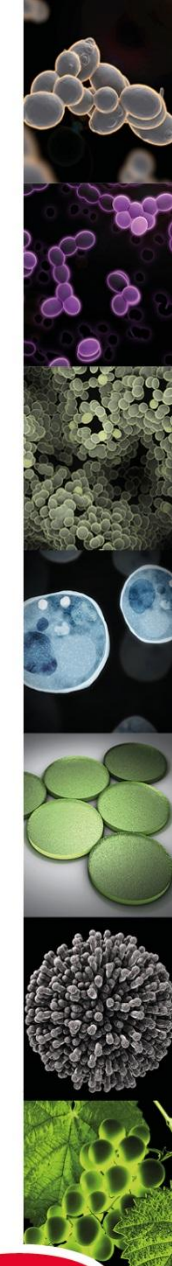


Molecules that bind SO_2 in wine

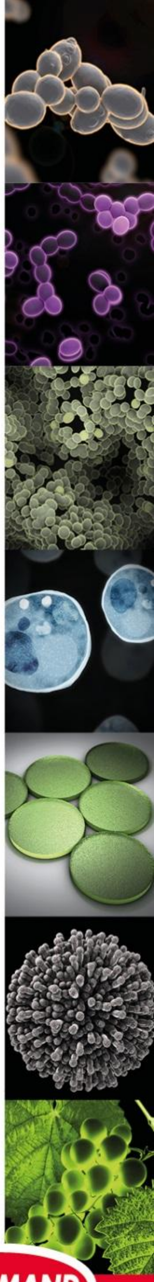
アセトが亜硫酸の効きを悪くする主犯格

Acetaldehyde	20-100	0,0024	99,7
Pyruvate	20-330	0,3	28
Acide 2-oxoglutarique	50-330	0,5	25
Glyoxal	0,2-0,5	-	81
Méthylglyoxal	0,7-6	0,017	87
Acide galacturonique	100-700	17	10
Acide glucuronique	Traces-60	50	1
5-oxofructose	Traces-2500	0,48	22
Dihydroxyacétone	Traces-20	2,65	16
Glycéraldéhyde	Traces-10	0,4	26
Acide gluconique	1000-25000	20	-
Acide 2-oxogluconique	Traces-1200	1,8	-
Acide 5-oxogluconique	Traces-500	-	-
Υ et δ-gluconolactone	6% et 4% de l'acide gluconique	4,22	5,6
Glucose	$\pm 100\ g \cdot L^{-1}$	800	0,03

Dissociation constants, levels in wine, and binding rates in wines made from botrytis-affected grapes.
Source: Burroughs-Sparks, 1964, 1973; Blouin 1965, 1995; Guilloux-Largeteaux, 1996; Barbe, 2000



SO_2 binding compounds: the key role of acetaldehyde



- Present in wines with concentration from a few mg/L to 150 mg/L
- Perception threshold: 40-45 mg/L
- Main origin: yeast metabolite during alcoholic fermentation
- 1 mg acetaldehyde binds with 1.5 mg of SO_2
- Binding is fast. At pH 3.3, 98% of the acetaldehyde binds in 1 hour and a half and 100% binds in 5 hours!

より少ない亜硫酸添加量で効く！

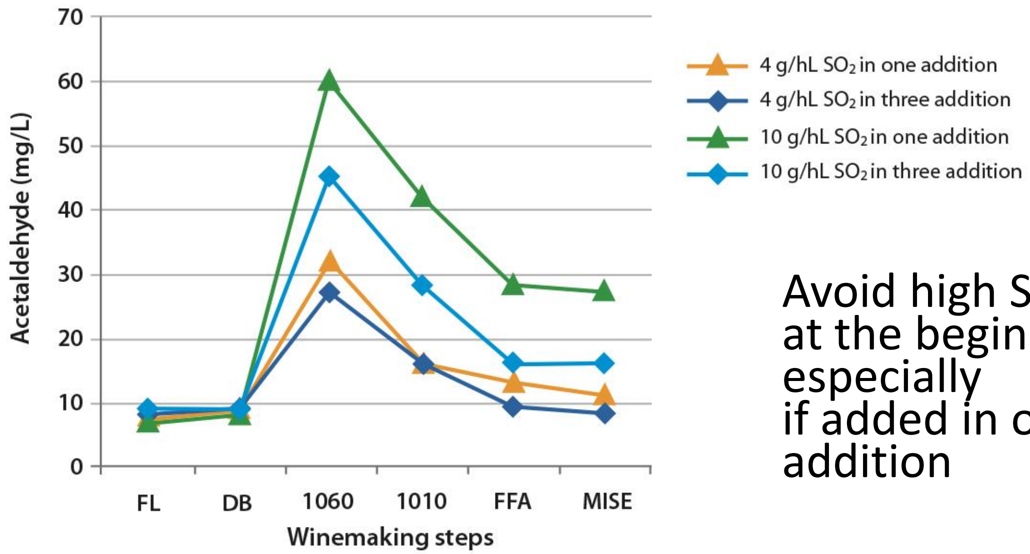
↑

酵母にアセトを産生させない！

- Example … in a wine after alcoholic … ss than 10 mg /L free SO_2
  - If the acetaldehyde level is 20 mg/L, sulphiting must be 3 g/hL.
  - If the acetaldehyde level is 50 mg/L, sulphiting must be **7 g/hL**!

How to limit SO_2 binding compounds?

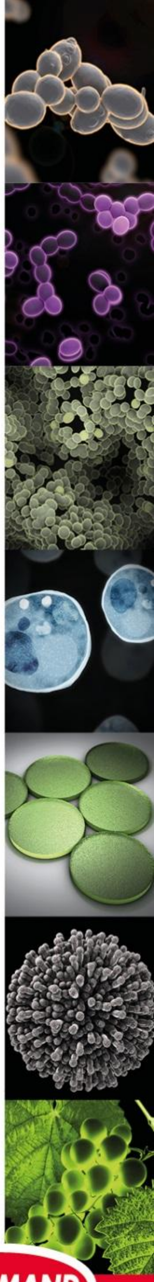
The role of initial SO_2 addition



Avoid high SO_2 addition at the beginning, especially if added in one single addition

Source: IFV Centre du Rosé

好例：比較的少量を三分割



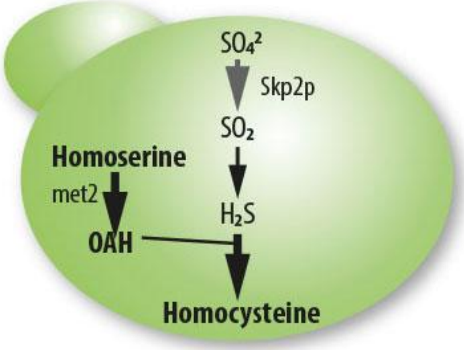
Specific yeast selection: low SO_2, acetaldehyde & H_2S production

LALVIN ICV OKAY™
For Young, Fresh and Aromatic Wines

LALVIN ICV OPALE 2.0™
For rosé and white wine with citrus and exotic notes

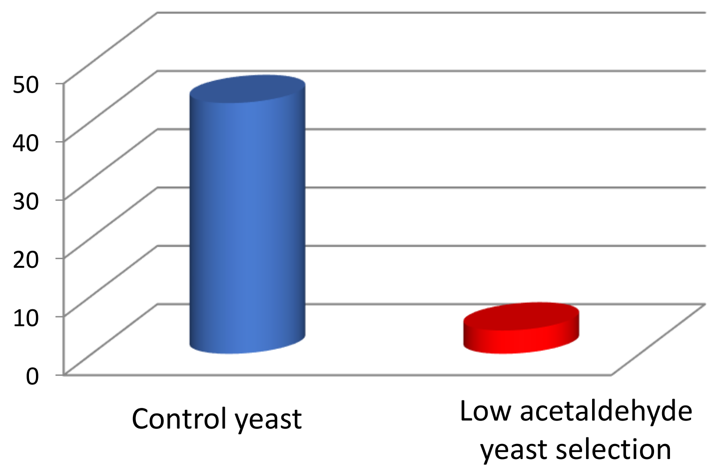
LALVIN PERSY™
For sulfur compound management in reds

LALVIN SENSY™
For sulfur compound management in white and rosé

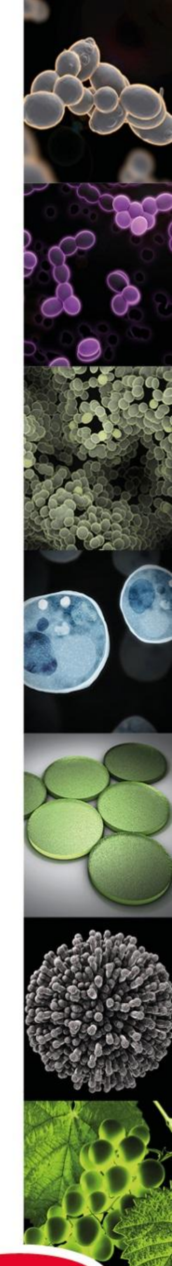


Low acetaldehyde, SO_2 & H_2S wine yeast

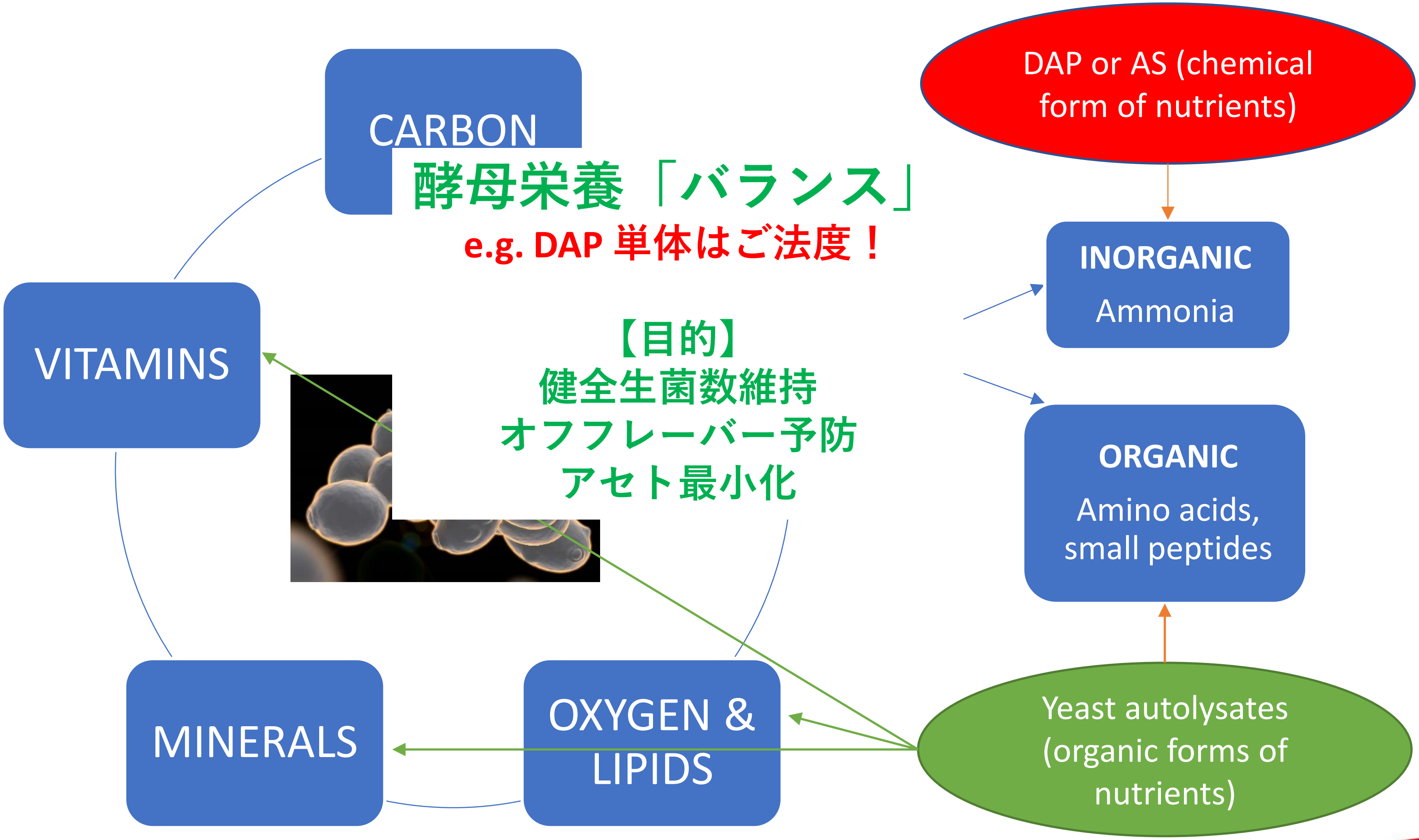
Acetaldehyde (mg/l±4)

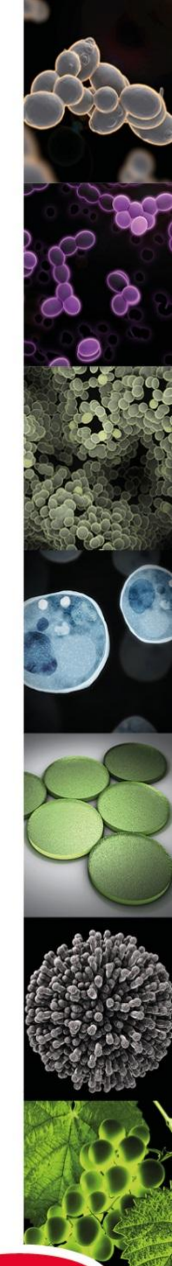


INRA SCIENCE & IMPACT
Montpellier SupAgro
GROUPE ICV L'art & l'expertise du vin



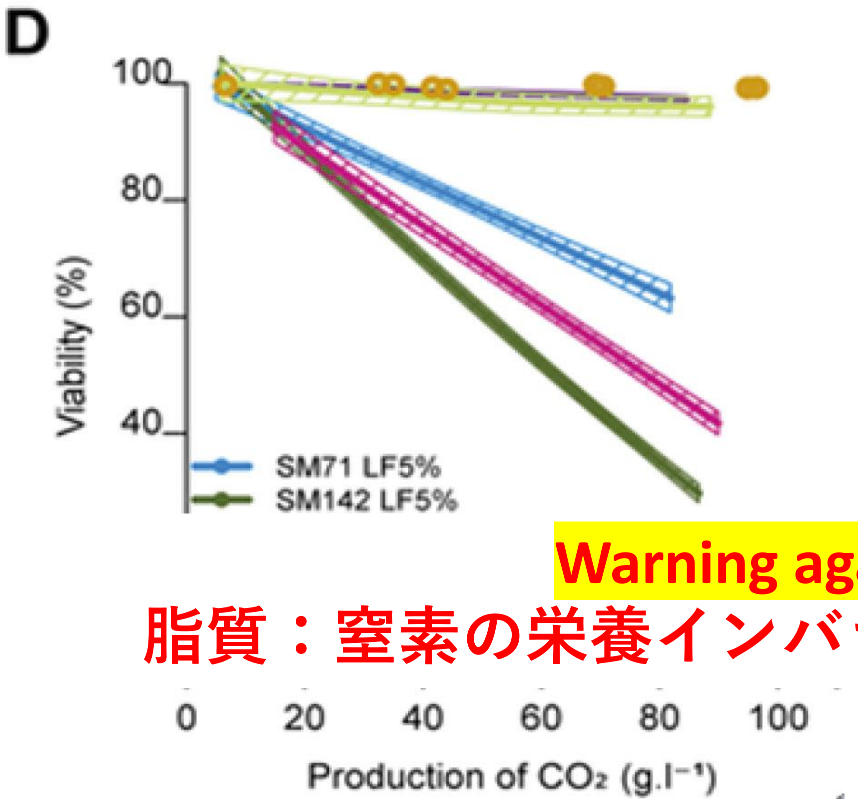
Managing a balanced and non chemical yeast nutrition to ensure healthy fermentations





Managing a balanced and non chemical yeast nutrition to ensure healthy fermentations

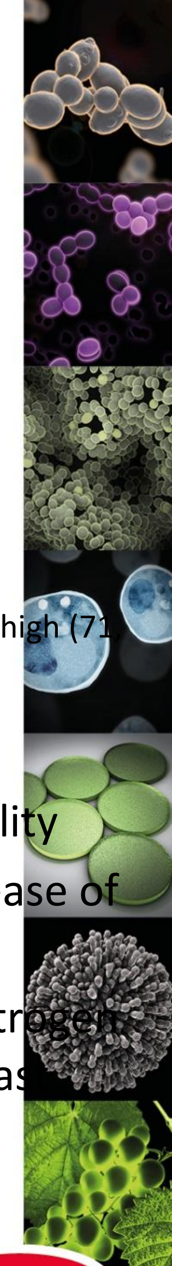
- One example of the lipids role and interaction with nitrogen



- Experimental conditions
  - Same yeast, same conditions
  - Impact on viability
  - Variables
    - 3 Nitrogen Levels: low, medium and high (71, 142 and 425 mg/L YAN)
    - 2 lipids levels: deficiency (5%) vs no deficiency (100%)
- Nitrogen does not impact yeast viability
- ...crease of ...; nitrogen only is even more detrimental for yeast viability!

Warning against DAP!

脂質：窒素の栄養インバランス　→　酵母細胞死



Blondin et Tesnières., 2013, PlosOne : 8, e1645

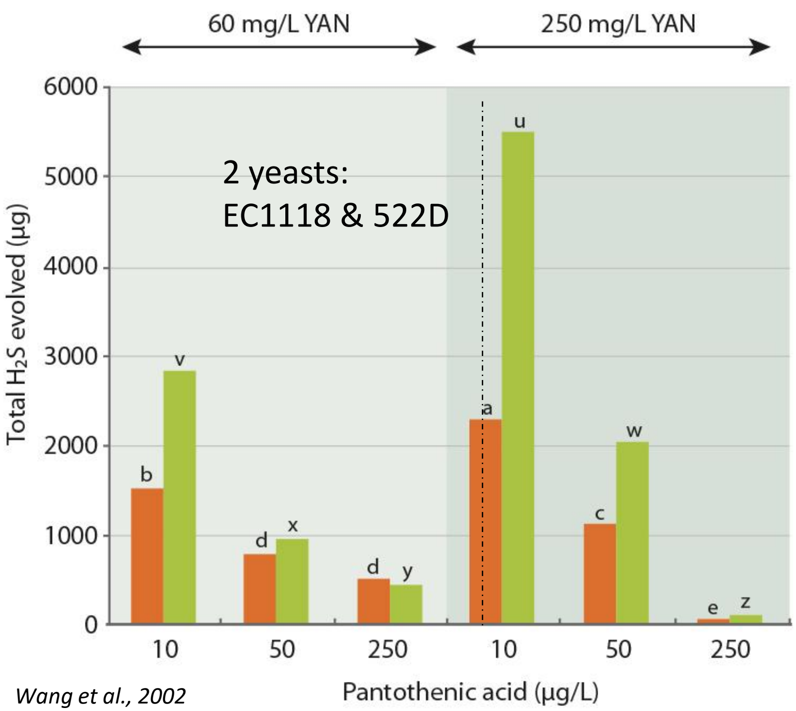
Warning against DAP!

Mana Cf. 脂質：窒素のインバランスストーリー east nutri

↓

酵母細胞死

Panthonetate (B5) and sulfur off flavors (H_2S)

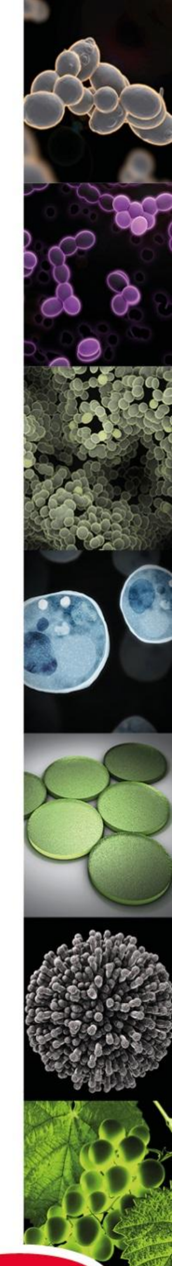


Wang et al., 2002

- Pantothenate deficiency
⇨ High H_2S production

- Even worse in high YAN condition and panthotenate deficiency.

- Nitrogen management is not enough…

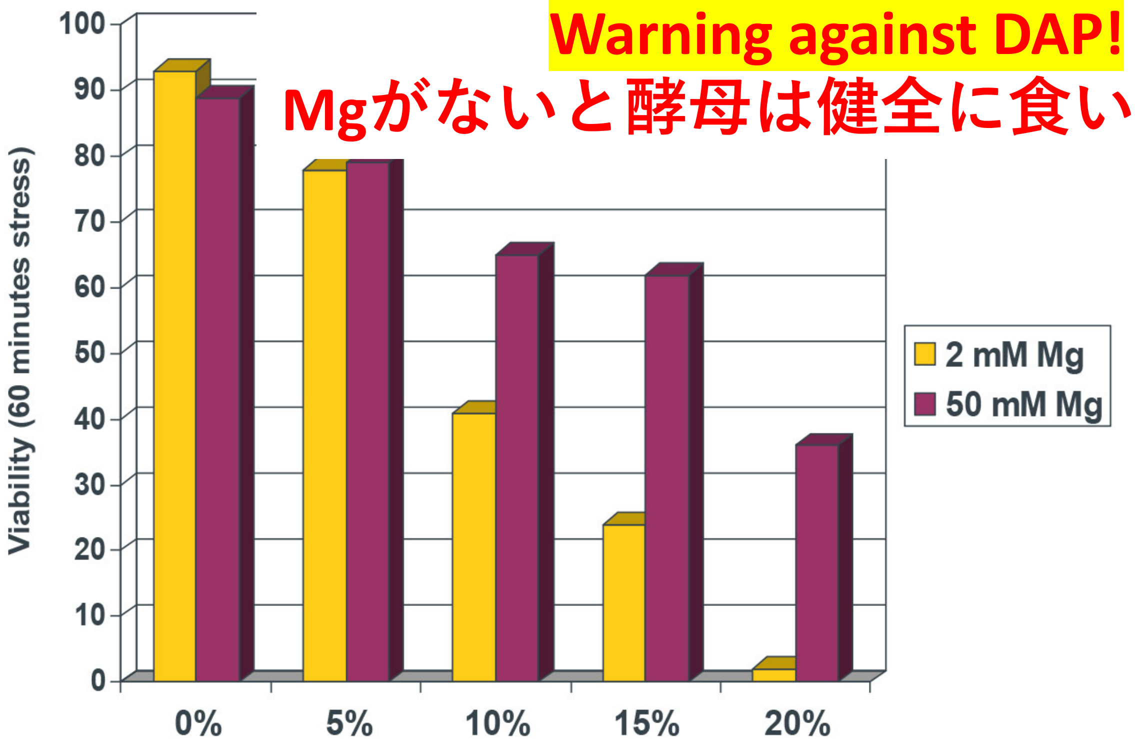


Managing a balanced and non chemical yeast nutrition to ensure healthy fermentations

- Example of the mineral role:
  Magnesium & ethanol tolerance

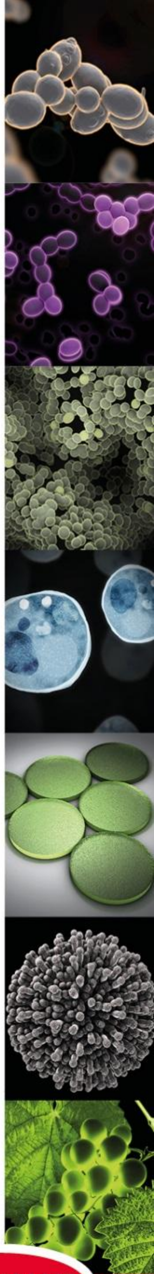
Warning against DAP!

Mgがないと酵母は健全に食い切れない



Birch and Walker, 2000

S. cerevisiae viability after 60 minutes of ethanol stress
Influence of various concentrations of MG^{2+}



How to limit SO_2 binding compounds?

チアミン不足

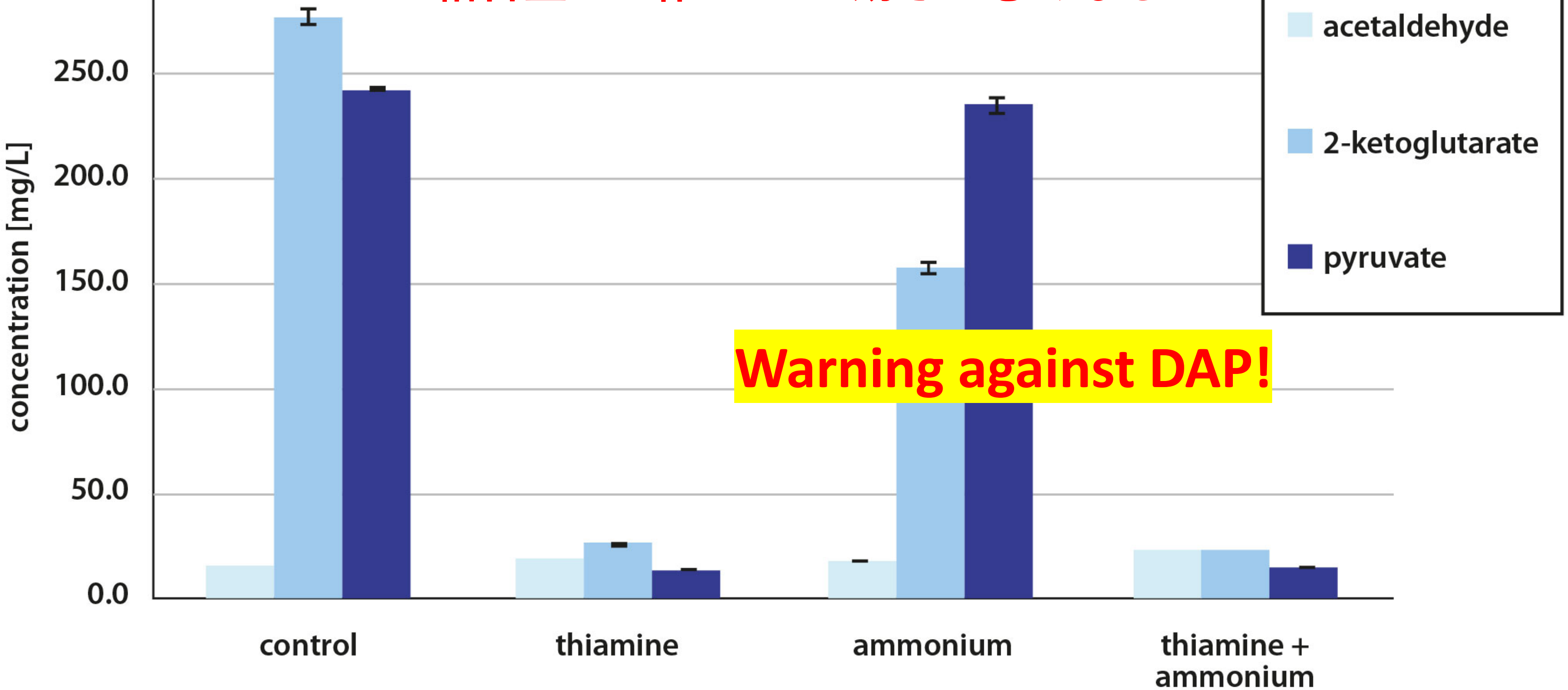
↓

The r　　　　　　　　　　　　nine)

アセト＆ピルビン酸増

↓

結合型SO2増＝SO2の効きが悪くなる



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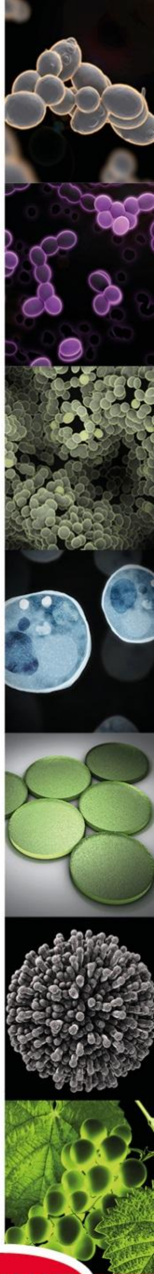
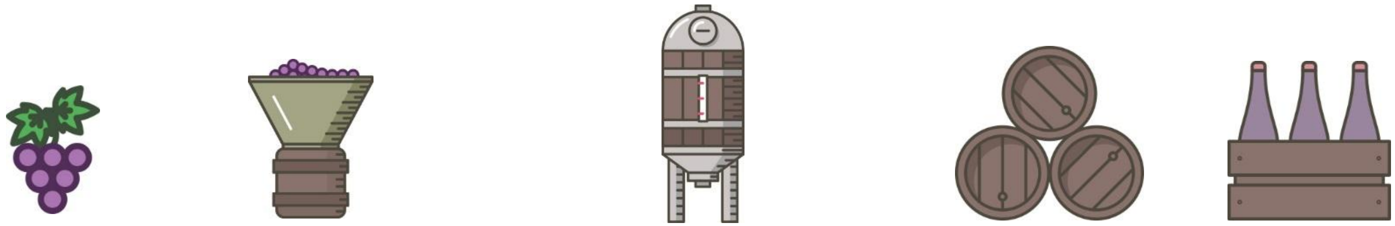
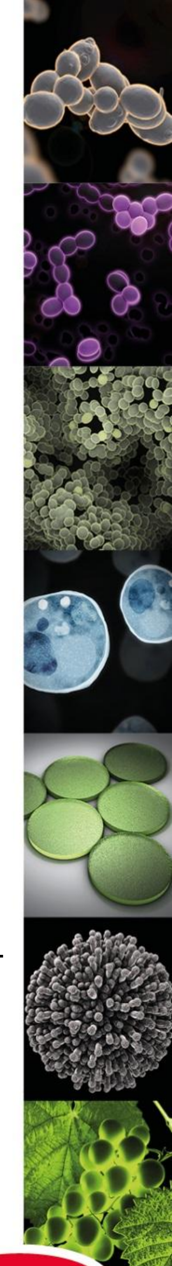


Overview of winemaking steps & risk management





Prefermentative steps Fermentations management	Correction & Stabilization	Fining & Aging Storage & Transport

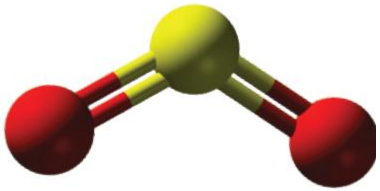
Main risks to manage

- Proteic stability
- Tartaric stability
- Quality improvement
- Oxydation
- Microbial contamination

Main chemical intrants

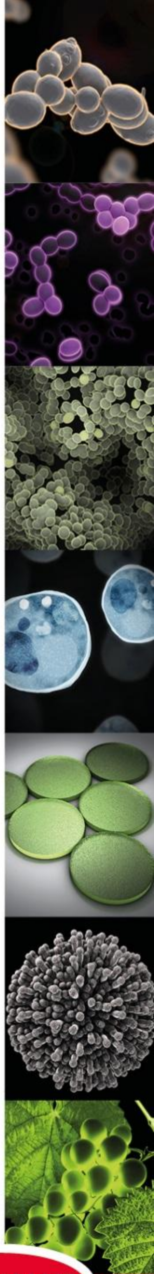
- SO_2
- PVPP
- CMC
- Salts
- Metatartaric acid

Stabilization at the end of fermentations



- Why reduce SO_2?
  - To avoid defects masking desirable aromas
  - To facilitate MLF
  - To avoid possible negative impact on health
  - To answer a market demand (fruitier wine, organic wines, etc.)

- How to reduce SO_2?
  1. By improving its addition efficiency
  2. バイオロジカルツールの活用



Fining alternatives

野生乳酸菌＆酢酸菌を抑制

ブレタノマイセスを抑制

• Fini

– C (trapping ality fining)

– Ye t (proteic sensorial ir results o

– Ye s (tartaric orial ir

BACTILESS™

BACTILESS™

Pure chitosan and chitin-glucan from Aspergillus niger

NO BRETT INSIDE

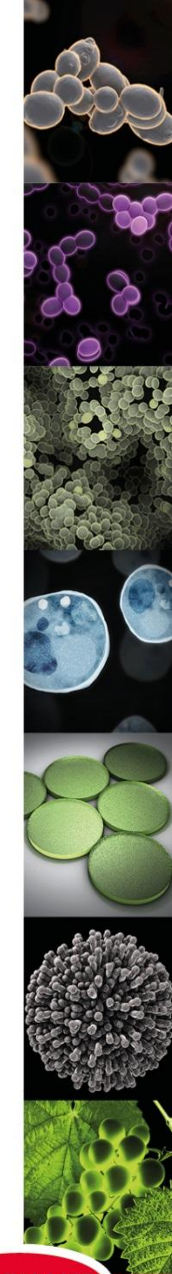
NO BRETT INSIDE®

Pure chitosan from Aspergillus niger

アレルゲンフリー（酵母由来）、剥ぎ取り感がより少ないFining agent

FINELY™

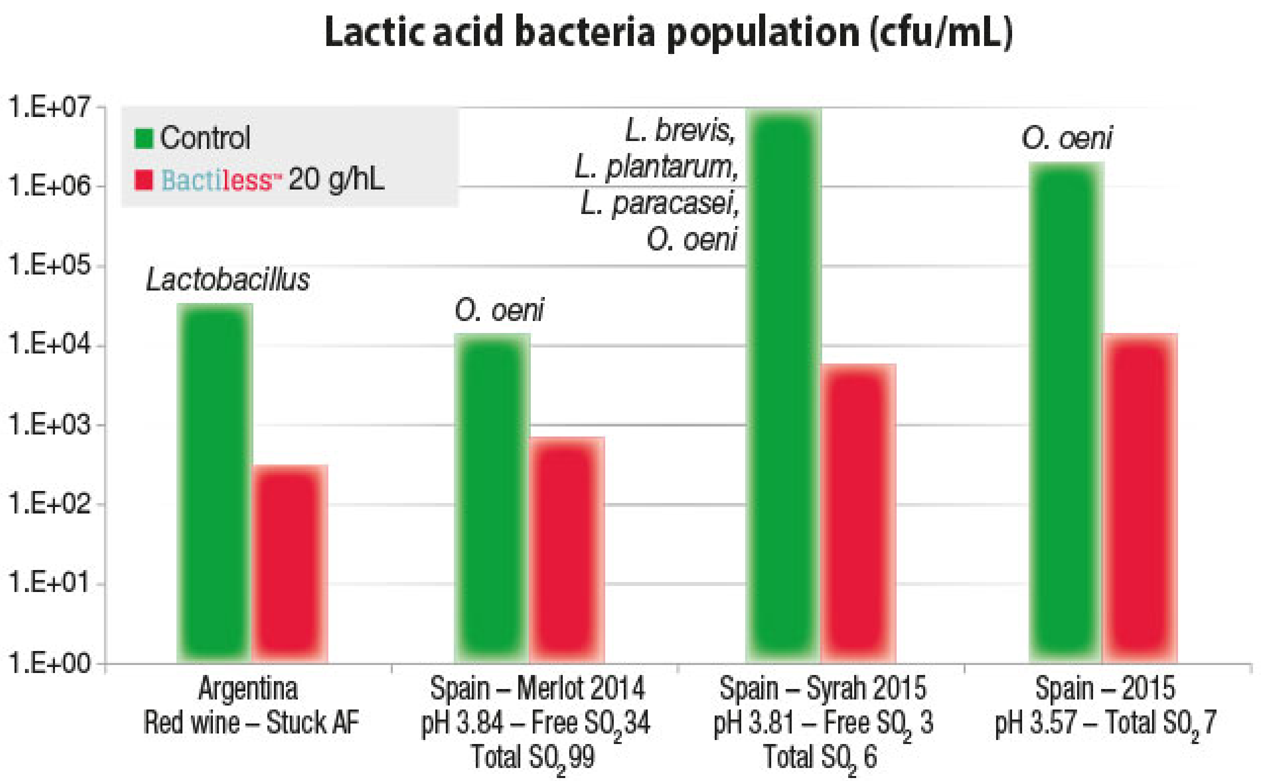
Yeast protein extract for a respectful wine fining

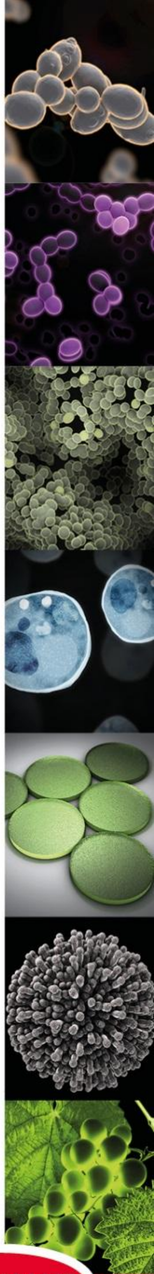


Chitosane & chitine glucane: an action towards bacteria

- Fighting lactic bacterias…

Lactic acid bacteria management in red wines in Winery-scale trials.





Chitosane & chitine glucane: applications

- Malolactic fermentation control

野生MLF予防目的での使用

→　リンゴ酸の保持＝フレッシュなワインキャラクターの維持

生体アミン、VA汚染予防

c

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ac … ially
af … ive
to

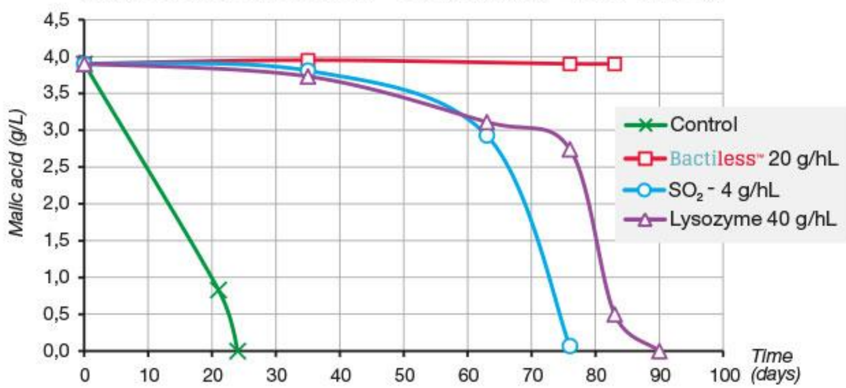
BACTILESS™

BACTILESS™

Pure chitosan and chitin-glucan from Aspergillus niger

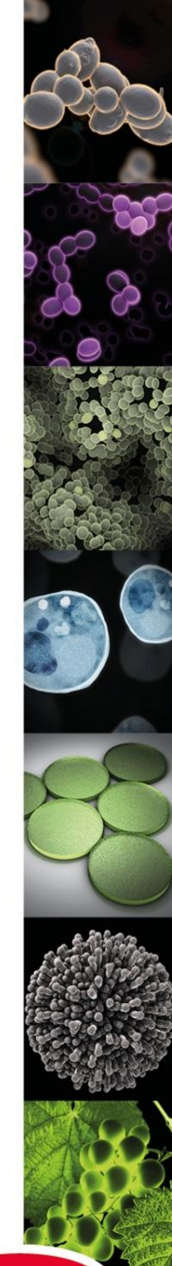
Trial in a Chardonnay wine (pH = 3.4) in collaboration with IFV: Comparison of different microbial stabilization tools and kinetics of malic acid degradation in the case of a lactic acid bacteria contaminated wine.

Malic acid degradation - Chardonnay 2014 - pH 3,4



Bactiless™ can avoid malolactic fermentation in white wines.

Avoiding spoilage bacteria, chitin derivates also reduces metabolites produced by those contaminants (biogenic amines, VA, etc.)



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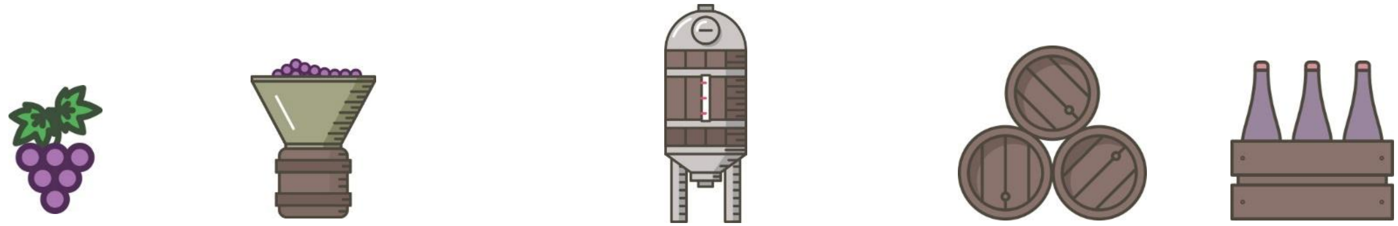
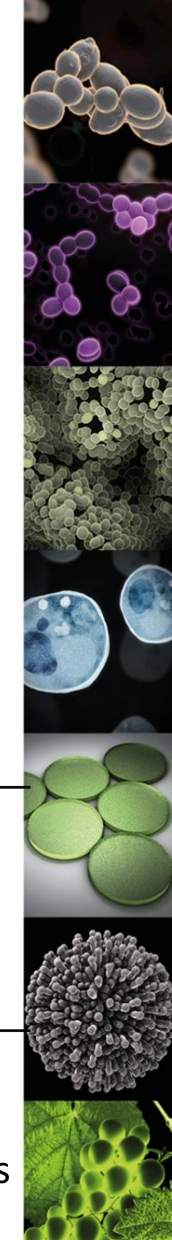
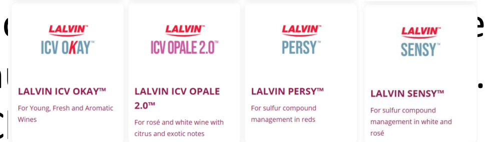




	Prefermentative steps Fermentations management	Correction & Stabilization	Fining & Aging Storage & Transport
Main risks to manage	Oxydation Microbiological spoilage Fermentation issues	Oxydation Microbial contamination Reduction	Proteic & tartaric stability Quality improvement Oxydation Microbial contamination
Main chemical intrants	SO_2 A bic acid D onium,phosphate am um sulfate	SO_2 Ac (tartaric, citric, lactic, etc.) Sa lcium carbonate, potassium salts) Cop lfate or citrate	SO_2 PP MC Salts Metatartaric acid
Biological alterna-tives	SIY rich in GSH Early yeast a Saccharomyces Yea and balanced nutrition	Limit binding compounds (low a e n .) C linked compc	Yeast protein extract Mannoproteins vated yeasts

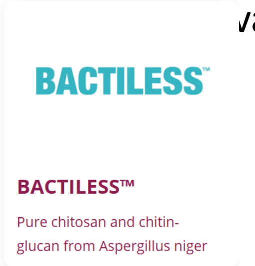
GLUTASTAR™

INITIA™



GO-FERM STEROL FLASH™

FERMAID O™



LALLEMAND
LALLEMAND OENOLOGY
Original by culture

まとめ：Ver.2025 2.0 for Red

Low SO2 Wine making プロトコル例

オプション適用例：
フレッシュな赤
ボルドー過散布果

GoFerm SF 30g/hL
Fermaid O 20g/hL x 2
（DAPは使用しない）
＋

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	PERSY 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
Co-inoculation	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）
おり下げ	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）

使用法詳細は
Webinar 2025
Eps#2参照

オプション適用例：
リンゴ酸過含有の場合

Cf. FINELY, Pure Lees Longevity, new techs, ...to be improved

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, p4

まとめ：Ver.2025 2.0 for White/Rose

Low SO2 Wine making プロトコル例

GoFerm SF 30g/hL
Fermaid O 20g/hL x 2
（DAPは使用しない）
＋

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酵母接種	亜硫酸効率向上	ICV OPALE 2.0 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
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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）

← 使用法詳細は Webinar 2025 Eps#2参照

オプション適用例：リンゴ酸過含有の場合

4

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弊社カタログ2025, p4

ご清聴ありがとうございました

1/質疑応答

2/今後について

Low SO2 Winemaking 2026(?)

… and more, stay tuned!

今後もwebinarの機会を増やしていきたい考えです。
今後ともご参加頂けますと幸甚です。