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GRAPE SOLIDS: composition and impact on alcoholic fermentation

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GRAPE SOLIDS

1 - Technological origin

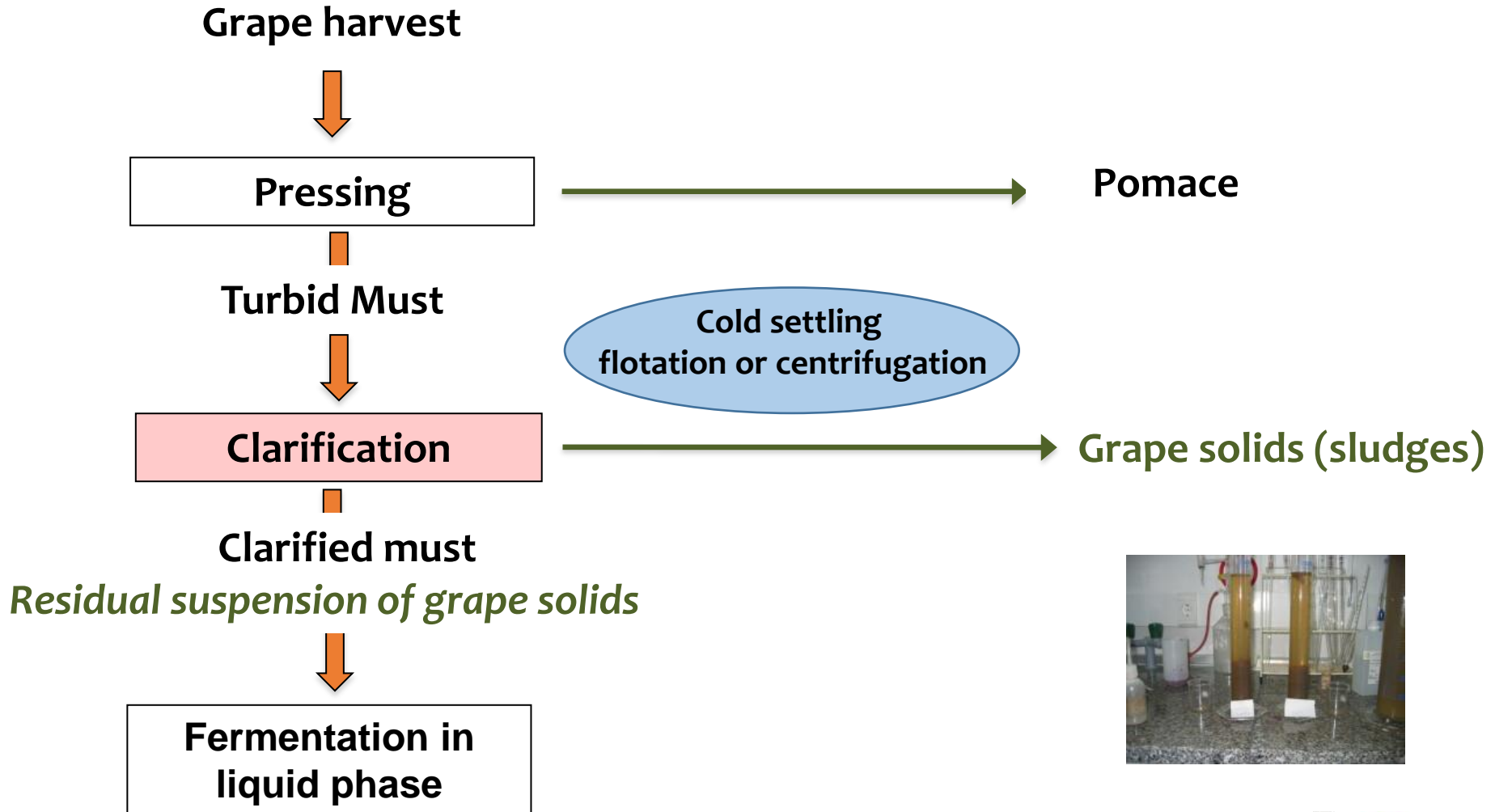
2 - Nature and composition

3 - Role and management during alcoholic fermentation

4 – Conclusion and perspectives

1 Technological origin

White/rosé winemaking



Grape harvest

Flash release or thermovinification

Extraction of phenolic compounds and polysaccharids

Pressing

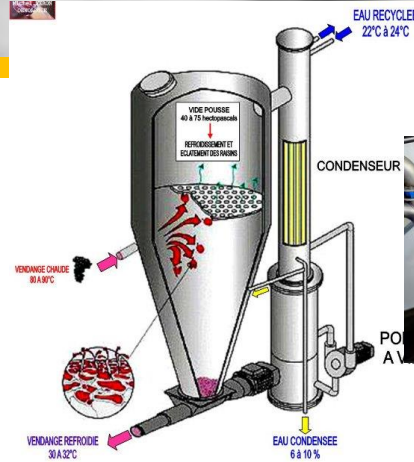
Colored and turbid must

Clarification

Clarified must

Residual suspension of grape solids

Fermentation in liquid phase at low temperature



Pomace

Flotation, centrifugation or vacuum rotative filtration

Grape solids (sludges)

2 Nature and composition

Nature

- Fine particles: cellular debris (cell wall fragments, chloroplasts, etc.)
- Large particles: aggregates of fine particles

Composition

- Chardonnay sludges (Alexandre et al, 1994)

Compound	Content (mg/g of DW)
Total sugars	720
Lipids	78
Minerals	55
Pectins	52
Nitrogen	26



Wet sludges



Dried sludges

Lipidic fraction

Phytosterols, fatty acids (in phospholipids and glycolipids)

	Red winemaking		Rosé winemaking		White winemaking		
	Merlot	Cabernet sauvignon	Cabernet	Marselan	Chardonnay	Maccabeu	Viognier
Phytosterols (mg/g DW)	3.7	9.4	4.9	5.4	8.8	11.2	3.6
Total fatty acids (mg/g DW)	22.4	53.2	23.5	26.6	45.5	41.2	16.2

* High variability of phytosterol contents (**factor 1 to 3**)

β -Sitostérol = major compound (78 %) + campesterol (7 %) + stigmasterol (5 %) + sitostanol (5 %)

* High variability of total fatty acid contents (**factor 1 to 3**) **according to grape variety**

3 Role and management during alcoholic fermentation

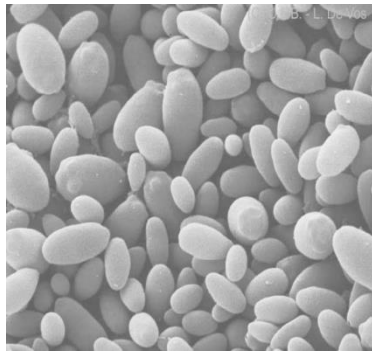
Positive impact

Grape solids = supply of lipids, mainly phytosterols

Must



Yeasts



Grape
phytosterols



Assimilation of
phytosterols

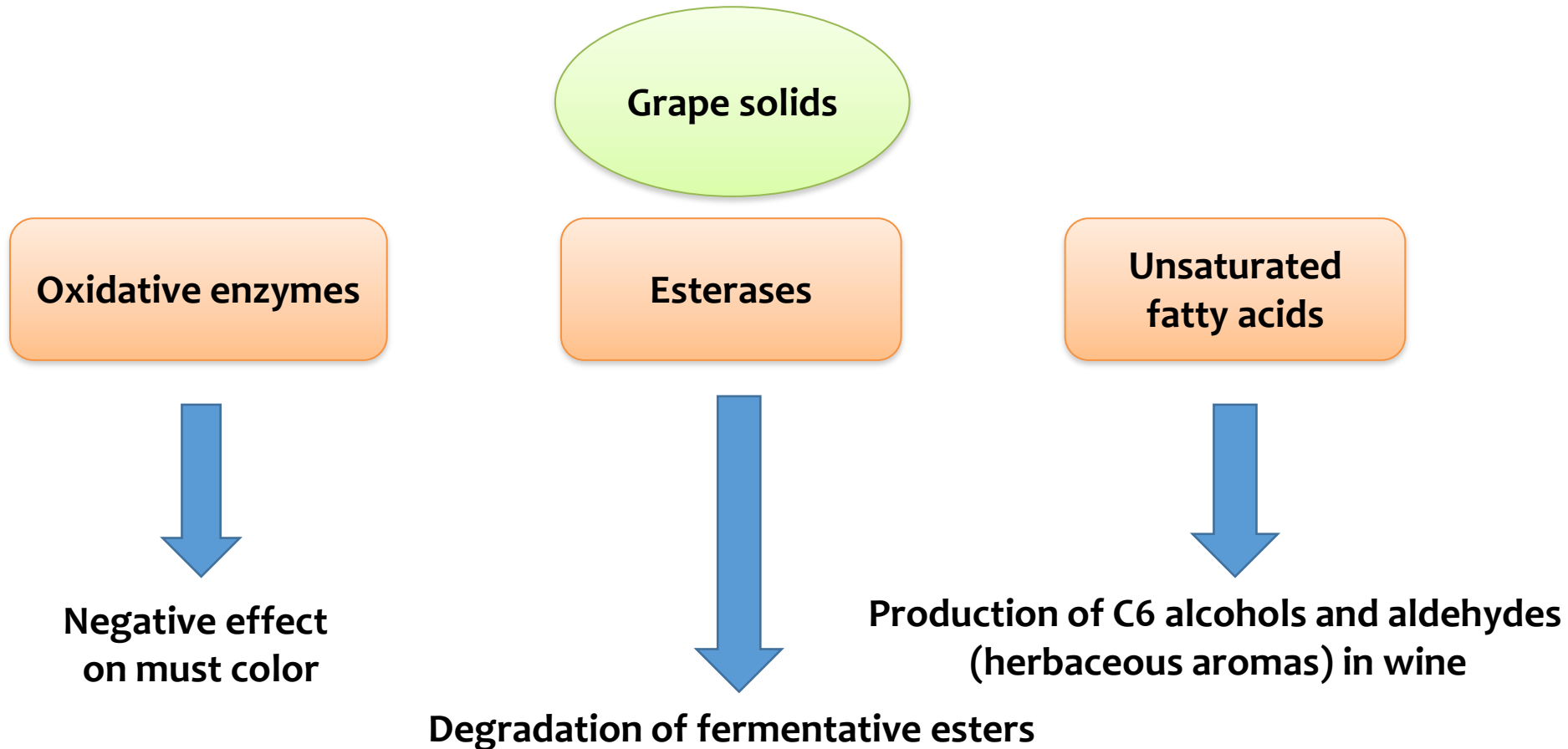
Oxygen



Synthesis of
ergosterol

Interest of leaving some grape solids in must

Negative impact



Interest of clarification

Level of clarification = Compromise

Experimental fermentations

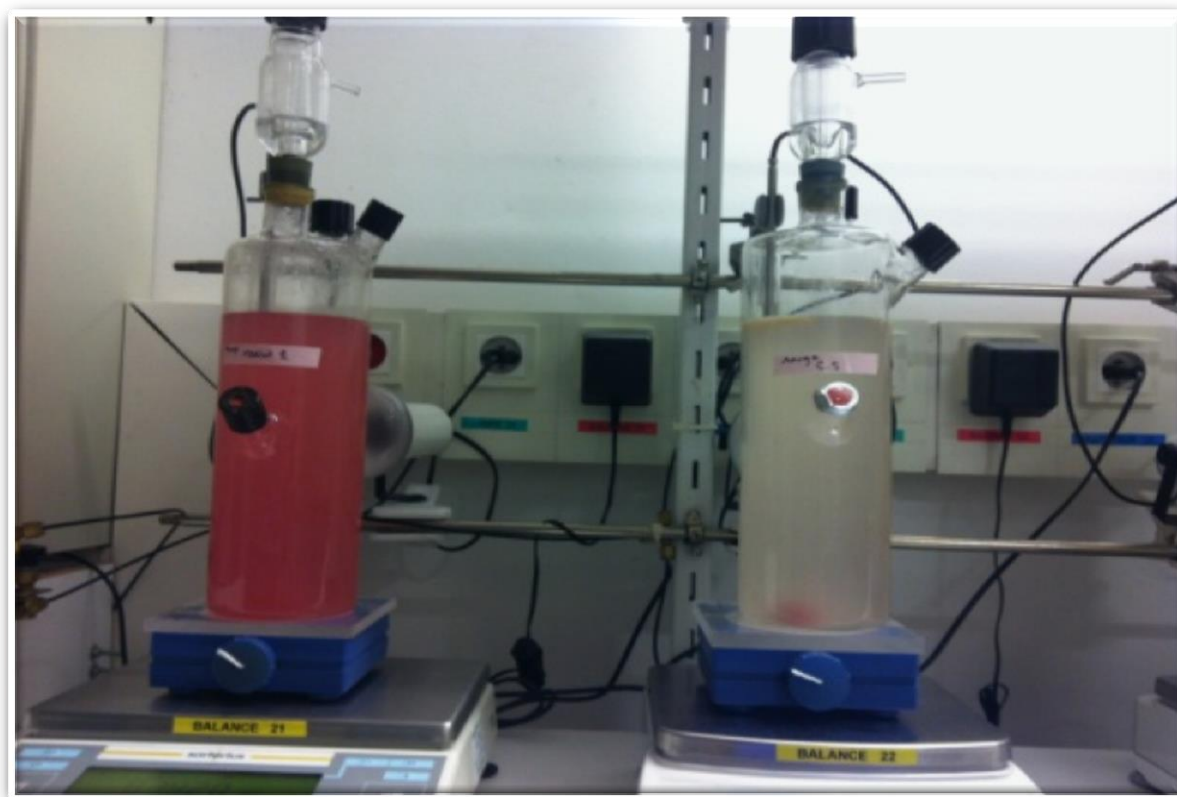
1 L-scale fermentations

Synthetic medium which mimics natural white must, grape solids supplementation

Anaerobiosis

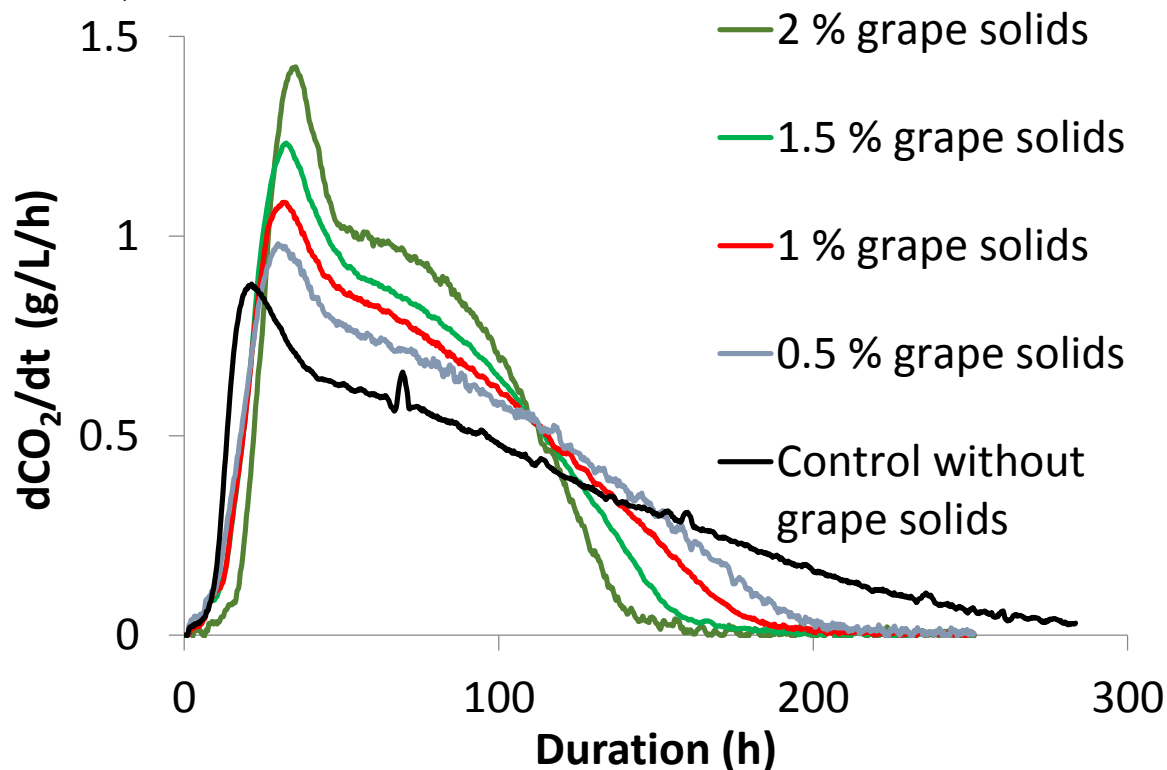
Inoculation with commercial *S. cerevisiae* at 10 g/hL - Isothermal conditions (22 or 24 ° C)

On-line measurement of CO₂ production rate



What is the effect of grape solids on fermentation kinetics?

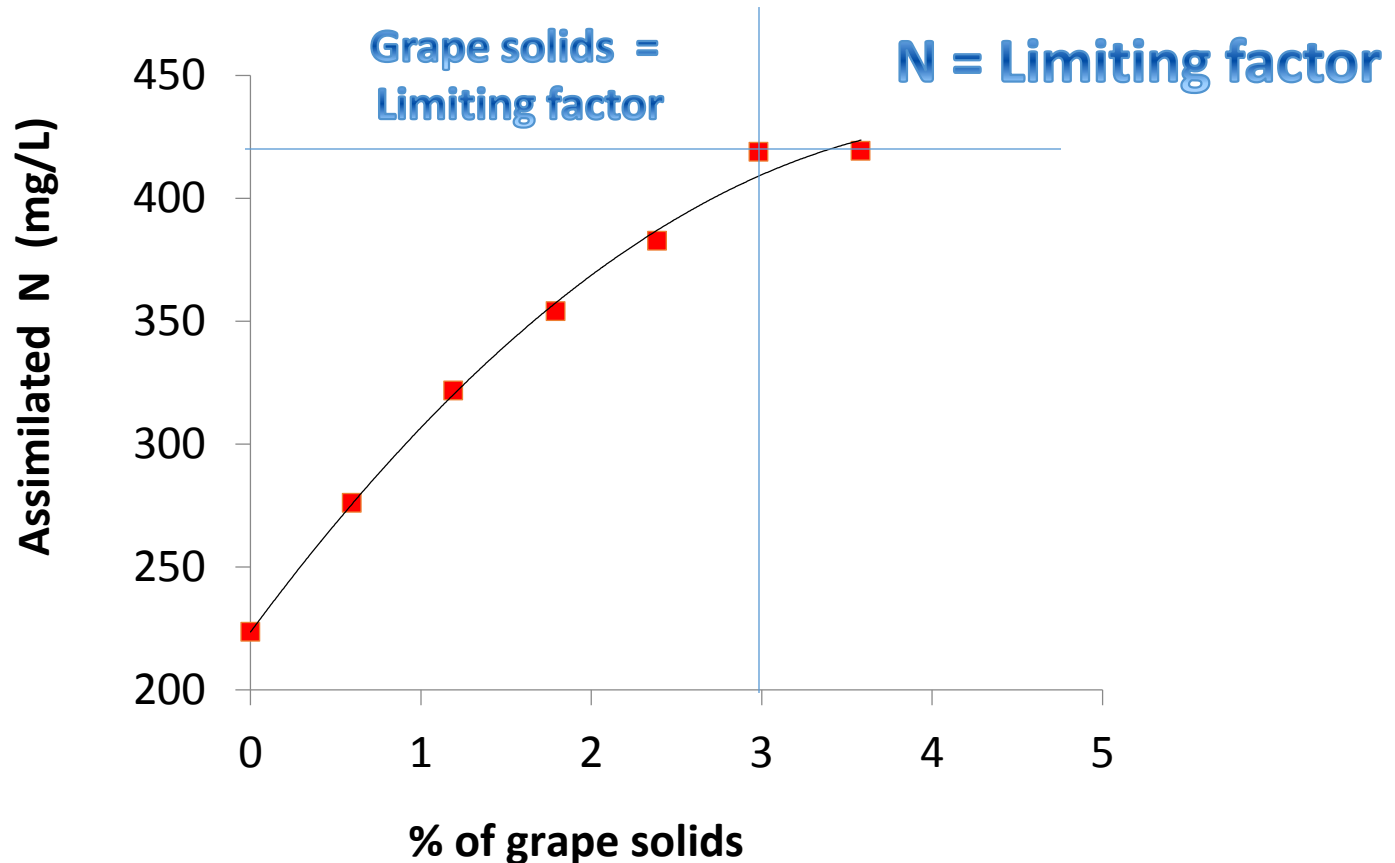
Synthetic must (425 mg N/L, 200 g sugar/L) with Sauvignon grape solids, strain Lalvin ICV K1 (Lallemand, France)



- * High impact on fermentation kinetics
- * Increase of cell population and viability

How to explain this impact?

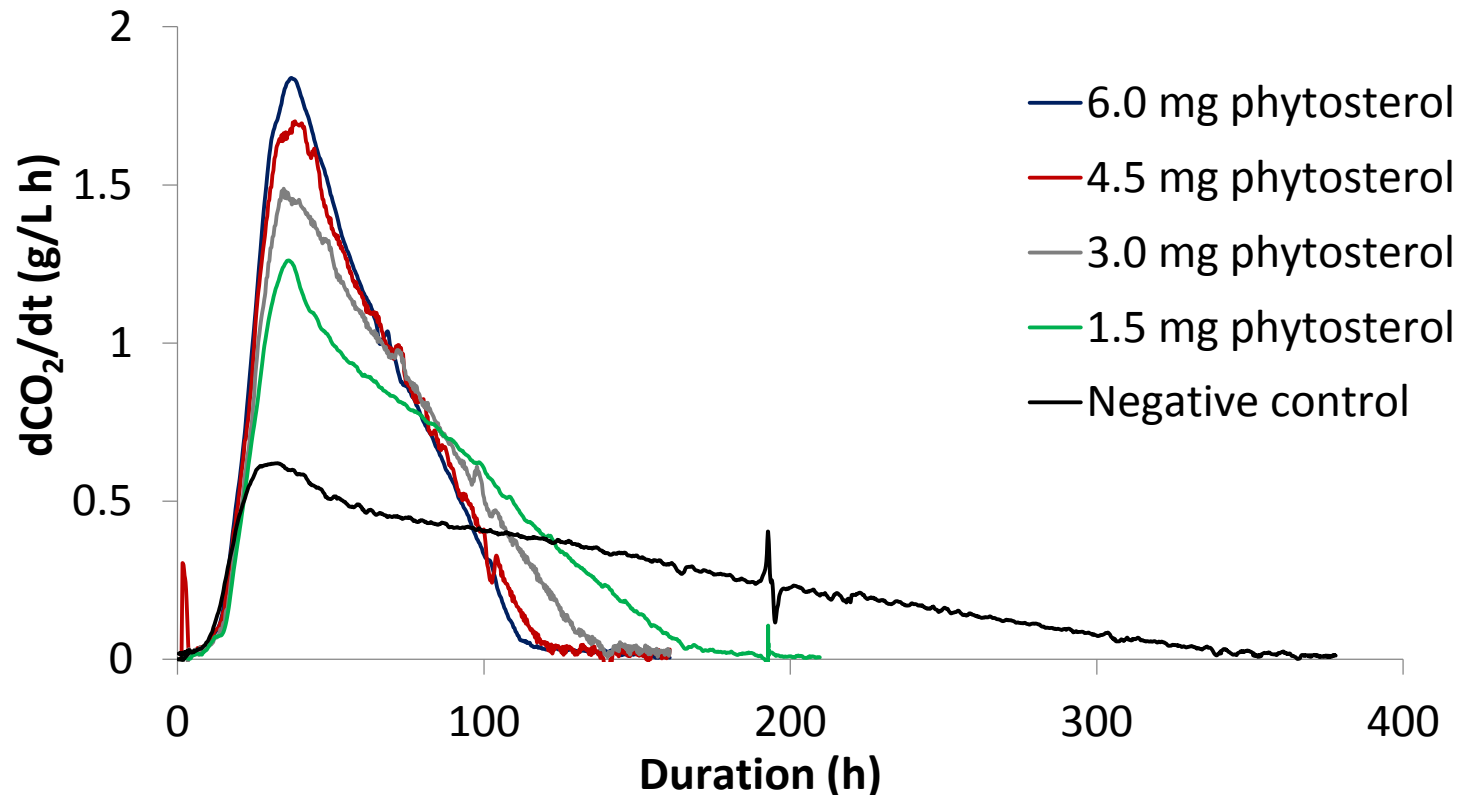
Synthetic must (425 mg N/L, 200 g sugar/L), strain Lalvin EC1118 (Lallemand, France)



**Addition of grape solids: better N assimilation by yeasts
= enhancement of yeast metabolism**

What is the key nutritional factor of grape solids?

Synthetic must (425 mg N/L, 200 g sugar/L), synthetic phytosterol (β -sitosterol), strain EC1118 (Lallemand, France)

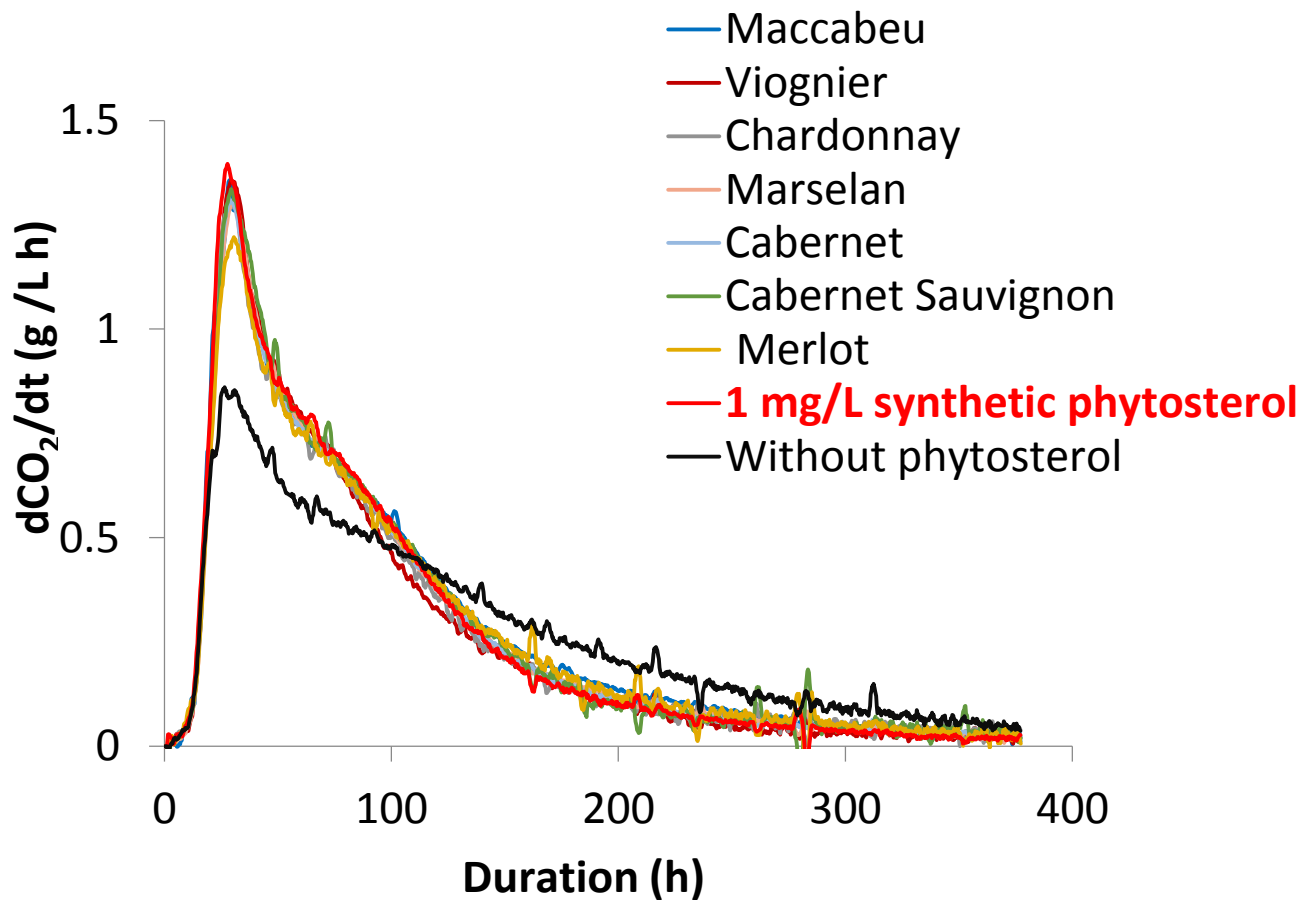


Phytosterol = similar effect than grape solids

What is the key nutritional factor of grape solids?

Synthetic must (425 mg N/L, 250 g sugar/L), 1 mg phytosterol /L from grape solids, strain EC1118 (Lallemand, France)

Normalized addition of 1 mg/L phytosterols from different grape solids sources



Phytosterols = key factor

Is there a minimal yeast requirement for phytosterols?

Assimilable N in must (mg/L)	Up to 220	250	300	350
Minimal phytosterol requirement for total N assimilation (mg/L)	0	0.5	1.5	3.0

The richer the must in N , the higher the phytosterols content allowing yeast to assimilate the totality of N

Strain	Phytosterol requirement to assimilate 425 mg N/L (mg phytosterols/L)
EC1118	3
Strain used for Champagne (Ochando et al, 2016)	8

Requirement range: at least 3-8 mg/L

Is must turbidity a good indicator of must phytosterol content?

Synthetic must (425 mg N/L, 250 g sugar/L)

Turbidity after addition of various grape solids in order to get 1 mg phytosterol/L

	Red winemaking		Rosé winemaking		White winemaking		
	Merlot	Cab. Sauv	Cabernet	Marselan	Chardonnay	Maccabeu	Viognier
Turbidity (NTU)	26	31	22	21	25	14	38

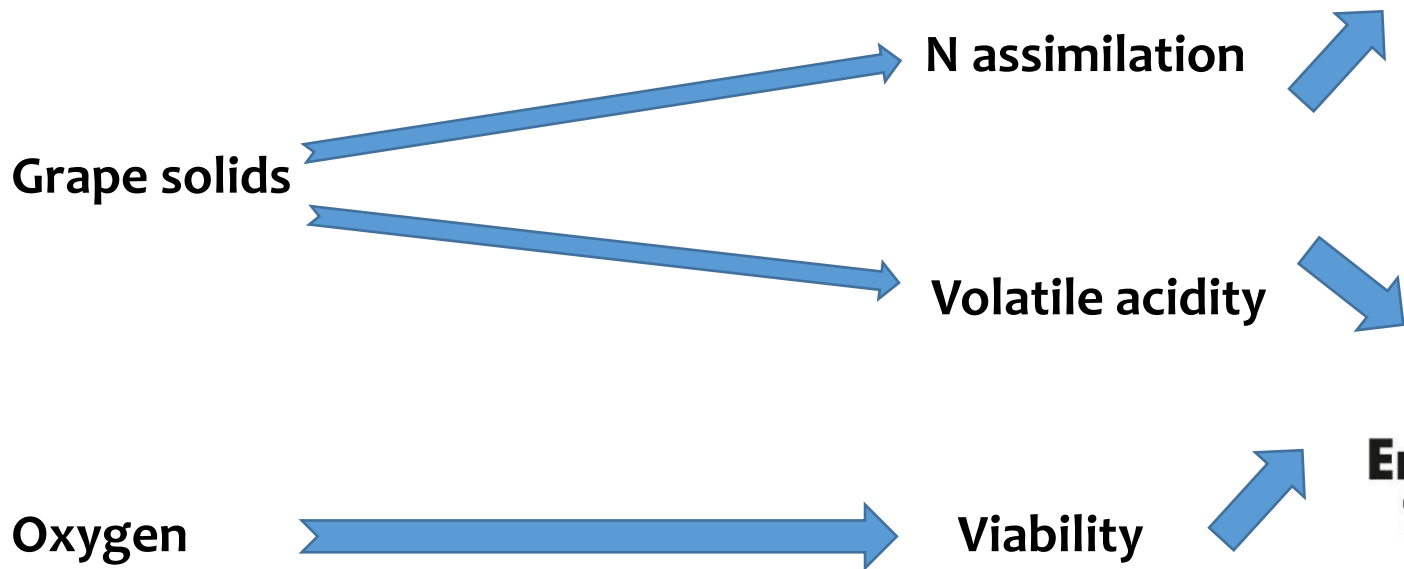
**Turbidity is not accurate
for the estimation of must phytosterol content**

4 Conclusion and perspectives

Phytosterols = key factor

High variability

- **phytosterol content in grape solids**
- **yeast sterol requirement**



**Need for a new criterion
to estimate phytosterols supply**

Variability of yeast requirement for phytosterols

Publications

- Casalta E., Vernhet A., Sablayrolles J. M., Tesnière C. & Salmon J. M. (2016). Review: **Characterization and role of grape solids during alcoholic fermentation under enological conditions**. *American Journal of Enology and Viticulture*, 67, 133-138.
- Casalta E., Cervi M.F., Salmon J. M. & Sablayrolles J. M. (2013). **White wine fermentation: interaction of assimilable nitrogen and grape solids**. *Australian Journal of Grape and Wine Research* 19 , 47-52.



Water for skin, wine for vitality

L'acqua per la pelle, il vino per la vitalità

L'eau pour la peau, le vin pour la vitalité

Thank you for your attention

Vi ringrazio per l'attenzione

Merci de votre attention