VARIETAL
THIOLS

Aromatic approaches:
extraction, release, expression

IOC
Révélons votre différence

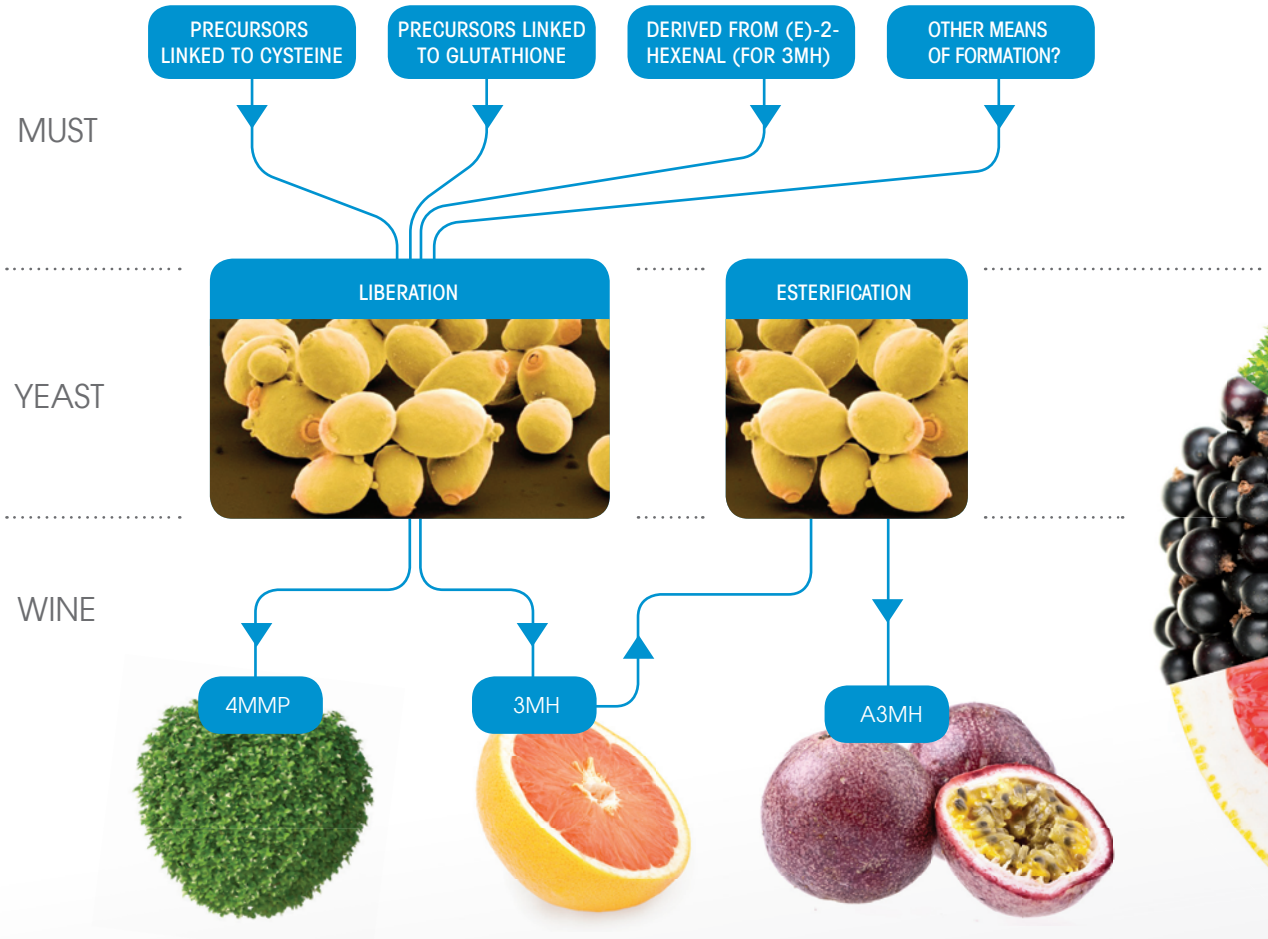
Varietal thiols: wine's key aromas

Many wines are associated with varietal thiols since these represent the major aromatic component of grape varieties said to be 'thiolic', such as the Sauvignon, Colombard, Verdejo. etc. They are also, however, a significant component in the complexity and fruity intensity of many other grape varieties such as Manseng, Muscat, Pinot, Merlot, Syrah, Cabernet, Grenache, Carignan, Malbec, etc.
Thiols are essential aroma compounds involved in the sensorial qualities of white and rosé wines, and even red wines, and they help achieve some very popular sensorial profiles for consumers.

Three main varietal thiols have been identified for winemaking, each with a characteristic odour:

- 4MMP (4-mercapto-4-methylpentan-2-one): boxwood, guava aromas
- 3MH (3-mercaptohexan-1-ol): grapefruit, passion fruit aromas
- 3MHA (3-mercaptohexyl acetate): passion fruit aroma

These thiols derive from odourless precursors and are released by the yeast during alcoholic fermentation. There are many means of optimising their quantities.



Ways to release varietal thiols (3MH, A3MH and 4MMP) within wines: the key role of yeast

Increasing the thiolic expression of wir

Take action as the grapes are ripening

These days, there are several possibilities for managing the vines. In essence:

•The thiolic potential reaches an optimal state as the gripe ripens, and then it decreases.

•Spraying nitrogen on the leaves of white grapes has a positive effect.

•Osmotic stress has an impact on the ratio of 4MMP/3MH.

It is possible to control the thiolic potential significantly, making use of the harvest date and other vineyard practices.

Make use of maceration

Maceration on the skins increases 3MH. Cold sediment maceration helps increase thiol levels. Three working approaches are possible:

• Enzymatic extraction of the precursors at low temperature, holding back that of the oxidisable polyphenols.

• Protection against oxidation using specific inactive yeasts that are rich in glutathione.

• Preventive fining out of the oxidisable polyphenols and oxidation catalysts (metals).

The balance between the extracted precursors and those for the polyphenols is critical for the final quantity of thiols.

Protect the wine must from oxidation

The known thiol precursors cannot be oxidised, BUT:

• The thiols themselves are very susceptible to oxidation.

• The oxidation of polyphenols in the must leads to subsequent oxidation of the thiols.

• Glutathione protects thiols over time: it must therefore be protected from any oxidation.

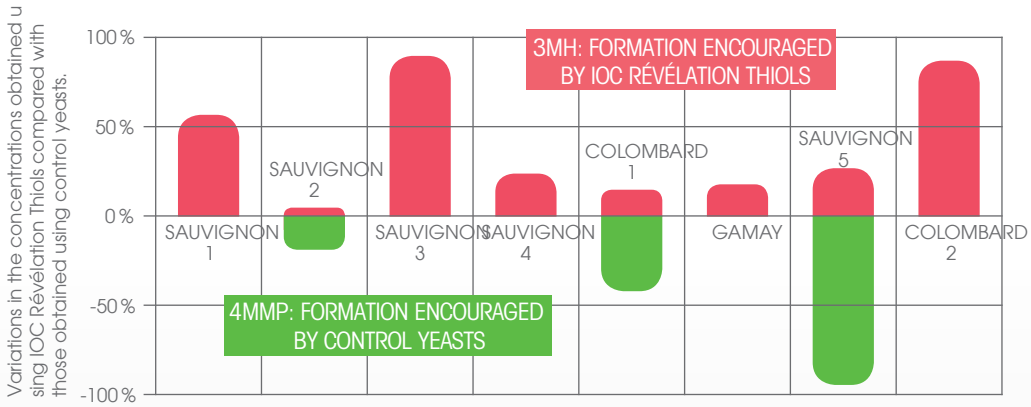
Generally speaking, controlling the level of oxygen transmission to the juice is still an important means of optimising the thiol levels in the wine.

Exploit the yeast lever

Yeast is the only means of releasing thiols, but not all yeasts are the same in this respect. Some are likely to release more 4MMP, others 3MH, whilst some assist the esterification of the 3MH, and thus release 3MHA. Moreover, yeasts can also produce fruity and floral esters that may interact with the thiols on the nose.

It is therefore necessary to select a yeast with known characteristics to control a wine's thiolic expression.

Effects of yeast on the release of 3MH and 4MMP (0% = concentrations obtained using control yeasts)



nes: courses of action

Control the fermentation environment

Yeast alone is not enough; its growth conditions are critical for the release of varietal thiols.

THE LEVEL OF MUST CLARIFICATION

• The effect of this on thiols is controversial: in our trials, it had little effect on the release of 3MH although a slight turbidity is sometimes favourable to 3MHA and a thick turbidity seems to generate more 4MMP.

• This level plays an important role in the production of esters that are often, but not always (depending on the yeast), assisted by more clarified wine musts.

• In some cases the perception of thiols is greater with those wines that had a lower turbidity (<60 NTU) as a result of certain ester/thiol synergy phenomena.

PRE-FERMENTATION pH

• A pH of 3.3 may help release more 3MH and 4MMP than a pH of 3.1.

FERMENTATION TEMPERATURE

• In general, a temperature of 18-20°C is more effective for the production of 3MH than one around 13-14°C.

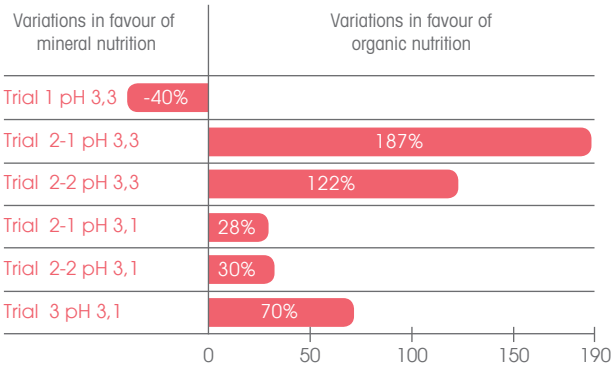
• There are, however, exceptions for certain yeasts where the opposite is found.

NUTRITION, A KEY FACTOR

• An excess of ammoniacal nitrogen significantly reduces the synthesis of 3MH.

• An organic nutrition based on amino acids is a good alternative for dealing with deficiencies.

IOC Révélation Thiols: the effect of nutrition on the release of 3MH - Variations in concentrations of the aromatic compounds obtained using organic nutrition as opposed to those obtained with mineral nutrition.



STIMULATING THE GLUTATHIONE LEVELS PRODUCED BY THE YEAST

Adding specific inactive yeasts rich in glutathione at the start of fermentation stimulates the production of glutathione via the yeast population.

Thanks to our knowledge of all these factors as applied to our yeasts, we are able to suggest suitable ways to reach the sensorial objective.

Protect the thiols until bottling … and beyond!

After fermentation, oxygen becomes the main enemy of thiols. Various practices may be implemented:

• Fining out of the metal catalysts and residual polyphenols.

• De-oxygenation and inert gas purging.

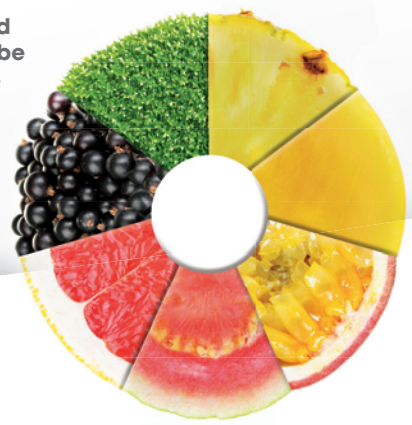
• Ageing on the lees.

• Monitoring and adjusting SO_2 levels.

• Choosing corks largely impermeable to oxygen.

• Wine storage conditions.

Everything gained beforehand can be lost if these steps are handled badly.



Three winning thiol approaches

Discover the three ways that we would recommend although, naturally, these must be adapted to your own conditions and raw materials since each situation will be unique.

	APPROACH 1 **PLANT/GUAVA THIOL PROFILE**	APPROACH 2 **CITRUS THIOL PROFILE**	APPROACH 3 **EXOTIC THIOL PROFILE**
GRAPE HARVEST	EARLY: TO PRESERVE THE PYRAZINE POTENTIAL	AT THE START OF TECHNOLOGICAL RIPENESS	AT FULL TECHNOLOGICAL RIPENESS
MACERATION		MACERATION ON THE SKINS OR COLD CELLARING ON FINE SEDIMENTS + **EXTRAZYME BLANC / EXTRAZYME MPF**: PREFERENTIAL EXTRACTION OF 3MH PRECURSORS RATHER THAN 4MMP	MACERATION ON THE SKINS OR COLD CELLARING ON FINE SEDIMENTS + **EXTRAZYME BLANC / EXTRAZYME MPF**: PREFERENTIAL EXTRACTION OF 3MH PRECURSORS RATHER THAN 4MMP
pH		IF PH=3.1, CONSIDER DE-ACIDIFICATION TO REACH PH=3.3	
CHOICE OF YEAST	**IOC eXence** YEAST: RELEASES 4MMP AND CONVERTS 3MH INTO 3MHA	**IOC RÉVÉLATION THIOLS** YEAST: RELEASES 3MH	**IOC eXence** YEAST: RELEASES 3MH AND CONVERTS INTO 3MHA
	LIMITS THE CONTRIBUTION OF FERMENTATION ESTERS	EXPRESSES 3MH USING ESTER/THIOL SYNERGIES	EXPRESSES EXOTIC FRUIT NOTES
PRE-FERMENTATION TURBIDITY	110-190 NTU	50-90 NTU	70-160 NTU
FERMENTATION TEMPERATURE	17 - 20°C	14 - 17°C	14 - 17°C

TOP TIPS FOR ALL THESE APPROACHES

1. To preserve the thiols formed by the stimulated production of glutathione by the yeast:
   –> ajout de GLUTAROM après levurage
2. To enhance the release of varietal thiols:
   –> Use the organic nutrient ACTIVIT O at the start and 1/3 of the way through alcoholic fermentation (AF)
3. Purge with inert gas or de-oxygenate if necessary each time the wine is transferred
4. Use finings suited to the elimination of oxidisable polyphenols on the must or on the wine
   –> Qi No[Ox], INOFINE V, PVPP...

An all-in-one solution: the ImpackThiols kit

A WELL-UNDERSTOOD YEAST: IOC RÉVÉLATION THIOLS

Our many experiments have given us a thorough knowledge of this yeast and of the conditions (must turbidity and pH, fermentation temperature, nutritional environment) in which it is best able to achieve its potential and that of your grapes.

A THIOL RELEASE AND PROTECTION AGENT: PROTHIOLS

Composed of nutrients and anti-oxidants, ProThiols stimulates the release of thiols and the production of glutathione with IOC Révélation Thiols.

UN PROTOCOLE SIMPLE

A single inoculation followed immediately by the addition of ProThiols will provide a long-lasting start for the liberation of your wine musts' thiolic potential and also protect these aromas until bottling.

Summary: Factors and practices affecting the levels and perceptions of thiols within wine

TYPE OF FACTOR	FACTORS AND PRACTICES	4MMP	3MH	A3MH	REMARKS
GRAPE GROWING	Grape variety	+++ / - - -			Wide variations
	Early harvesting	+	-		Varies with the type of precursor, vintage year and location of the vines
	Harvesting at the start of technological ripeness (8-10 days after sugar loading stops).	-	+		
	Harvesting when ripeness is advanced	- -	-		
	Osmotic stress	- -	++		
	Nitrogen leaf spraying	++			Valid for white wines
PRE-FERMENTATION	THigh levels of polyphenols	- -			May oxidise themselves and later oxidise the thiols
	High level of glutathione with juice	+			Thiol precursor and protector
	Maceration on the skins aided by selective enzymatic extraction	+	+++		Extracts 3MH precursors
	Cold cellaring with fine sediments	++	+++		Extracts thiol precursors
	Fining out of oxidisable polyphenols and oxidation catalyst metals	++			Preventive action
FERMENTATION	Thorough clarification of the must	+ / -			Effect on thiols is very dependent on the yeast. A positive effect on esters: may assist with the perception of fruity thiols
	Juice pH: 3.3 (vice 3.1)	++	+	+ / -	Observation valid for IOC Révélation Thiols
	IOC Révélation Thiols yeast	- -	+++	+	
	IOC eXence yeast	+ / -	+	++	
	Fermentation temperature of 17-19°C (vice 13-14°C)	+ / -	+	+ / -	Effect of temperature on thiols and esters is very dependent on the yeast used
	Organic nutrition (vice ammoniacal nutrition)	++ / -	+++	/	Effect of nutrition 4MMP is dependent on pH
	Addition of specific inactive yeasts, rich in glutathione, at the start of fermentation	++			Stimulates yeast-based production of glutathione with subsequent preservation of thiols
POST-FERMENTATION	Fining out of oxidisable polyphenols and oxidation catalyst metals	++			Protects against oxidation
	De-oxygenation & inert gas purging	+++			
	Ageing on the lees	+			
	Adequate levels of free SO_2	++			
	Low oxygen transmission corks when bottling	+++			
	Low wine storage temperatures	+++			

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