Colloidal stabilization of wines

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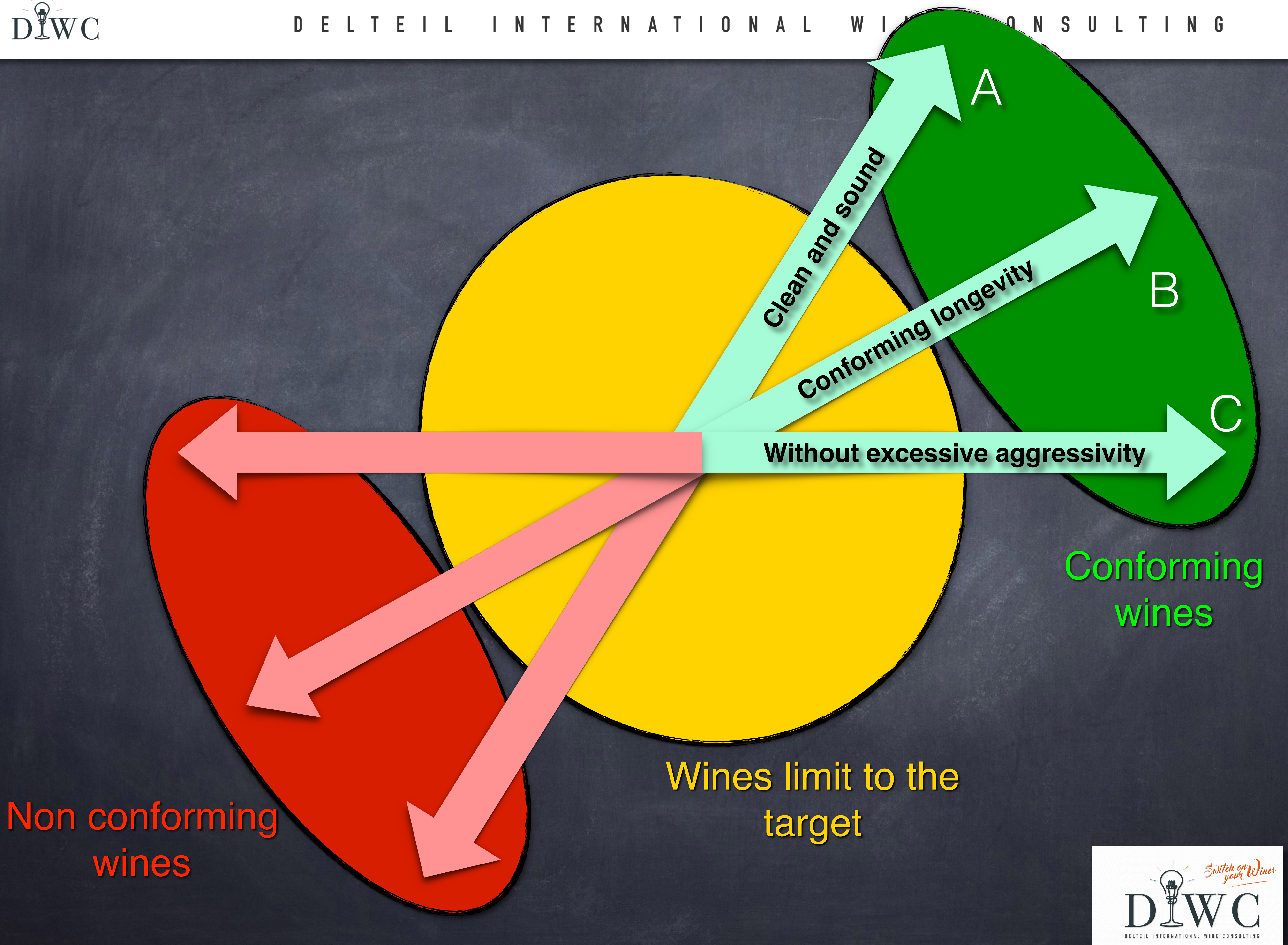
Stabilization of the colloidal matrix of the wine

- What is the colloidal matrix ?
  - The colloids
  - The interactions between colloids and other molecules
    - In the wine emulsion
    - The sponge effects of insoluble parts
    - The whole balance is under control of the pH: the lower the best ! (without aggressive acidic sensations)
- Practical examples on how to build and how to stabilize the colloidal matrix

There are sensory and technological universal axis to respect, whatever the market price segment

- When they are consumed, all wines must be:
  - Clean and sound (A axis), and
  - With the right longevity and the right consistency of style in the consumer's glass, until the last sip (B axis), and
  - Without excessive aggressivity i.e. 'balanced'. Aggressivity as perceived by consumers (not by winemakers !). The concept of aggressivity is variable according to the market (country, women, men, etc.), the price, the variety (C axis)


A
Clean and sound
B
Conforming longevity
C
Without excessive aggressivity
Conforming wines
Wines limit to the target
Non conforming wines
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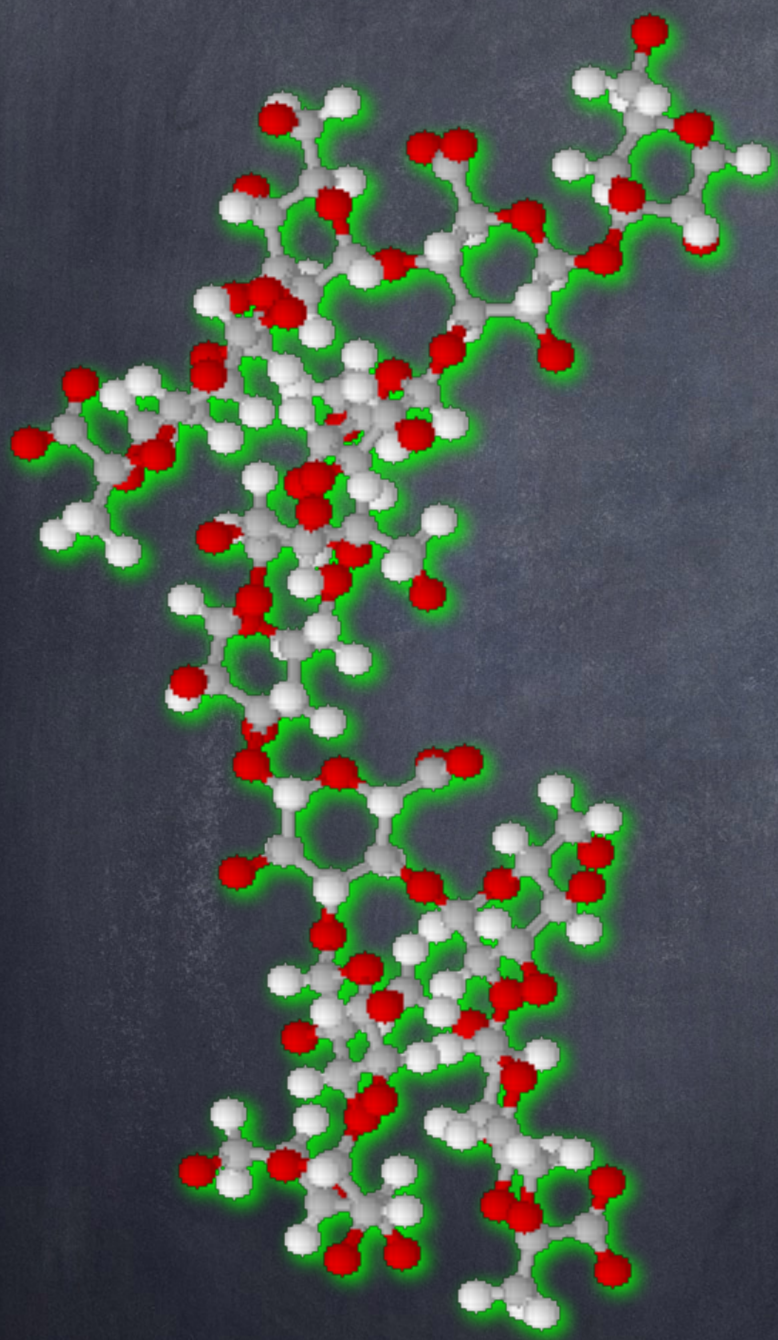
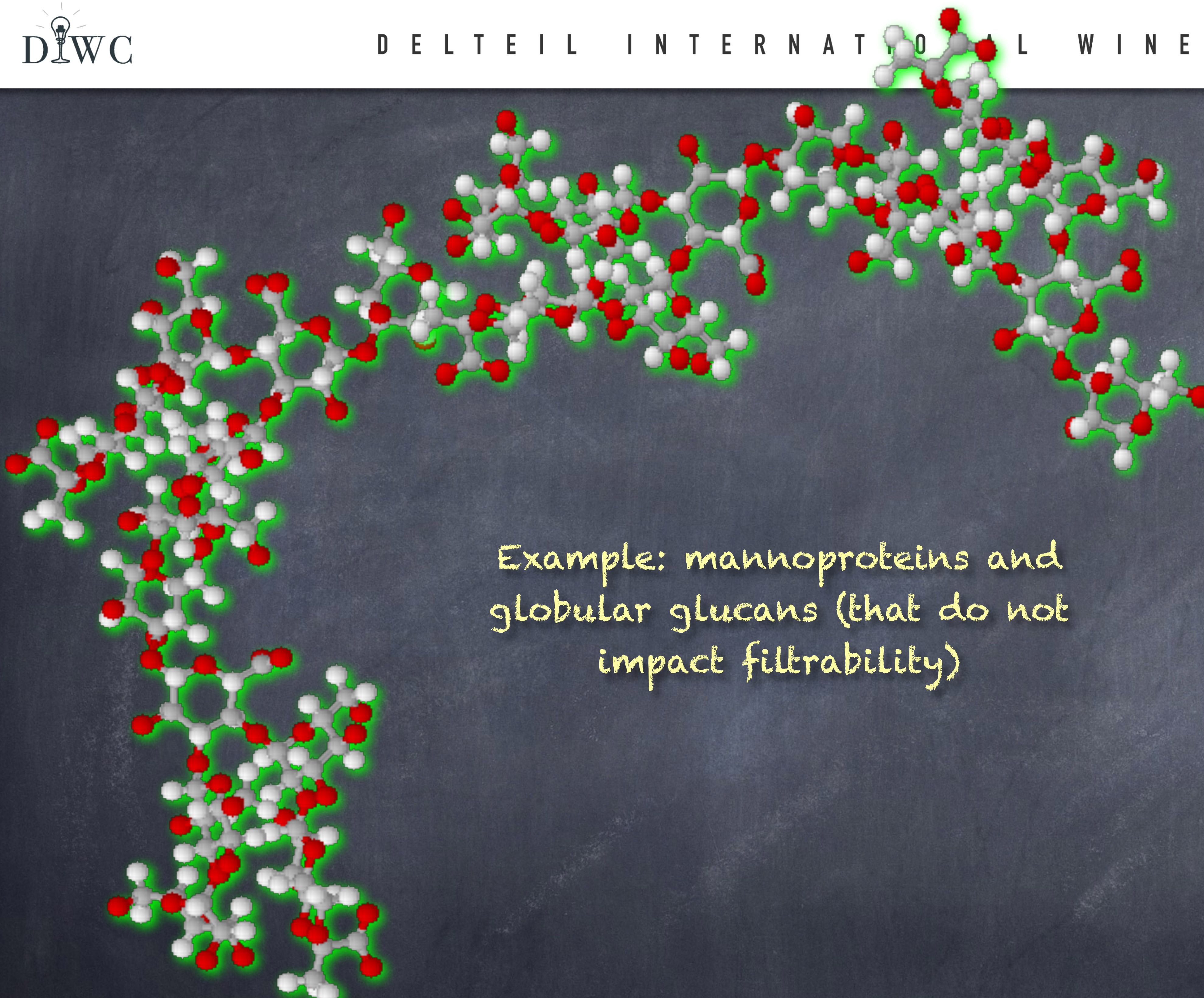
What is the colloidal matrix ?

1. The colloids

Colloids from grapes: mostly from pulp cell walls

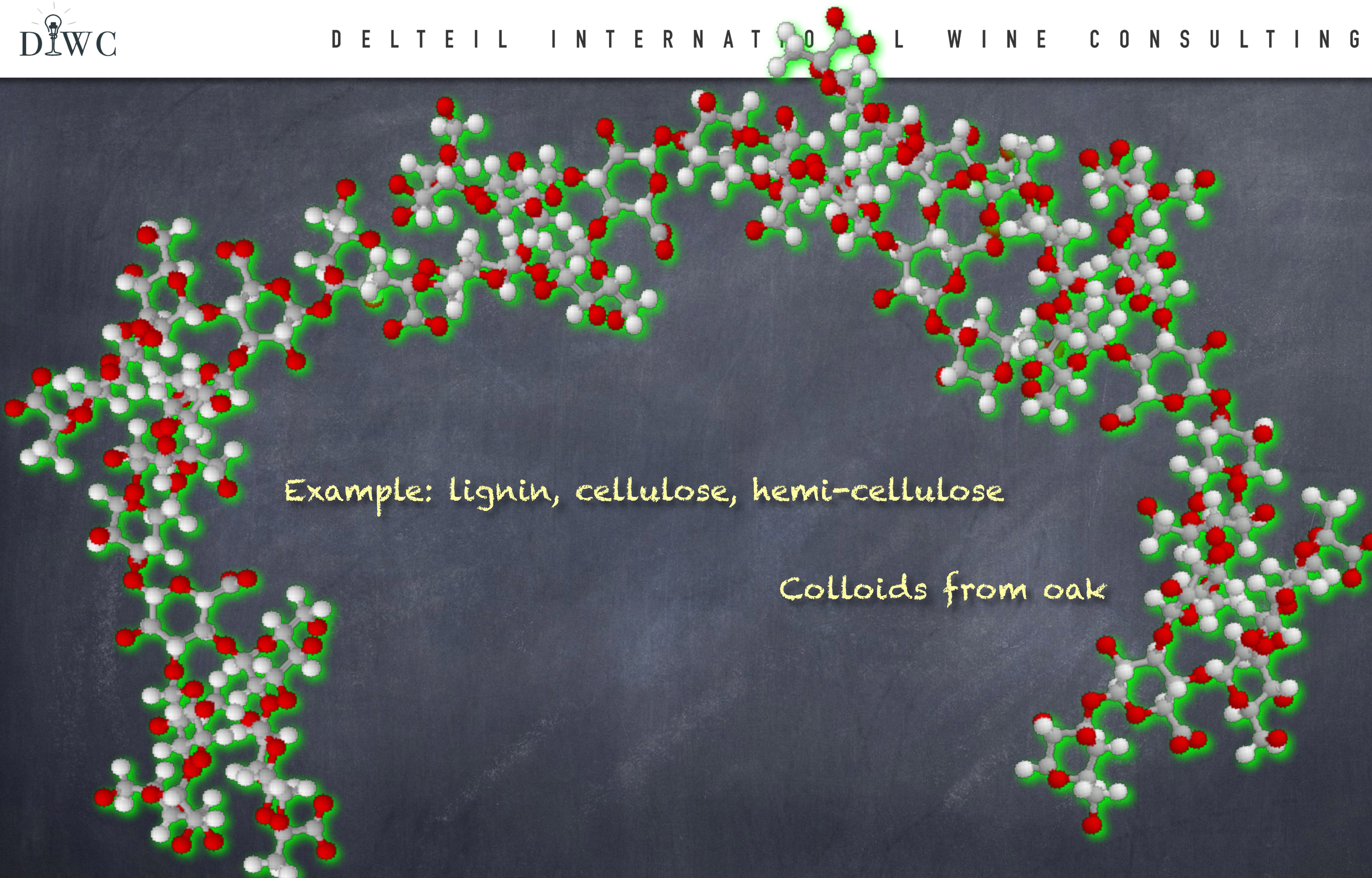


Example: rhamnogalacturonans



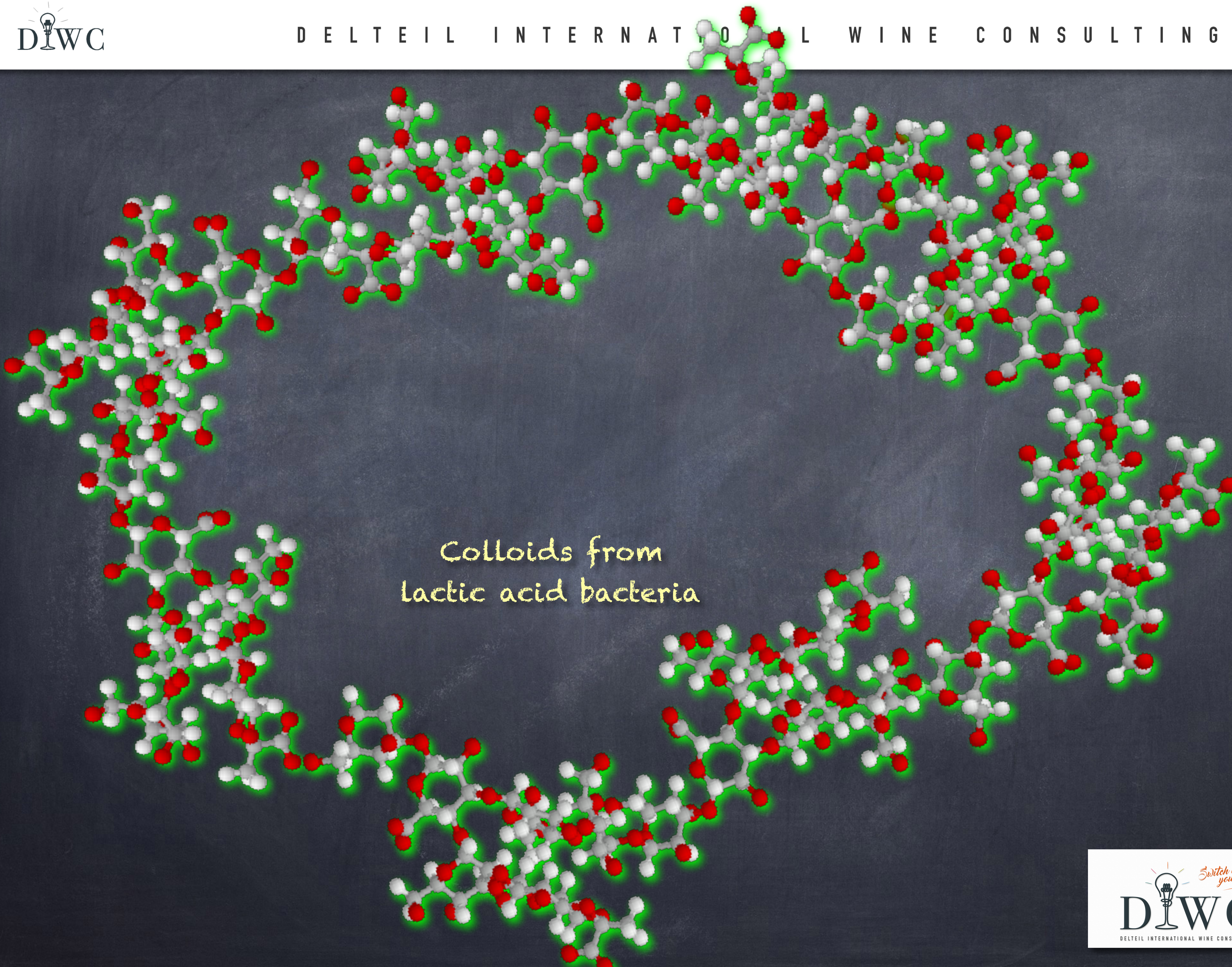
Colloids from yeast: live yeast and inactivated yeast

Example: mannoproteins and globular glucans (that do not impact filtrability)

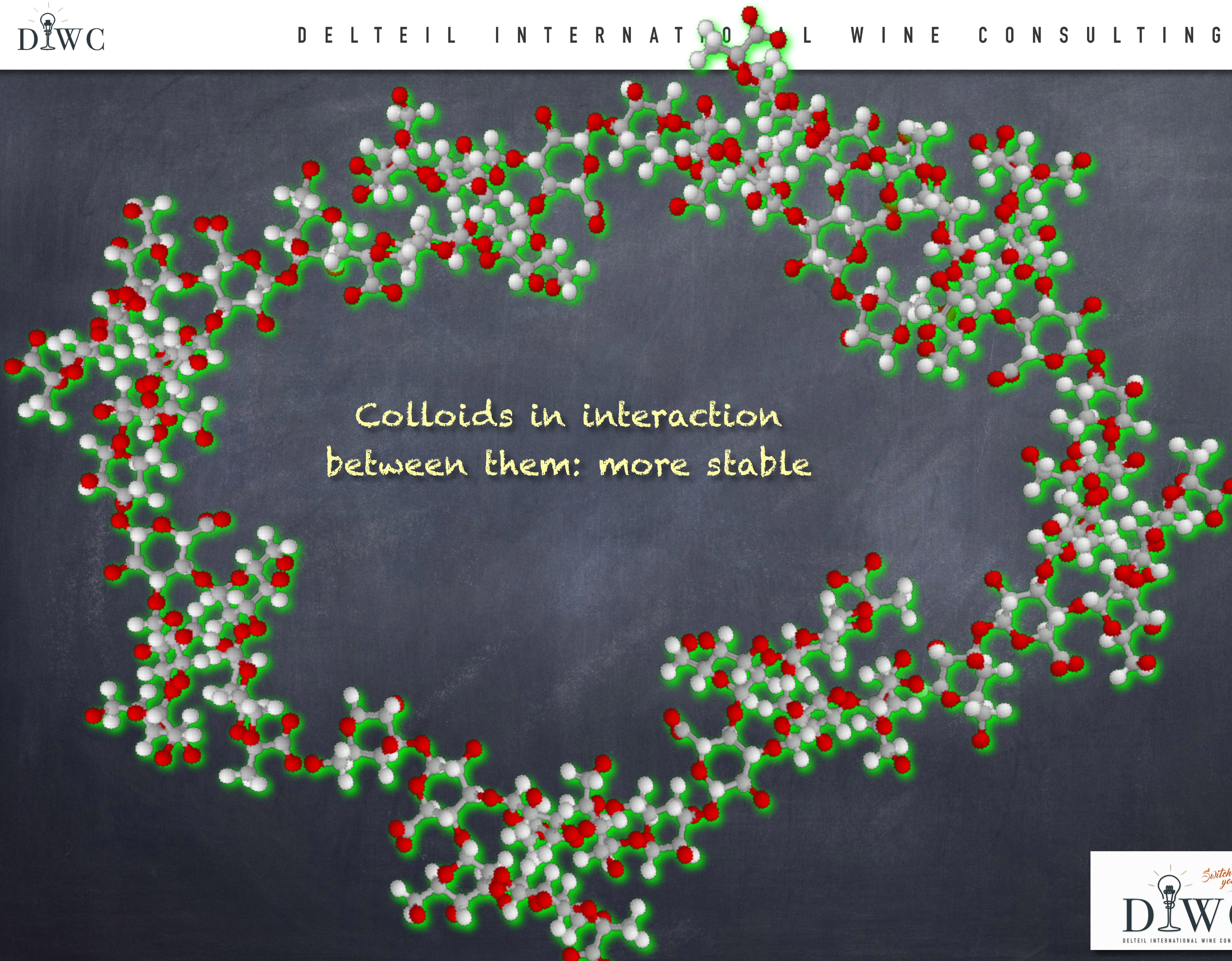


Example: lignin, cellulose, hemi-cellulose

Colloids from oak

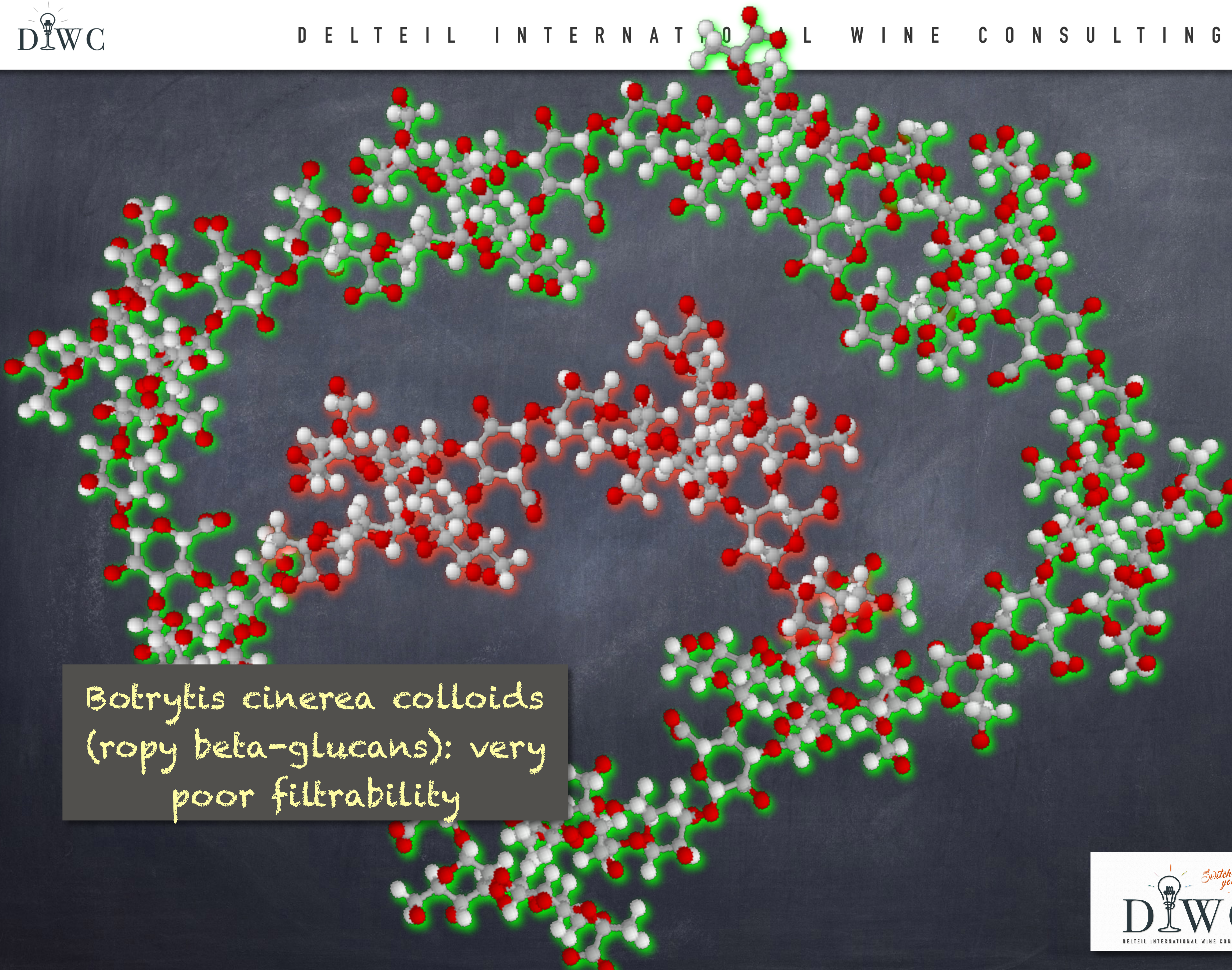


Colloids from lactic acid bacteria


Colloids in interaction
between them: more stable

Build a balanced and stabilized colloidal matrix

- Extract the right amount and balance of:
  - Grape colloids
  - Yeast colloids
  - Oak colloids
  - Bacteria colloids
- Stabilize that colloid network: the foundation of the wine emulsion. With several additions when possible : yeast and oak
- Do not impoverish or destabilize the colloidal matrix with useless fining or excessive tannin additions

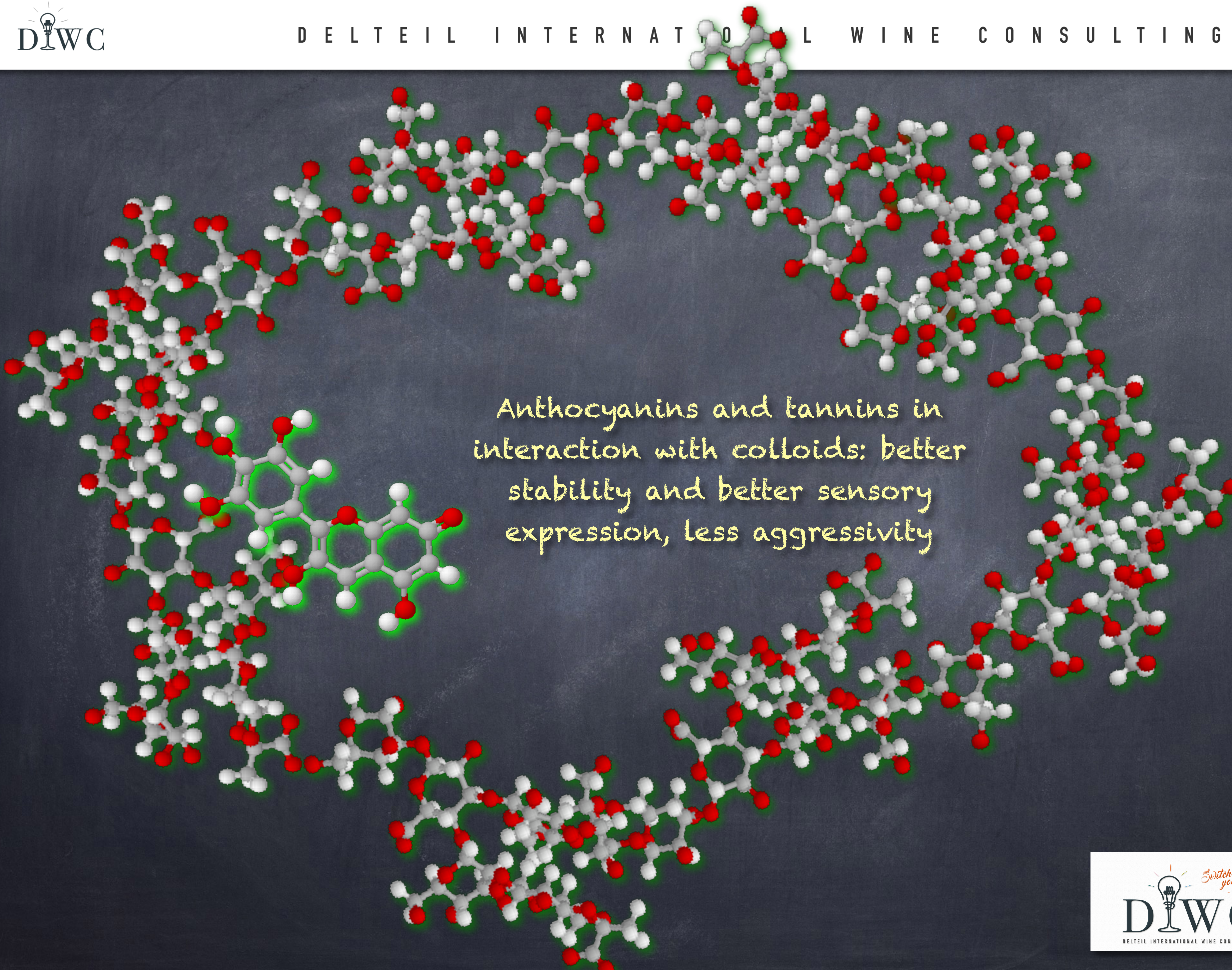


Botrytis cinerea colloids (ropy beta-glucans): very poor filtrability

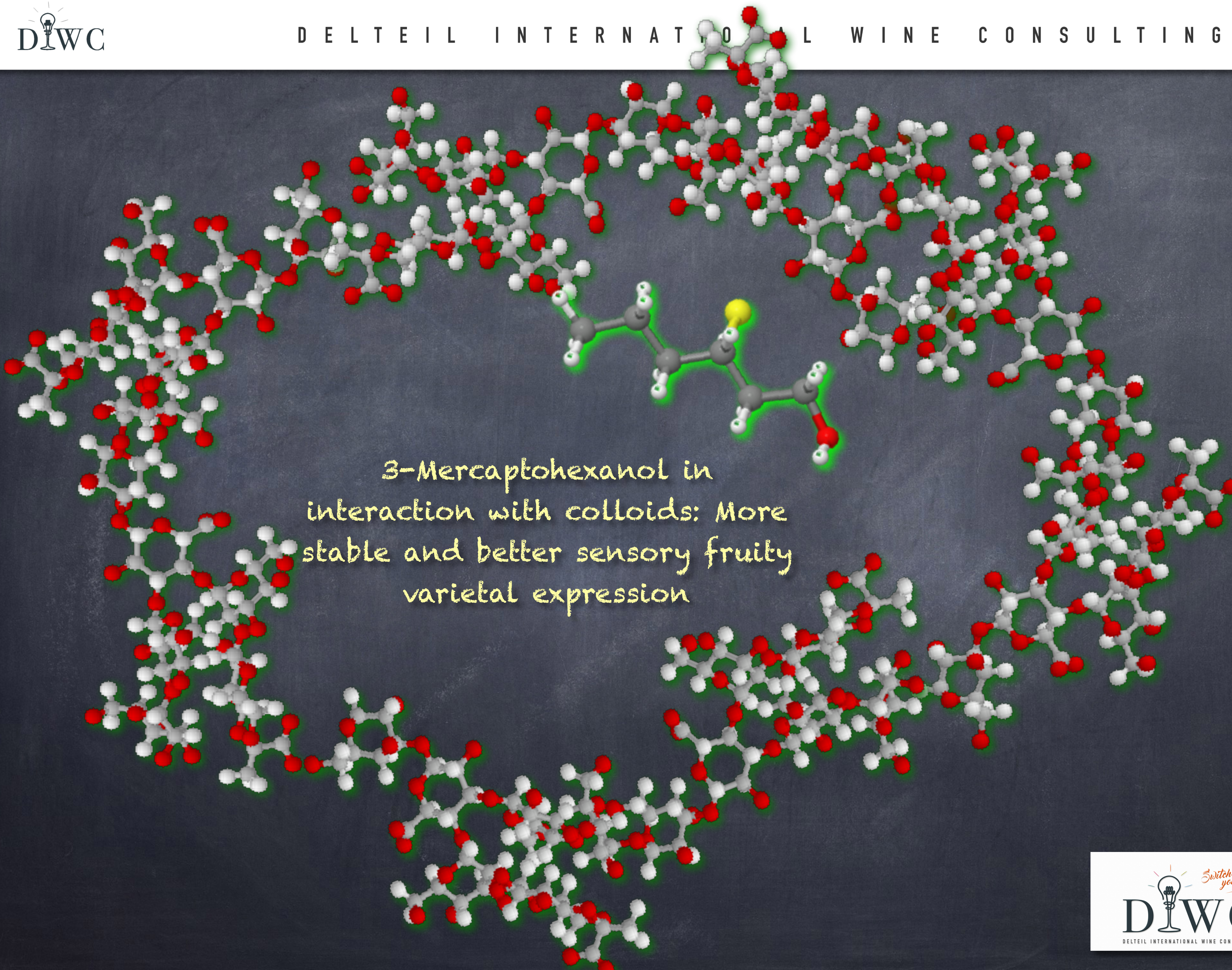
Build a balanced and stabilized colloidal matrix (2)

- Do not extract colloids from Botrytis cinerea and different fungi:
- Do not add carboxy-methyl-cellulose in a red wine with unstable color

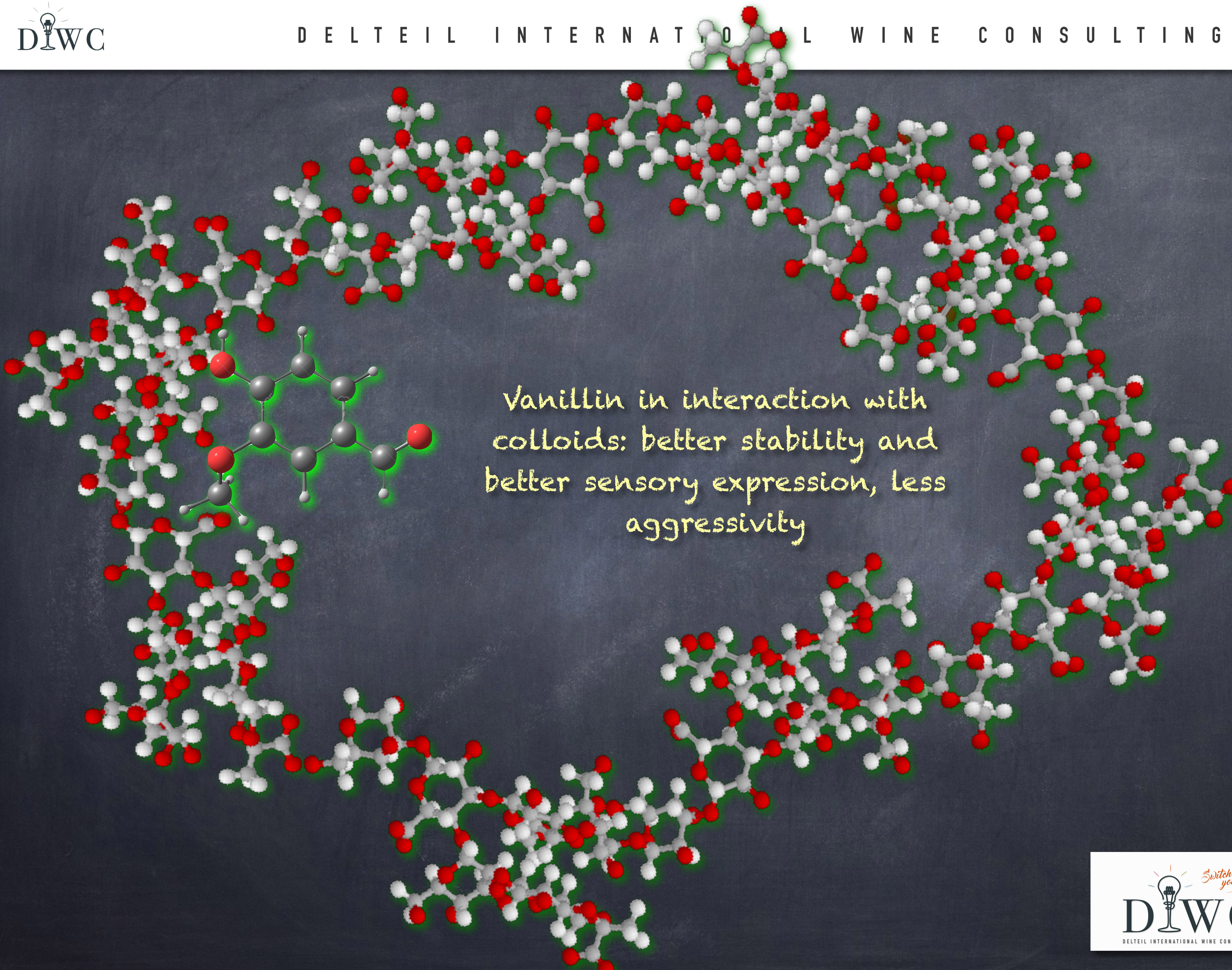
2. Elements in interaction with the different colloids



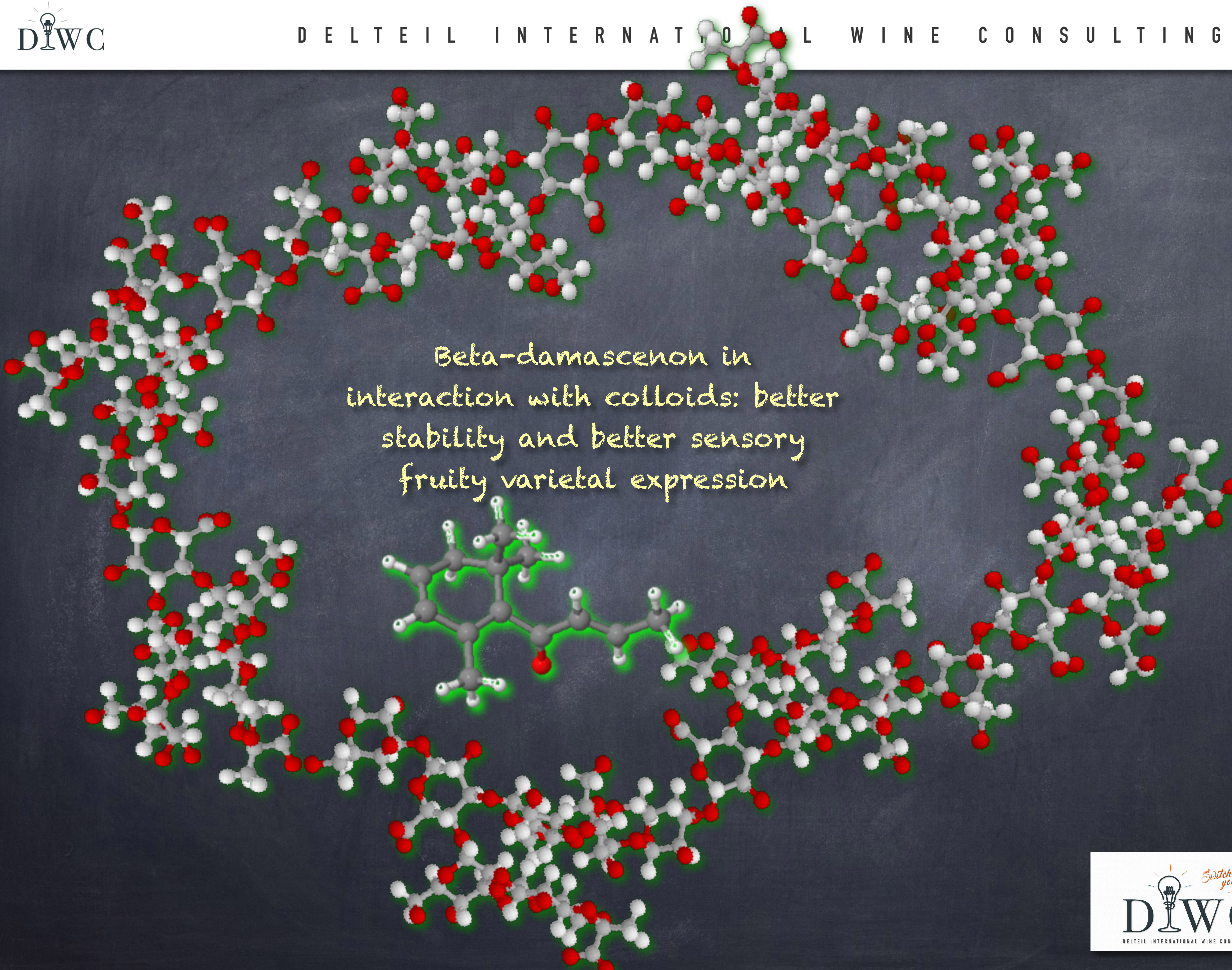
Anthocyanins and tannins in interaction with colloids: better stability and better sensory expression, less aggressivity

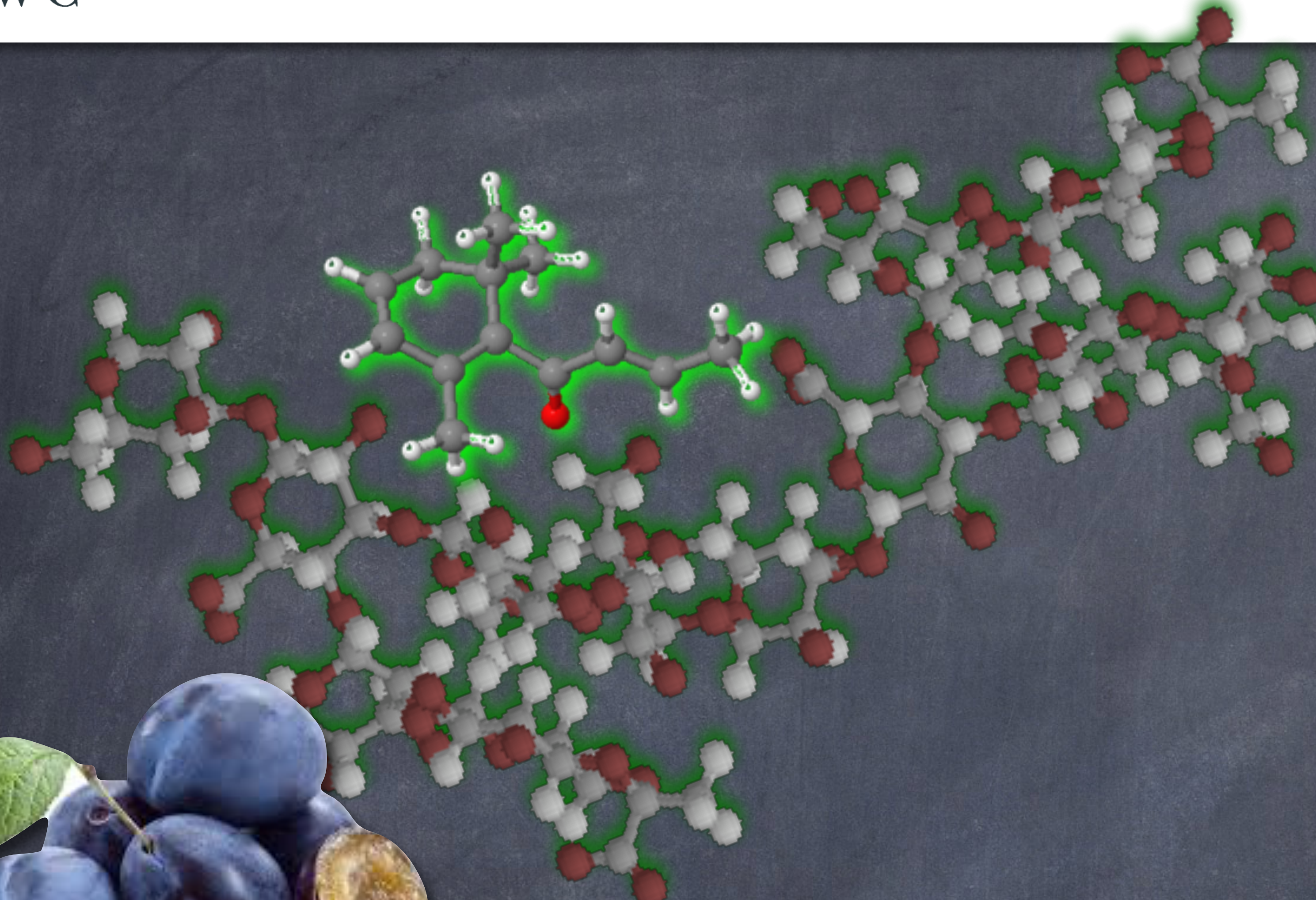


3-Mercaptohexanol in interaction with colloids: More stable and better sensory fruity varietal expression

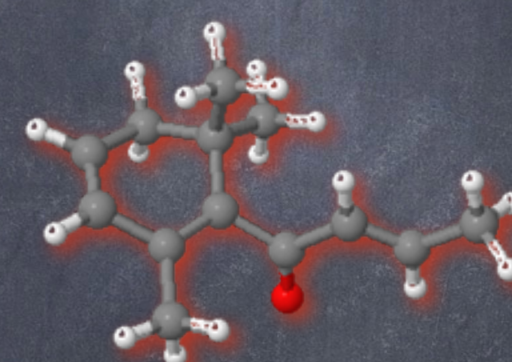


Vanillin in interaction with colloids: better stability and better sensory expression, less aggressivity


Beta-damascenon in interaction with colloids: better stability and better sensory fruity varietal expression



Real fruity aromas come from volatiles aromas in interaction with colloids. Already in the grape, then in the wine

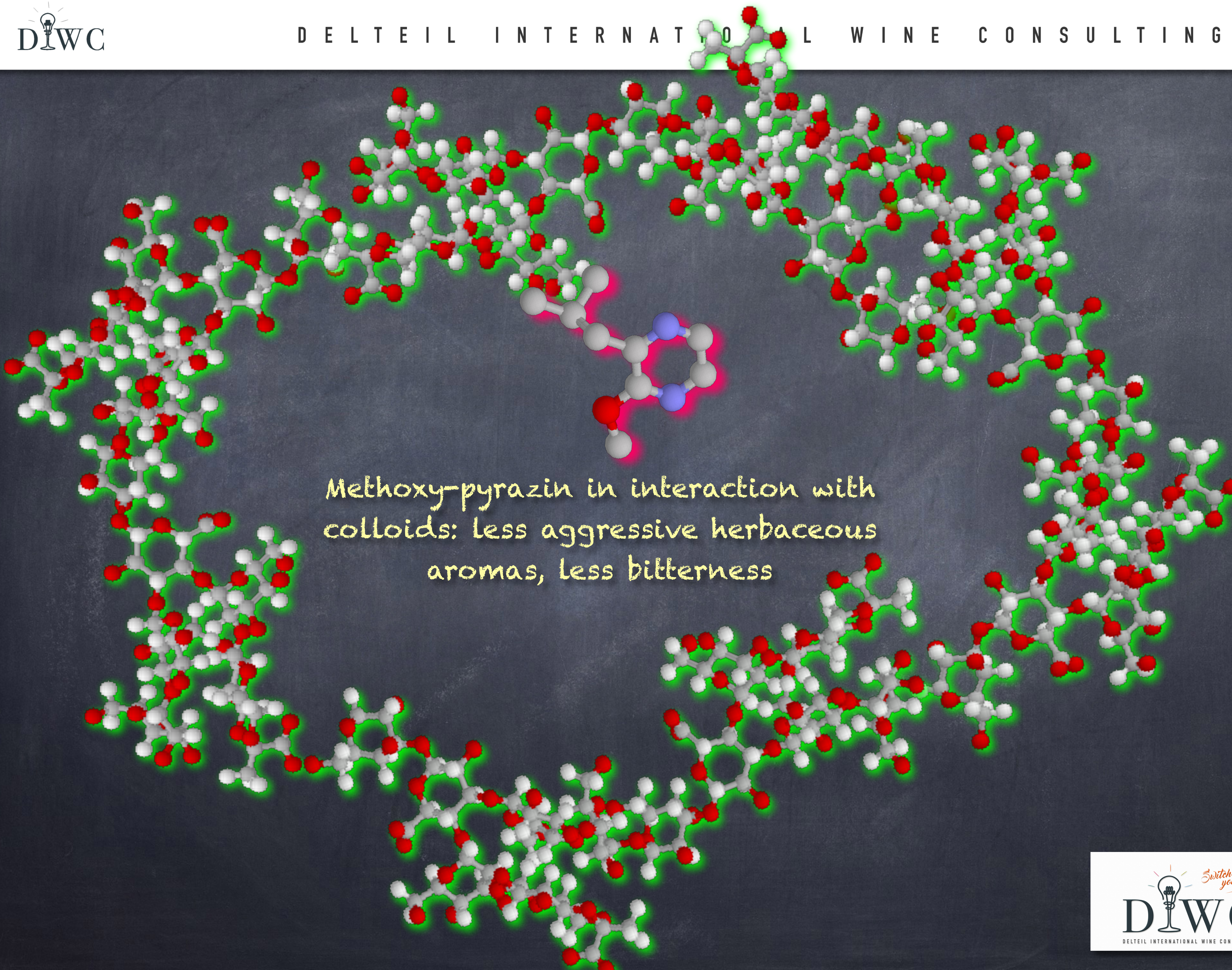


Volatiles aromas not in interaction with colloids are unstable, more sensitive to oxydation and have a more artificial pharmaceutical expression, not really fruity

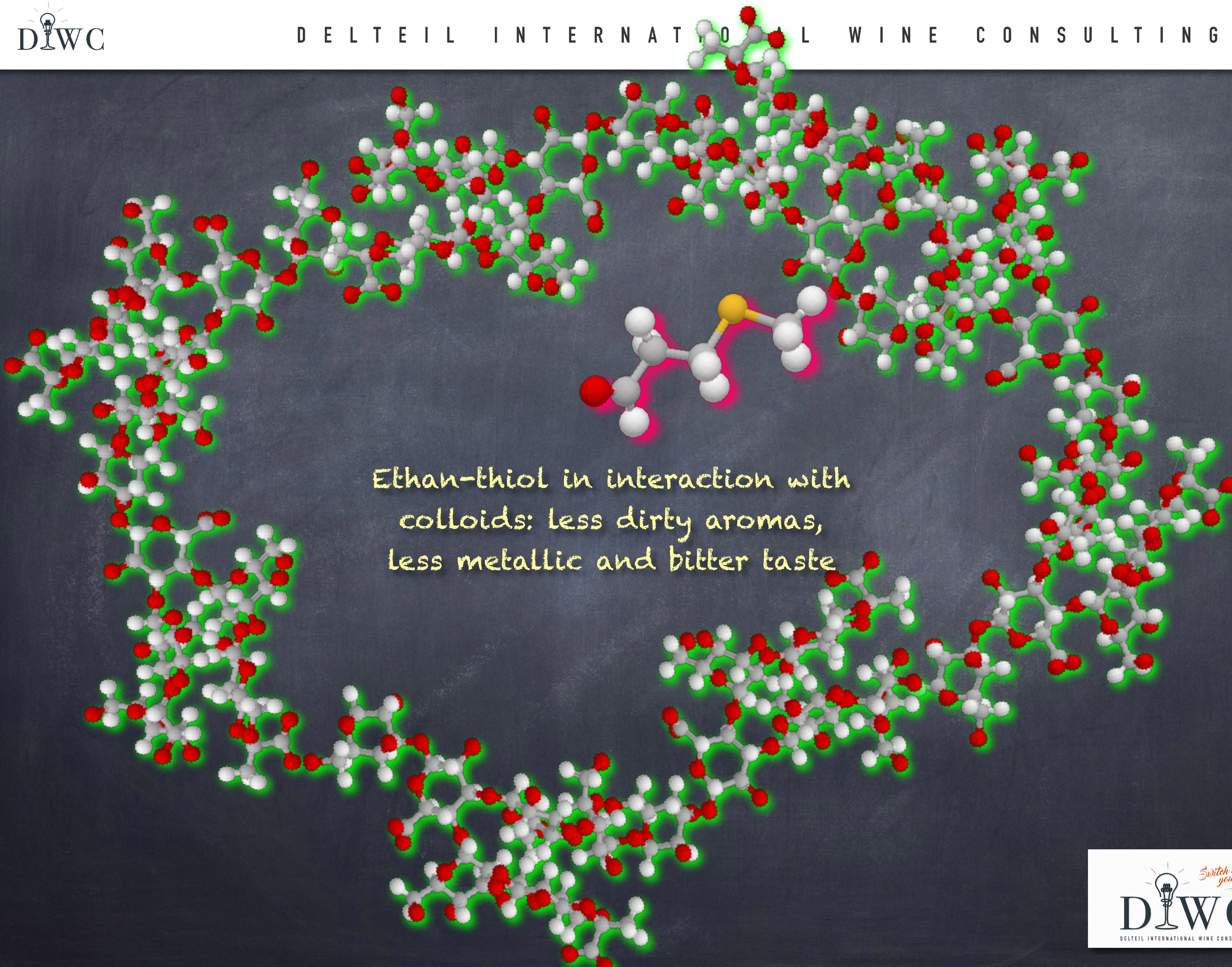
Develop the potential quality

Integrate potential aromas and mouthfeel molecules into the balanced and stabilized colloidal matrix

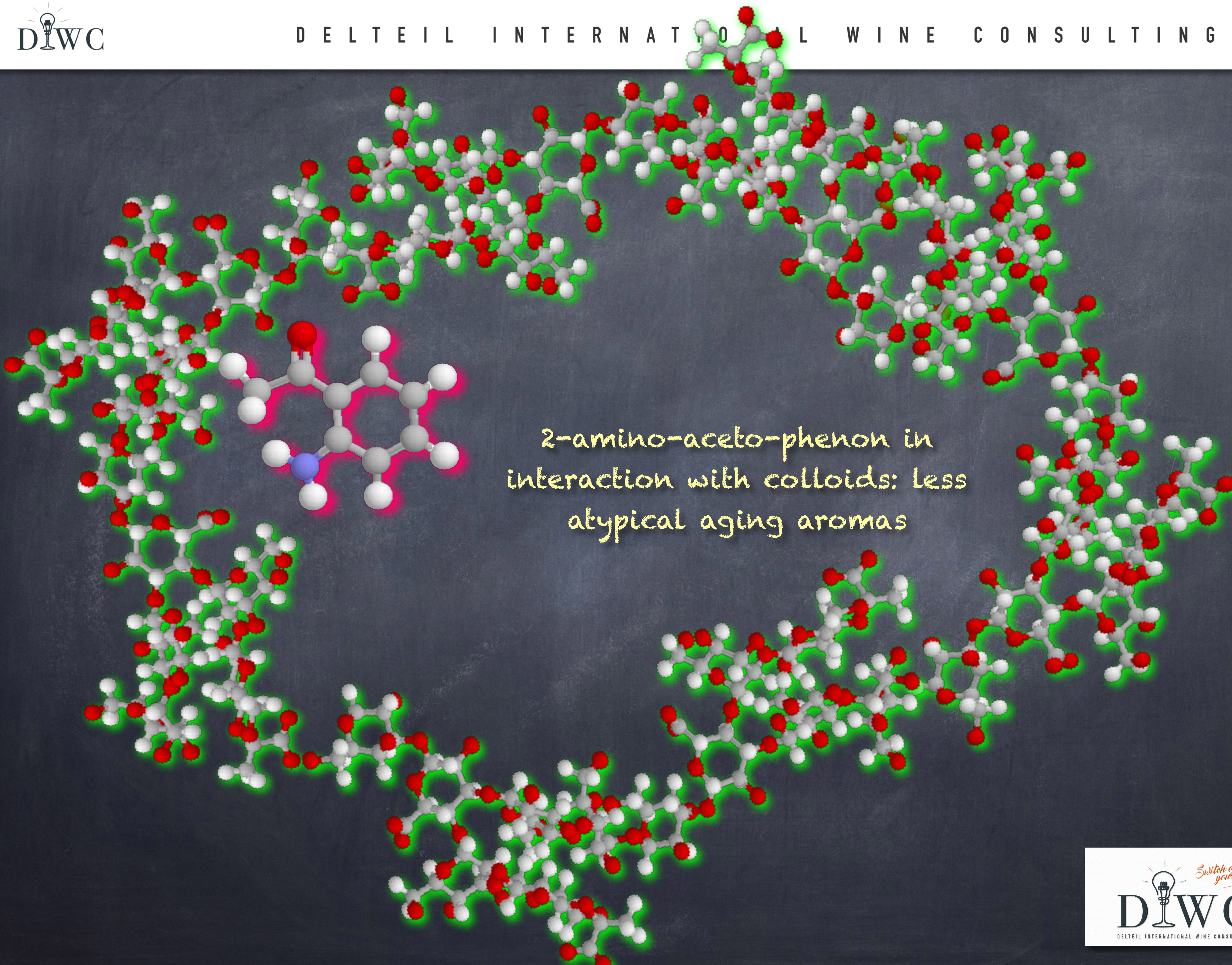
- Extract and produce the right amount and balance of:
  - Grape aromas and mouthfeel molecules
  - Yeast aromas and mouthfeel molecules, including the « revelation » of grape precursors
  - Oak colloids, aromas and tannins
  - Bacteria aromas and colloids, including the « revelation » of grape precursors
- Stabilize the network made of aromas / mouthfeel molecules / colloids. With several additions when possible : yeast and oak
- Do not impoverish or destabilize the aromatic/colloidal matrix with useless fining or excessive tannin additions



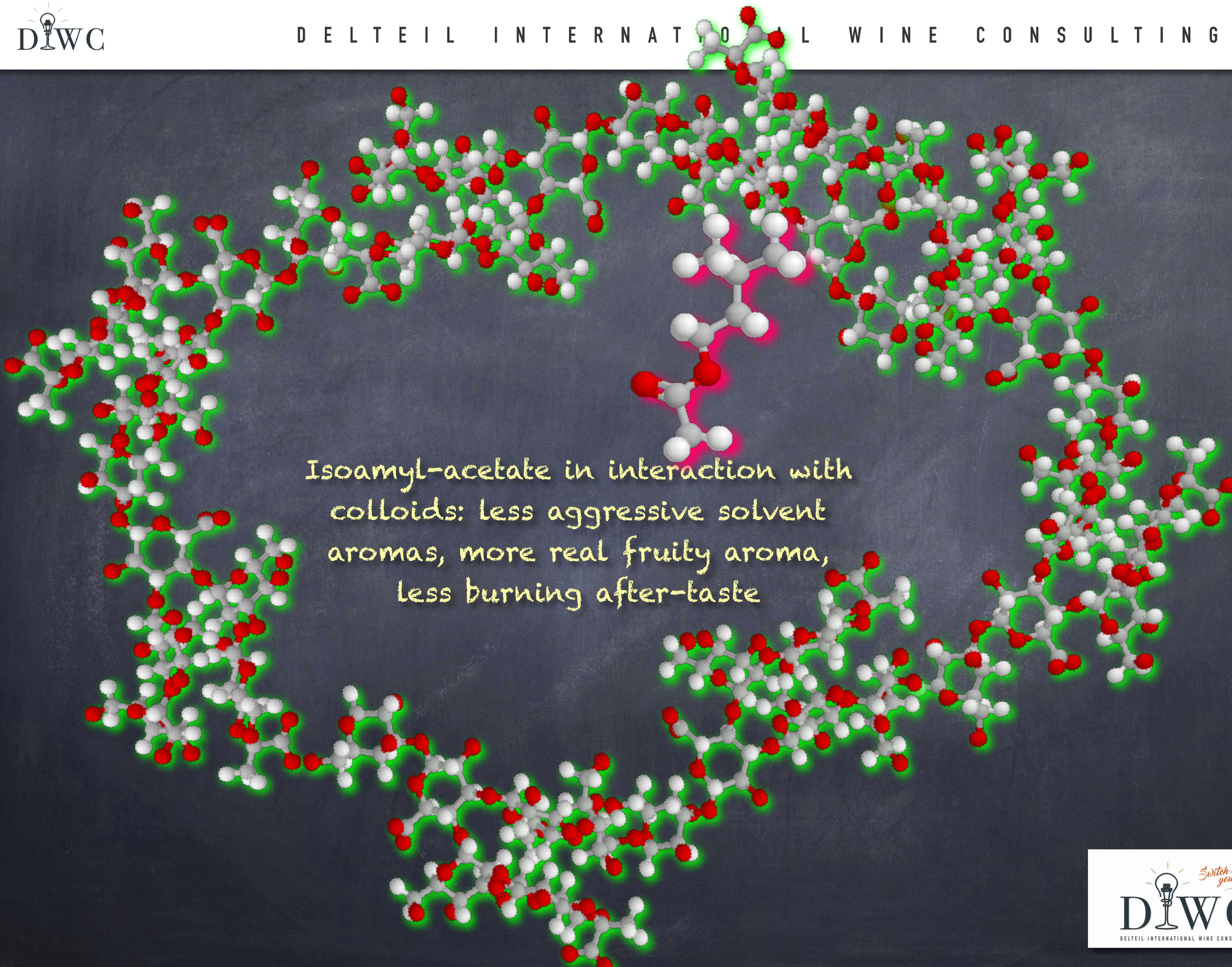
Methoxy-pyrazin in interaction with colloids: less aggressive herbaceous aromas, less bitterness



Ethan-thiol in interaction with colloids: less dirty aromas, less metallic and bitter taste



2-amino-aceto-phenon in interaction with colloids: less atypical aging aromas


Isoamyl-acetate in interaction with colloids: less aggressive solvent aromas, more real fruity aroma, less burning after-taste

Limit the risks :

Integrate potential aromas and mouthfeel molecules into the balanced and stabilized colloidal matrix

- Limit the extraction and production of:
  - Grape negative aromas and mouthfeel molecules
  - Yeast negative aromas and mouthfeel molecules
  - Oak negative aromas and tannins
  - Bacteria negative aromas and mouthfeel molecules
- Do not push the aggressive molecules with excessive tannin additions

3. Interactions with the different colloids on insoluble particles: the sponge effect

The sponge effects: key points in the colloidal stabilization

- Insoluble grape particules
- Insoluble yeast parts
- Insoluble oak parts
- Insoluble bacteria parts

Absorb and eliminate negative molecules

- Absorption is due to tension-active and electrostatic phenomena. They are instantaneous
- Absorb unstable and negative molecules on :
  - Grape insoluble parts (delestage, pumping over, punching down)
  - Yeast insoluble parts: good practices in lees management and several additions of specific inactivated yeast (e.g. Noblesse)
  - Oak insoluble parts
  - Bacteria insoluble parts: good practices in lees management

Absorb and eliminate negative molecules (2)

- Absorb with regular additions when possible : several specific inactivated yeast and oak fragments (staves, blocks, chips) added during aging

- Do not impoverish or destabilize the colloidal matrix with useless protein fining or excessive tannin additions

Unstable anthocyanins and aggressive tannins absorbed on yeast cell structures (e.g. Noblesse) are eliminated with heavy lees

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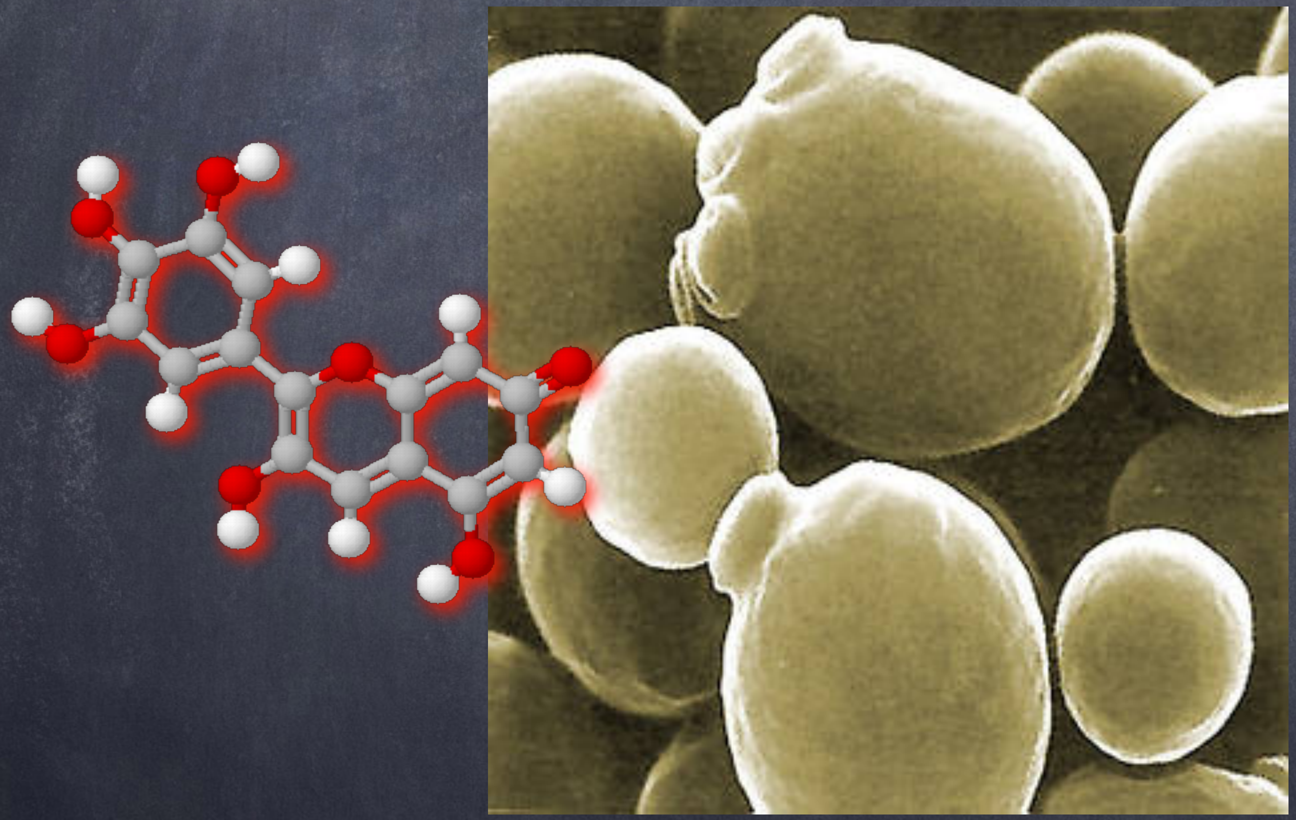
More stable and more balanced wine



Very recent research (INRA Montpellier) has demonstrated that complete inactivated yeast (e.g. OptiRed, Noblesse) are more efficient than yeast extracts

Unstable anthocyanins and aggressive tannins absorbed on bacteria cell structures are eliminated with heavy lees

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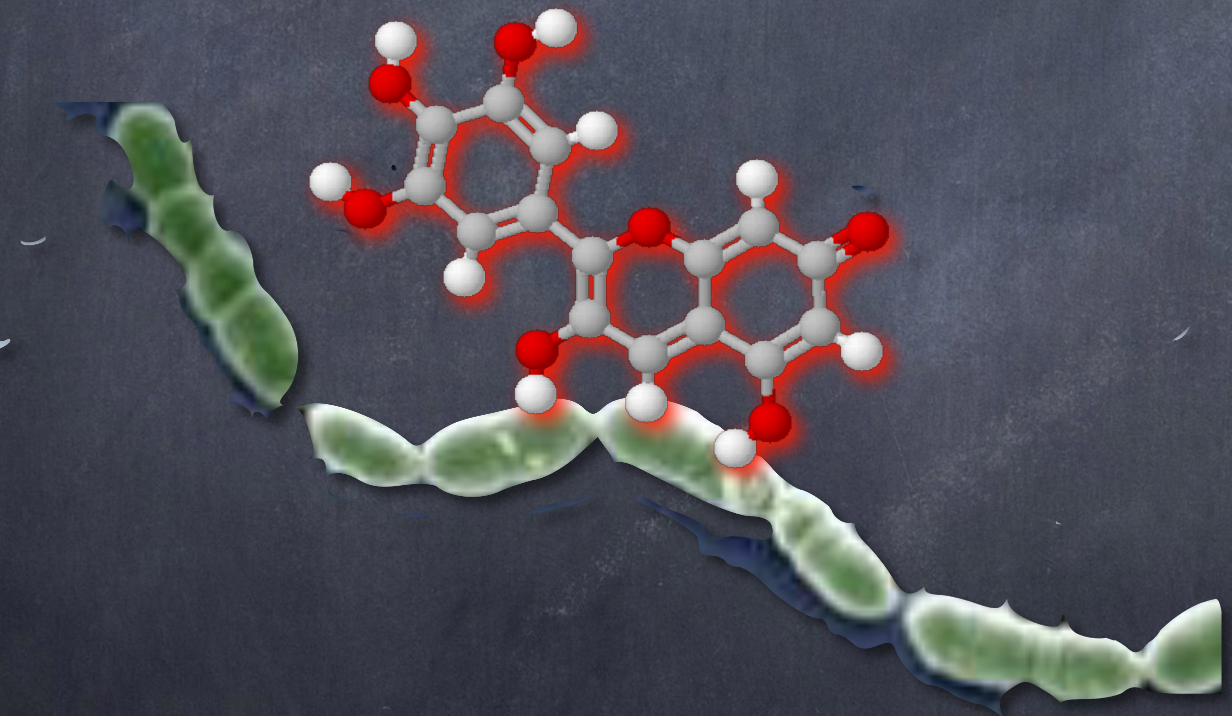
More stable and more balanced wine



Unstable anthocyanins and aggressive tannins absorbed on oak structures are eliminated

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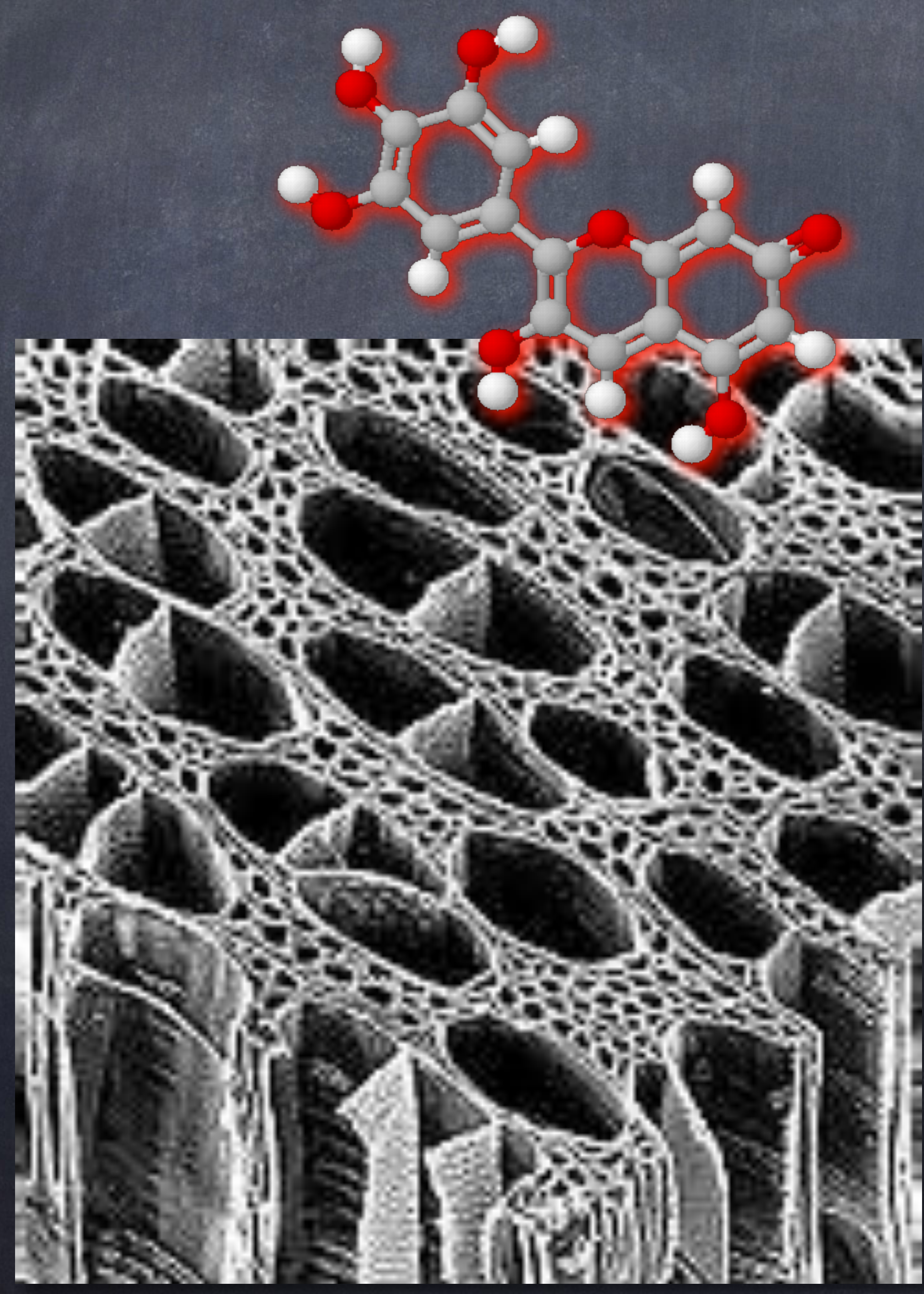
More stable and more balanced wine



Herbaceous and sulfur molecules absorbed on yeast cell structures are eliminated with heavy lees

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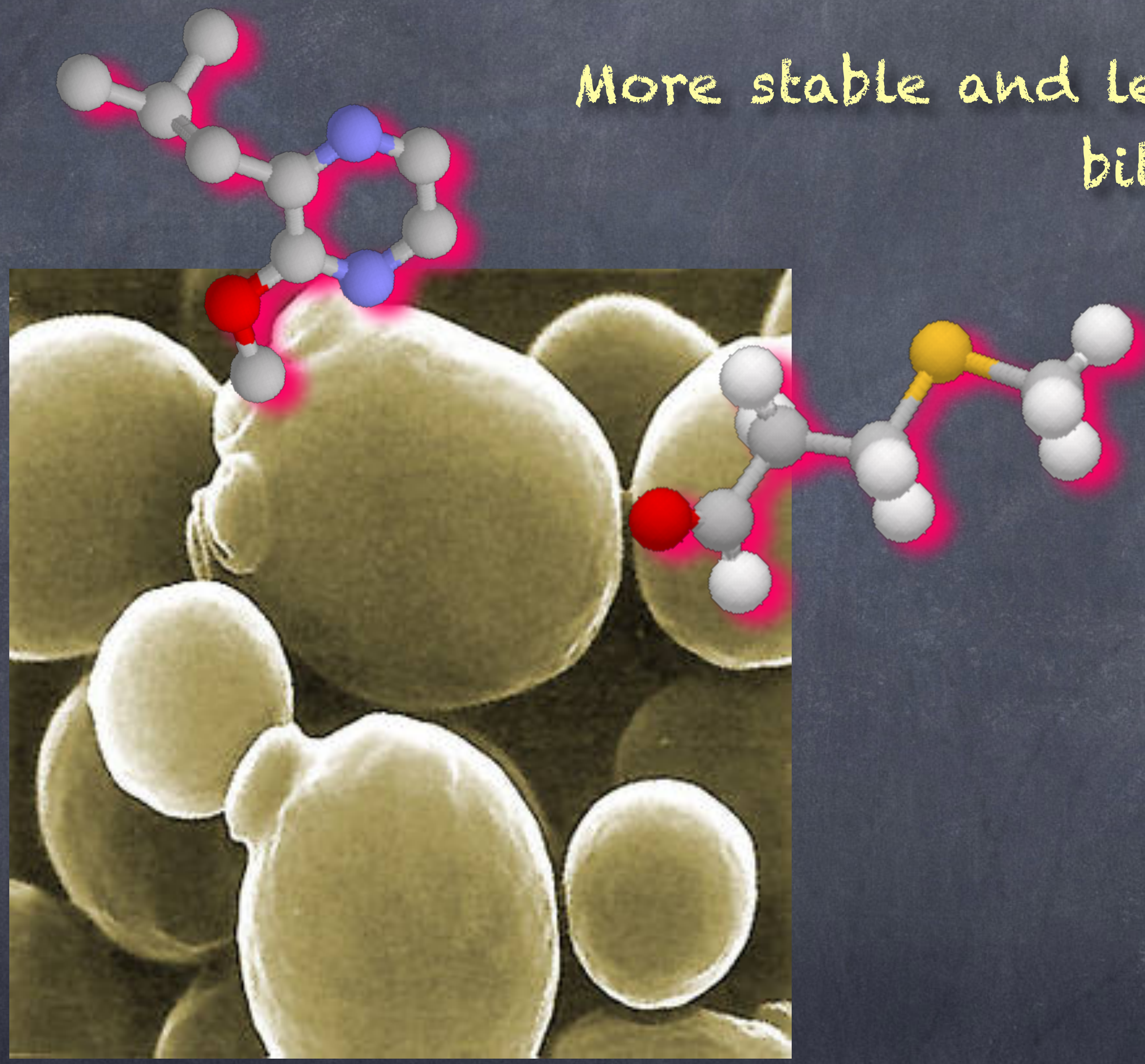
More stable and less sulfur/green and less bitter wine



Herbaceous and sulfur molecules absorbed on oak structures are eliminated

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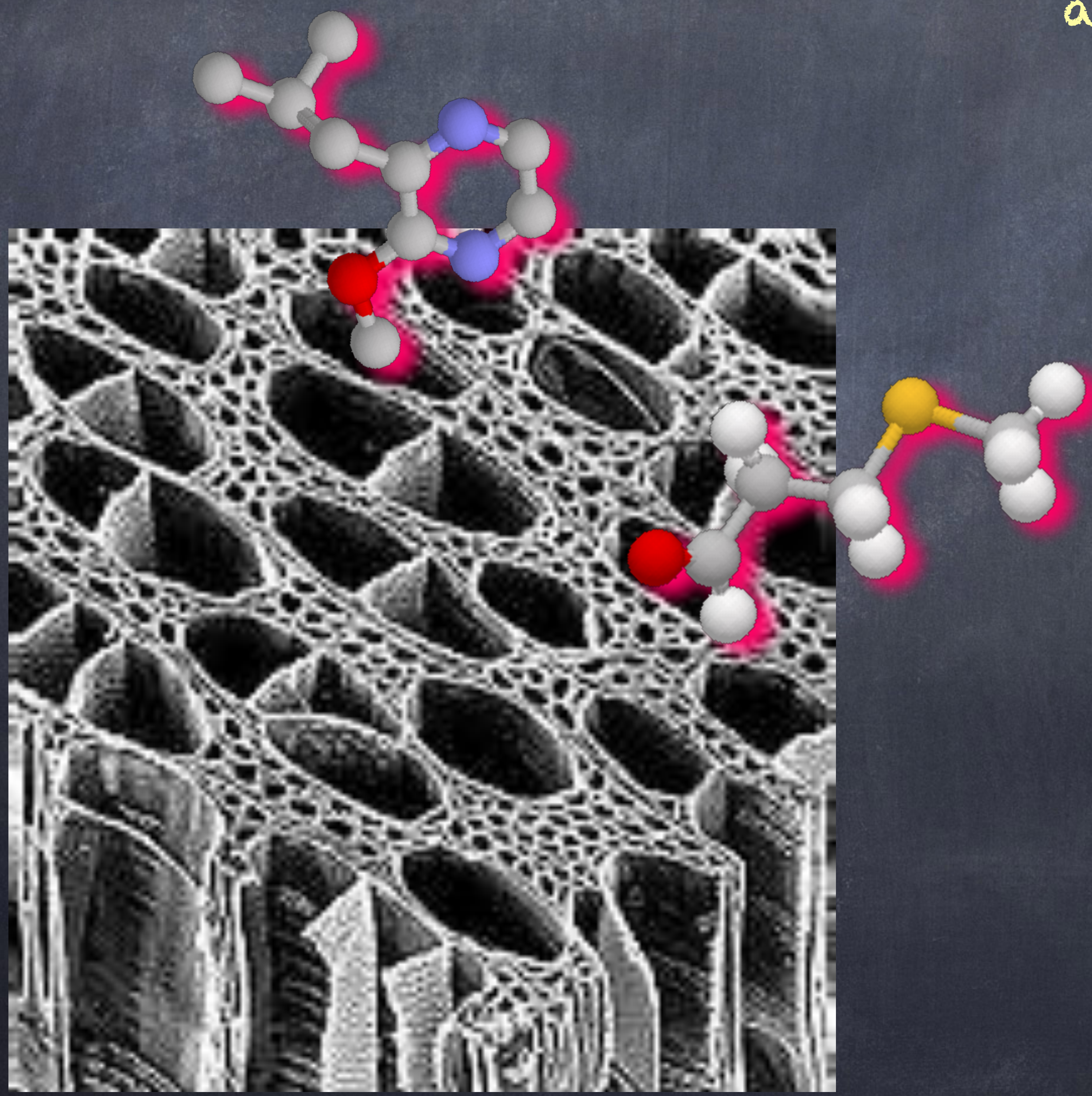
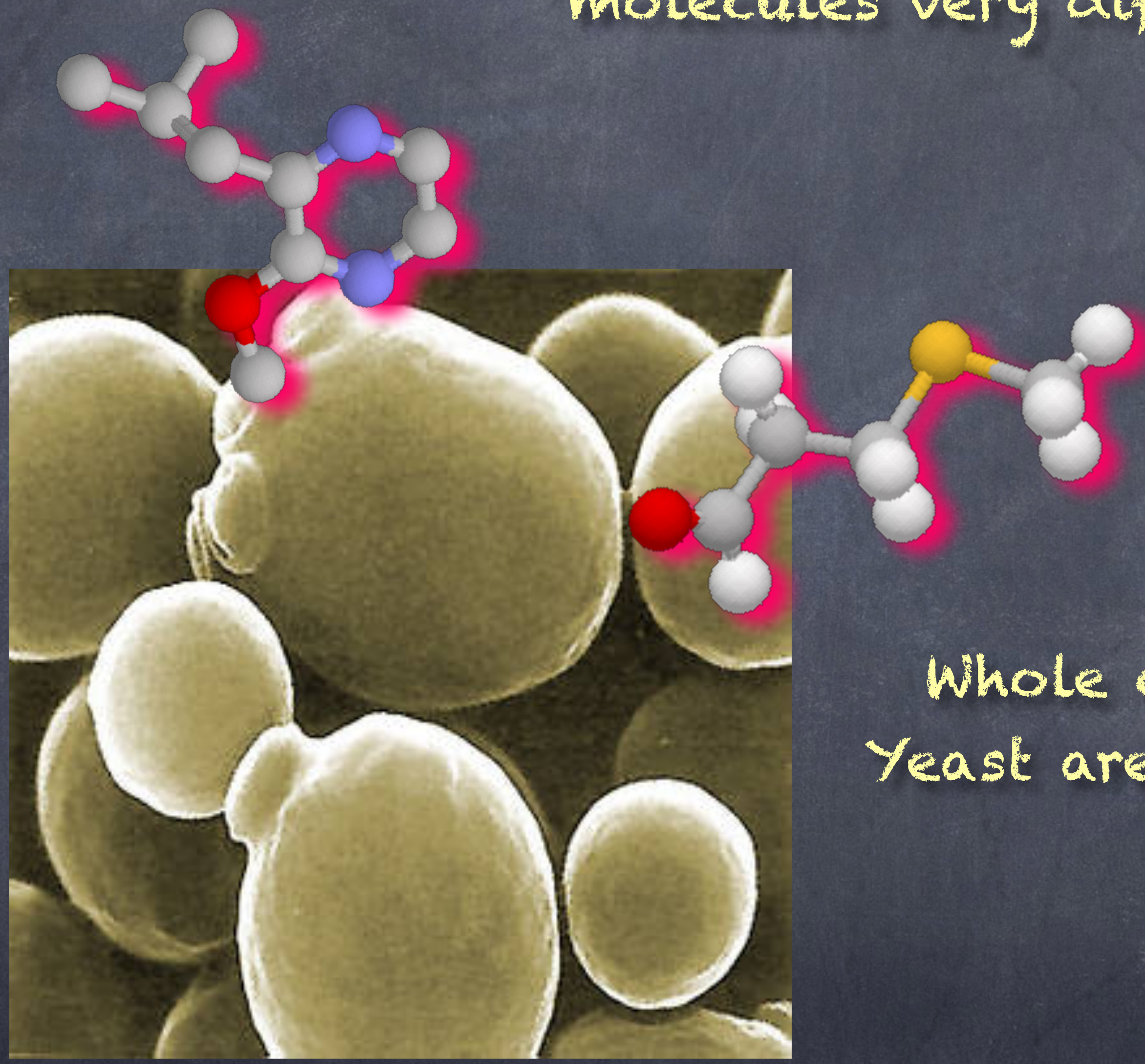
More stable and less sulfur/green and less bitter wine



Choices in the use of yeast and oak as sponges

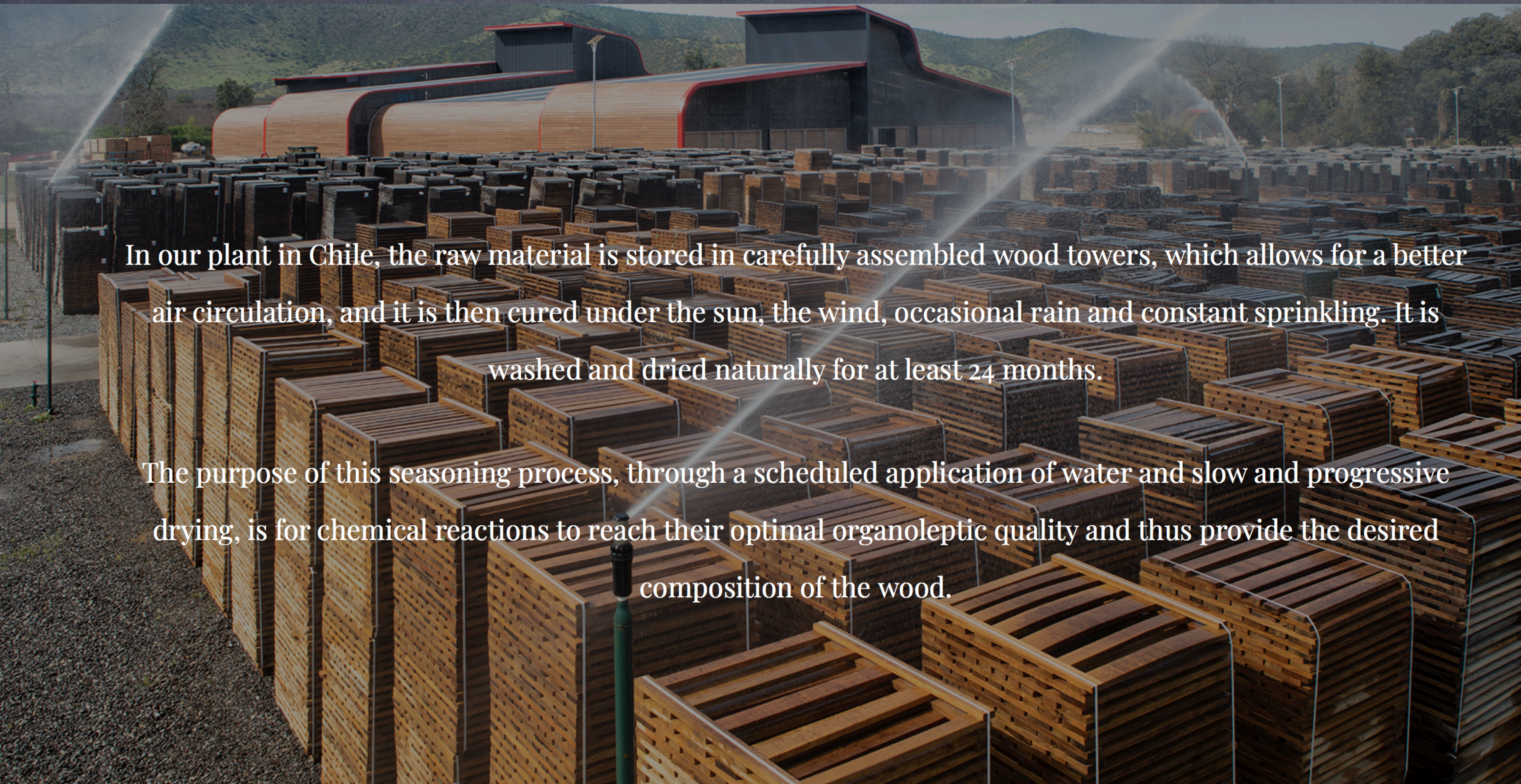
Noblesse (SIY) is the most efficient sponge because of the strain used, especially for molecules very difficult to absorb, like the OTA



Whole cells Specific Inactivated Yeast are more efficient than yeast extracts

Important elements to manage the sponge effect of oak

- Long oak seasoning before toasting is important:
  - Alternative water washings and dryings expand and retract regularly the oak pores and allow a better sponge effect in the wine
  - That is important regarding barriques and oak fragments (staves, blocks, chips)



In our plant in Chile, the raw material is stored in carefully assembled wood towers, which allows for a better air circulation, and it is then cured under the sun, the wind, occasional rain and constant sprinkling. It is washed and dried naturally for at least 24 months.

The purpose of this seasoning process, through a scheduled application of water and slow and progressive drying, is for chemical reactions to reach their optimal organoleptic quality and thus provide the desired composition of the wood.

Important elements to manage the sponge effect of oak (2)

- Convection toasting at moderate temperature without oxygen allow a better sponge effect
- On the contrary, flame toasting burns and obstructs the first millimeters of oak and limit the interesting sponge effect.
- That is important regarding barriques and oak fragments (staves, blocks, chips)

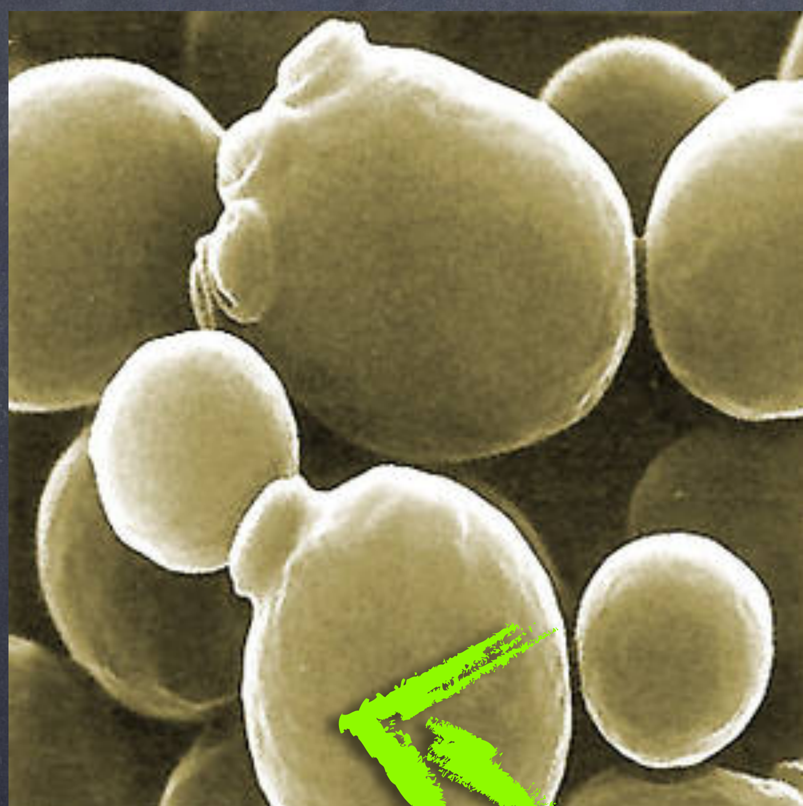
Important elements to manage the sponge effect of oak (3)

- Of course during wine contact the oak will also liberate some aromas and tannins
- To manage a good balanced sponge effect, non aggressive aromas and tannins oak is necessary to avoid excess of artificial vanilla and hard tannins tastes
- That is important regarding barriques and oak fragments (staves, blocks, chips)

Limitations in the use of yeast and oak as sponges

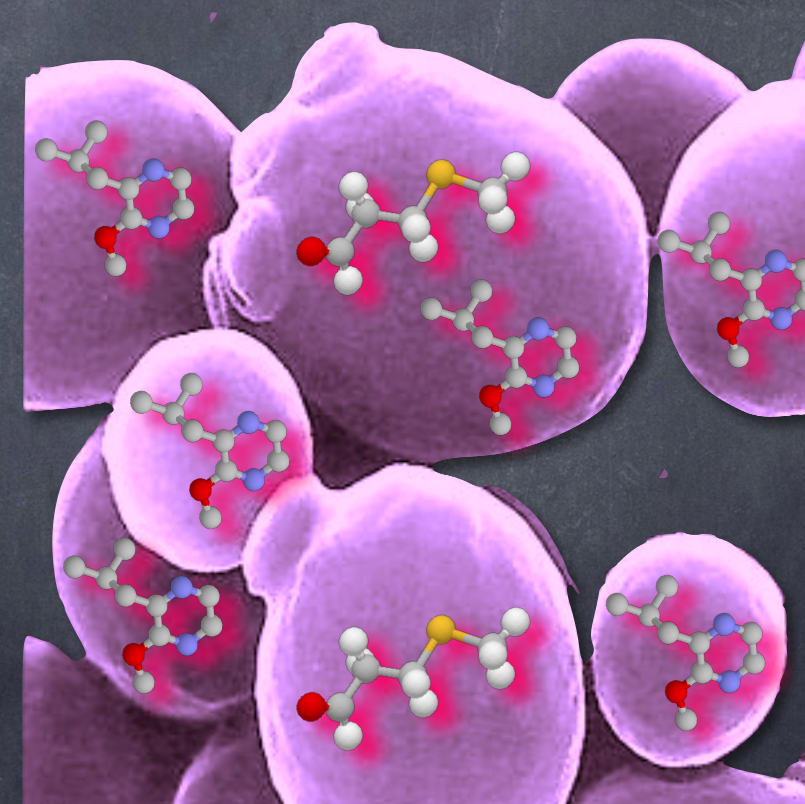
When dead yeast or Specific Inactivated Yeast are saturated with color or other reactive molecules, their sponge efficiency is limited because their reactive sites are already occupied

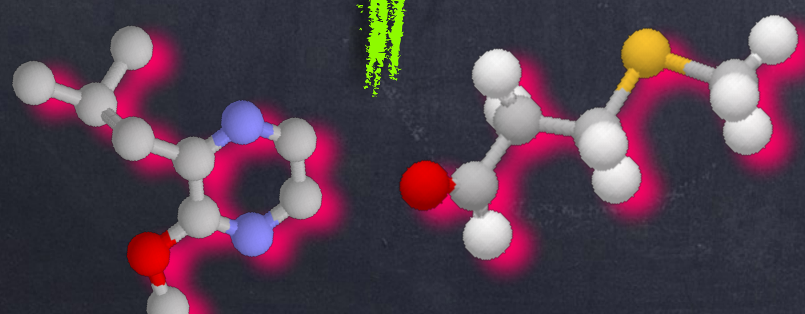
Recently added Noblesse SIY



Intense attraction

Weak attraction





Noblesse SIY added last month

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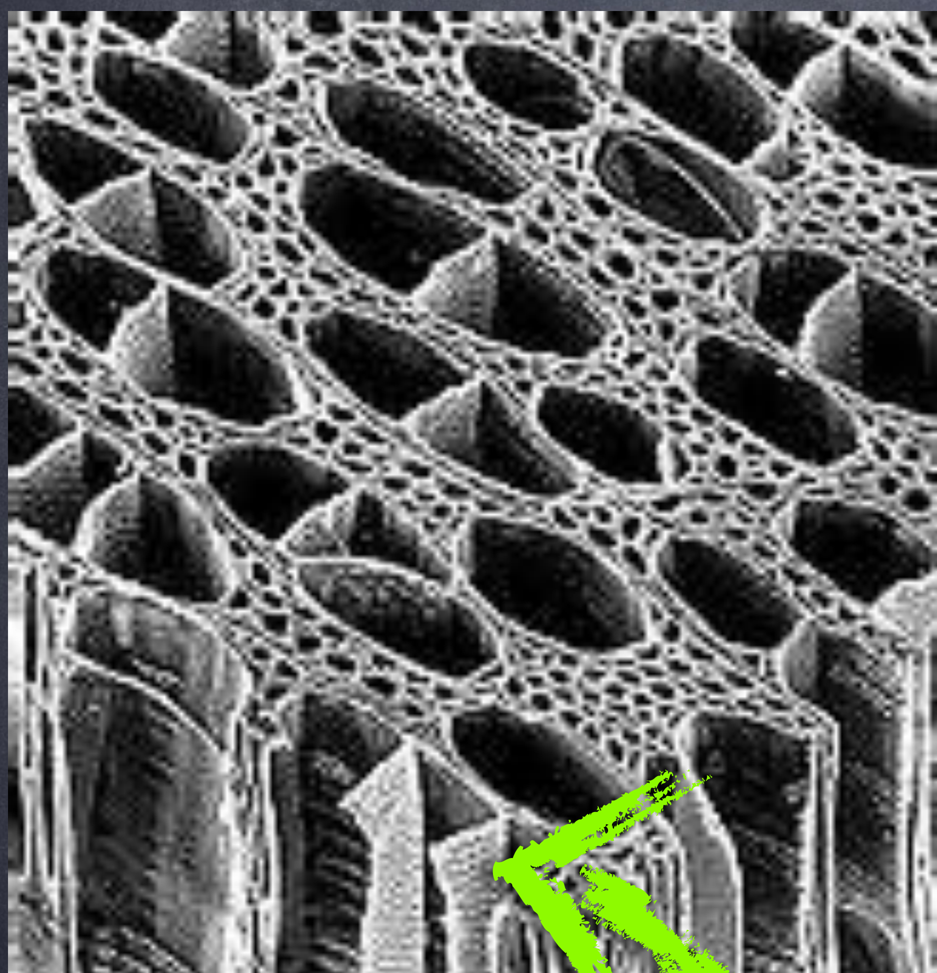
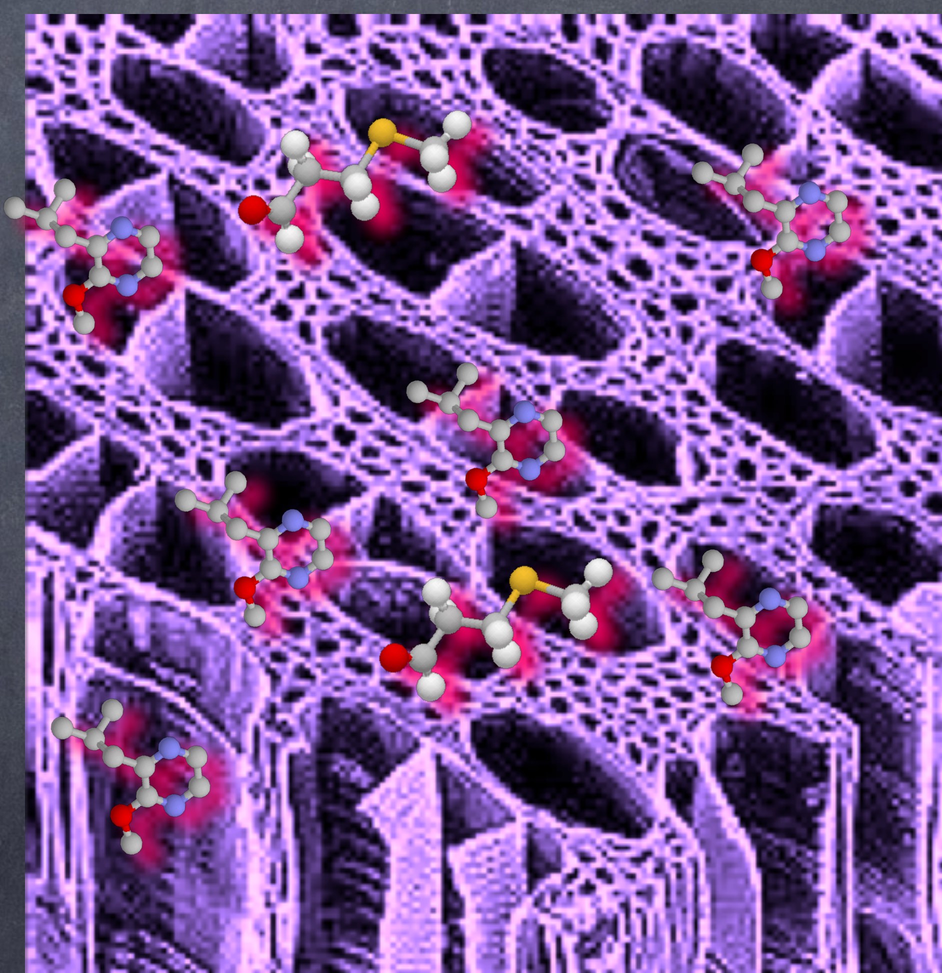
Recently added oak staves

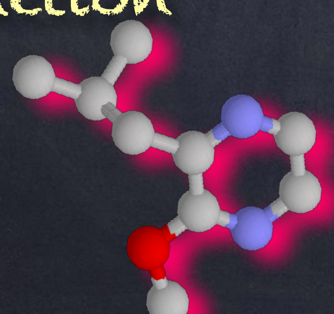


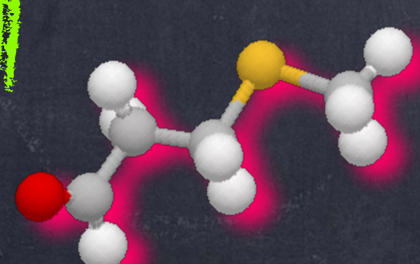
When oak surface is saturated with color or other reactive molecules, its sponge efficiency is limited because its reactive sites are already occupied. True for barriques and oak fragments



Weak attraction

Intense attraction

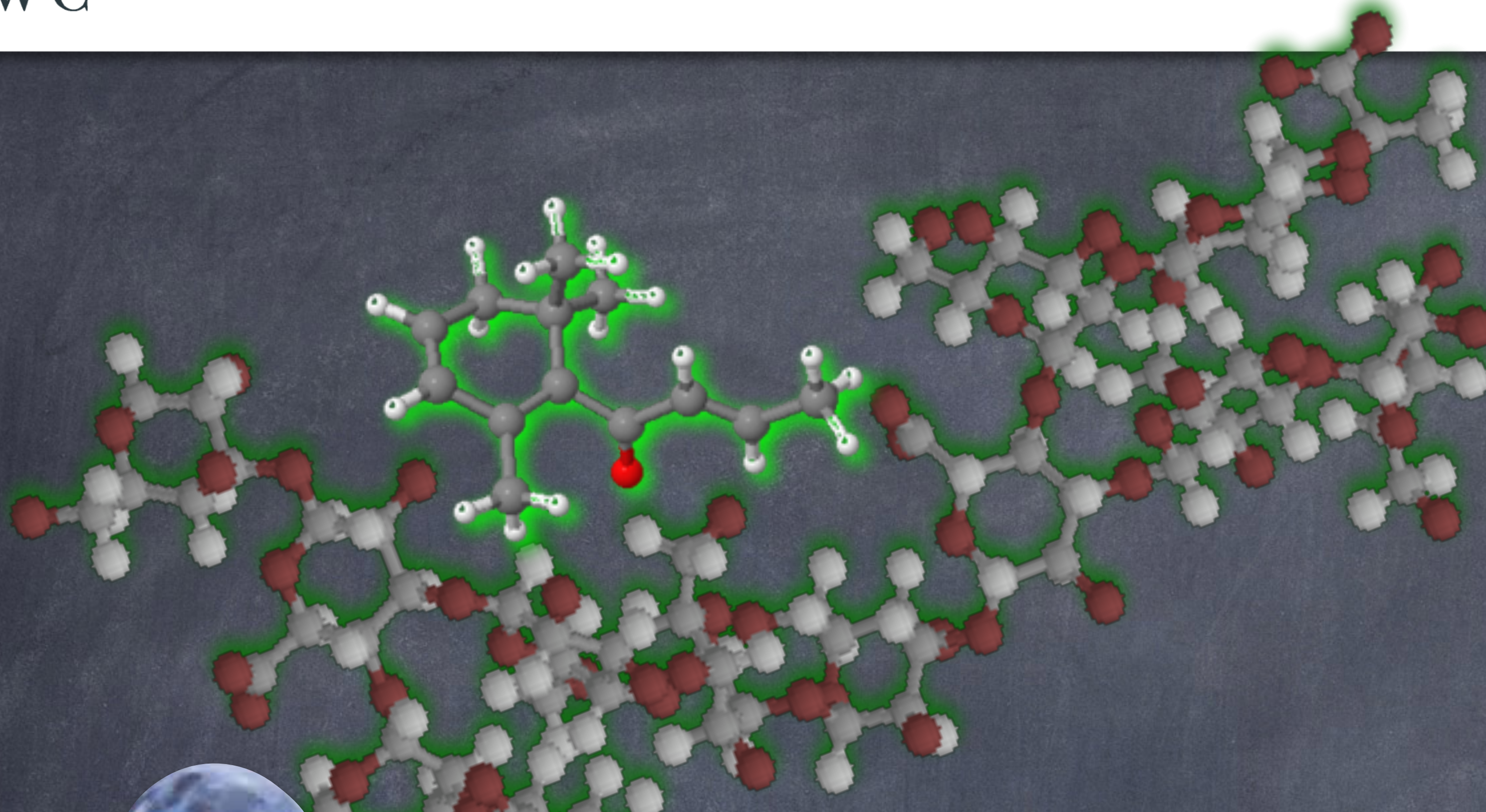




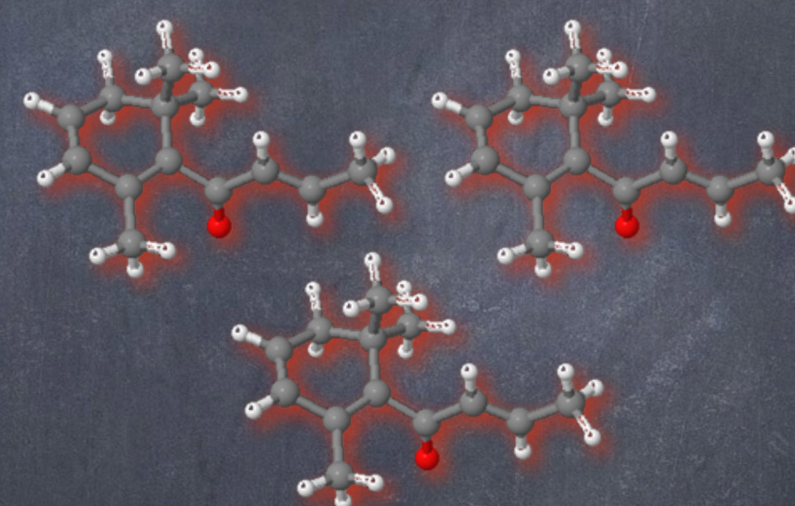
Oak staves added last month

Do the sponge effect affect the interesting aromas ?

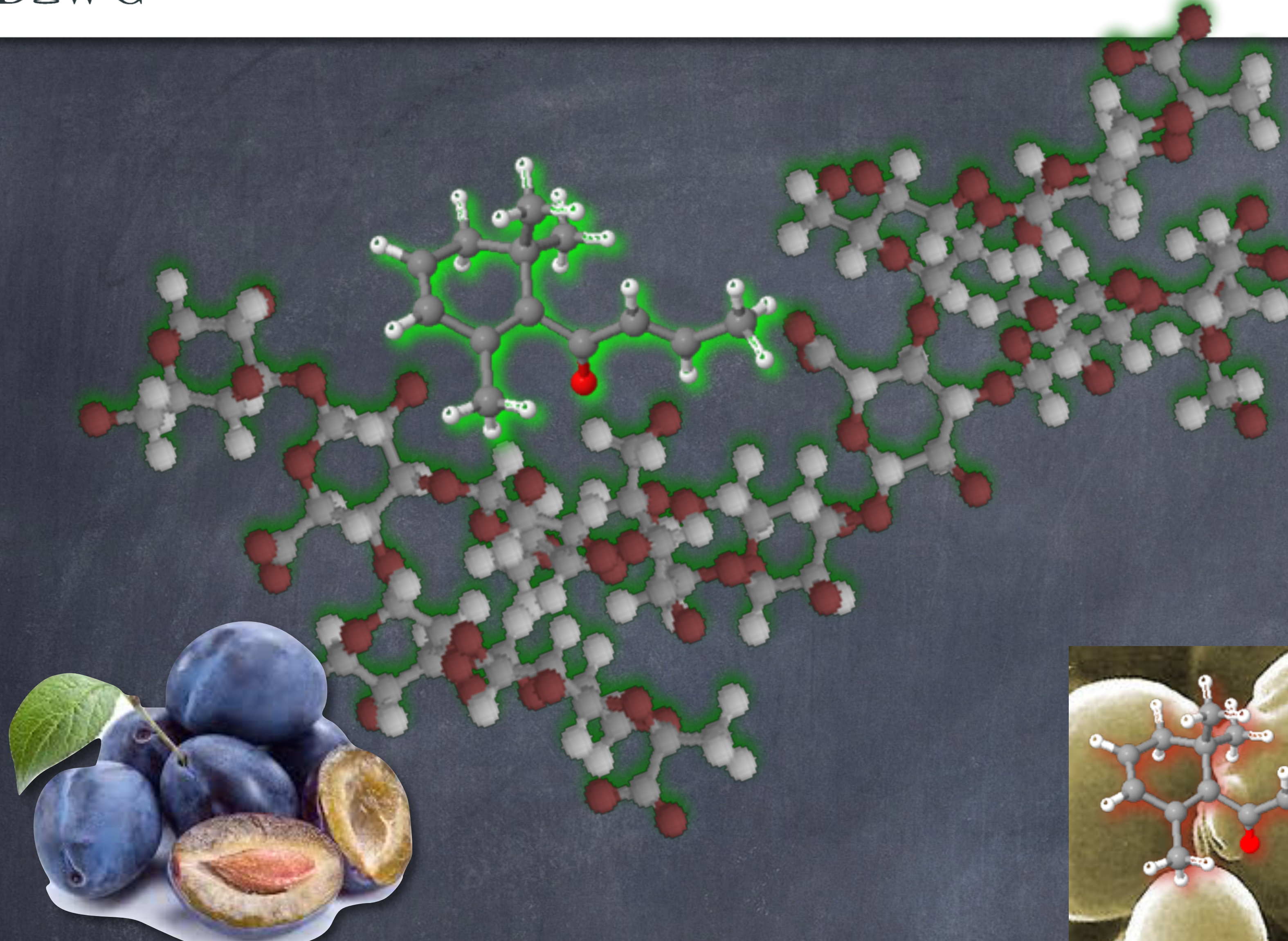
No !

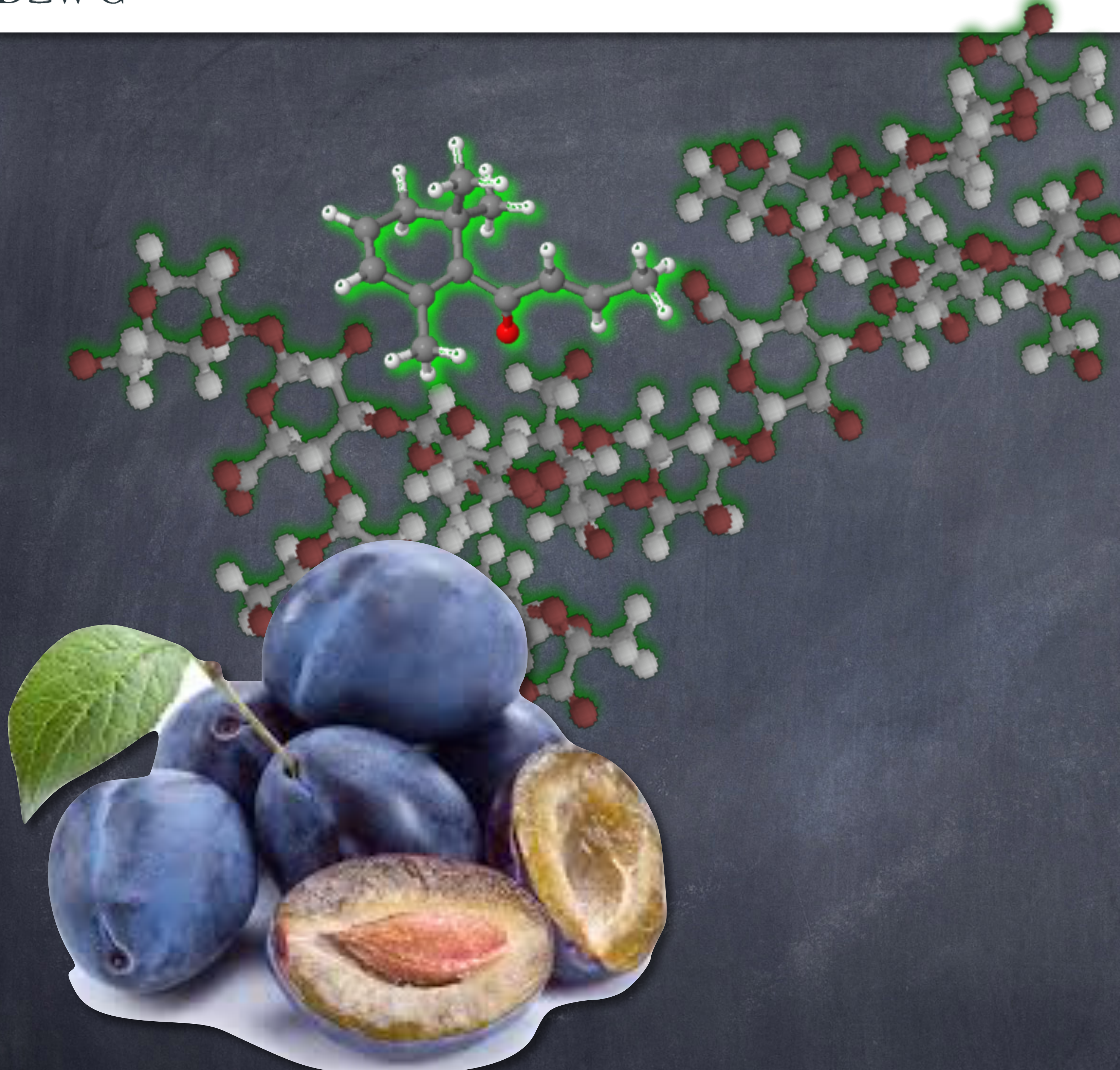


Before



During





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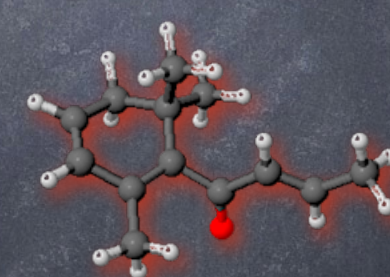
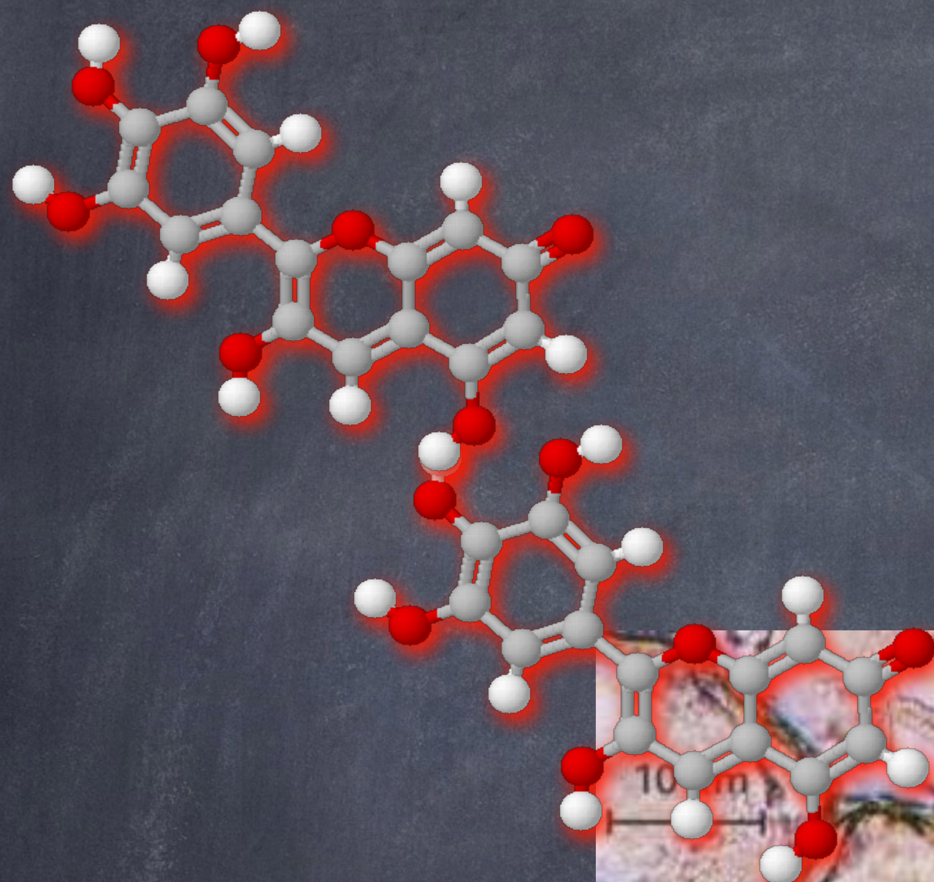


Are all sponge effects interesting?

No !



During too long maceration (over 15 days), grape cell structures are able to absorb also interesting color and tannins

What can destabilize the colloid matrix and the wine sensory balance ? (1)

- Oxidation:
  - When quinones are forming, they also precipitate with interesting colloids
  - Oxidized compounds are less integrated in the matrix and are more aggressive sensorily

What can destabilize the colloid matrix and the wine sensory balance ? (2)

- Excess of catechin in white, pinking
- Excess fining with protein (animal or vegetal)
- Useless bentonite treatments
- Too much oak for too long (excess of tannins)

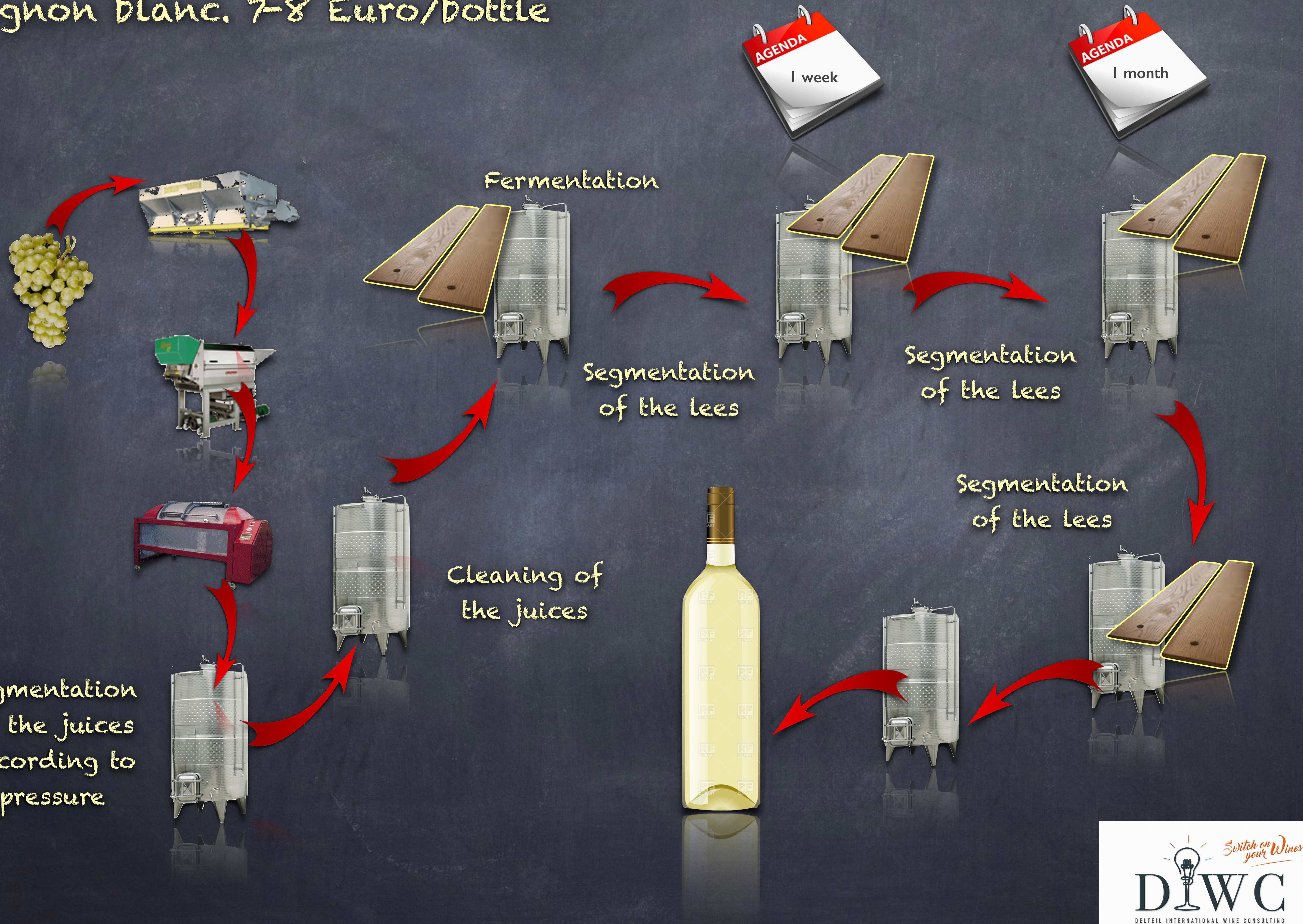
Practical examples of good practices

White wines

What are Good Practices?

- Techniques that are validated at the scientific, experimental and practical levels in wineries

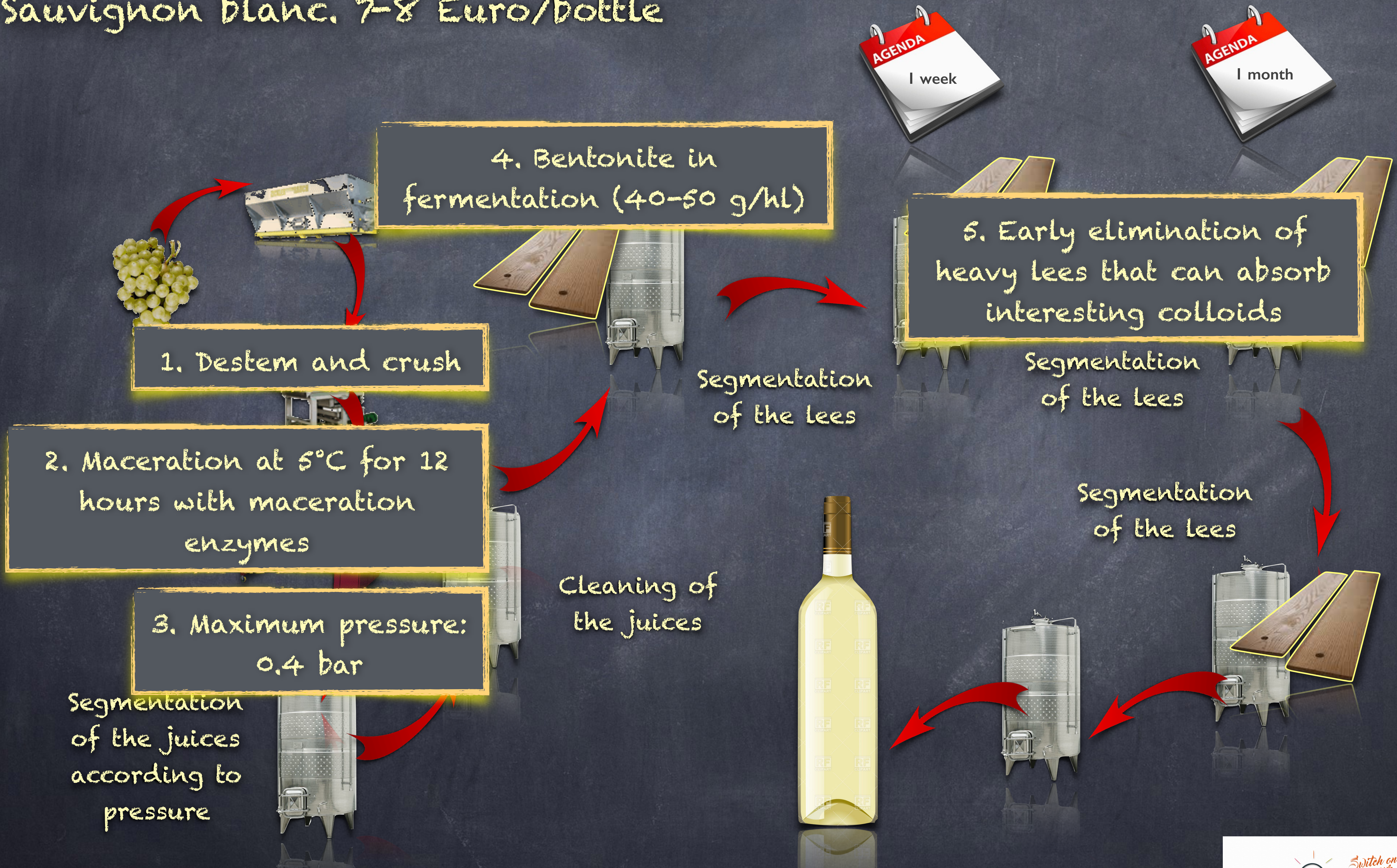
Sauvignon blanc. 7-8 Euro/bottle



Build the colloidal matrix with grape colloids

- Without too much catechins extraction
- Without excess of bentonite: reach protein stability with the minimum dosage

Sauvignon blanc. 7-8 Euro/bottle



Avoid excessive oxidation

- Without wine contamination with too much iron (from old poorly kept equipment)
- Without wine contamination with too much copper (from old poorly kept bronze equipment or excess of addition of copper sulfate or copper citrate)

Sauvignon blanc. 7-8 Euro/bottle

1. pH adjustment, 2 g/hl SO2 + 4 g/hl ascorbic acid

2. In the press 1 g/hl SO2. Dry ice (CO2, 1 kg/hl)

3. After the press: 1 g/hl SO2 + 1 g/ hl ascorbic acid. Cover the juice with CO2 until active fermentation

4. Low acetaldehyde and low SO2 producing yeast strain: Exsense or Opale 2.0. Ferment between 16 and 18°C

5. As soon as fermentation finishes: 3 g/hl SO2 + 4 g/hl ascorbic acid

6. Early elimination of heavy lees that are catalyzers for strong oxidation. Keep wine below 12°C

7. Keep 1 mg/L molecular SO2 all through aging, until bottling. Cover wine with neutral gas. Keep wine below 12°C

8. Bottling with 40 mg/L free SO2 + 5 g/hl ascorbic acid. Storage below 12°C

Segmentation

Cleaning of the juices

of the lees

of the lees

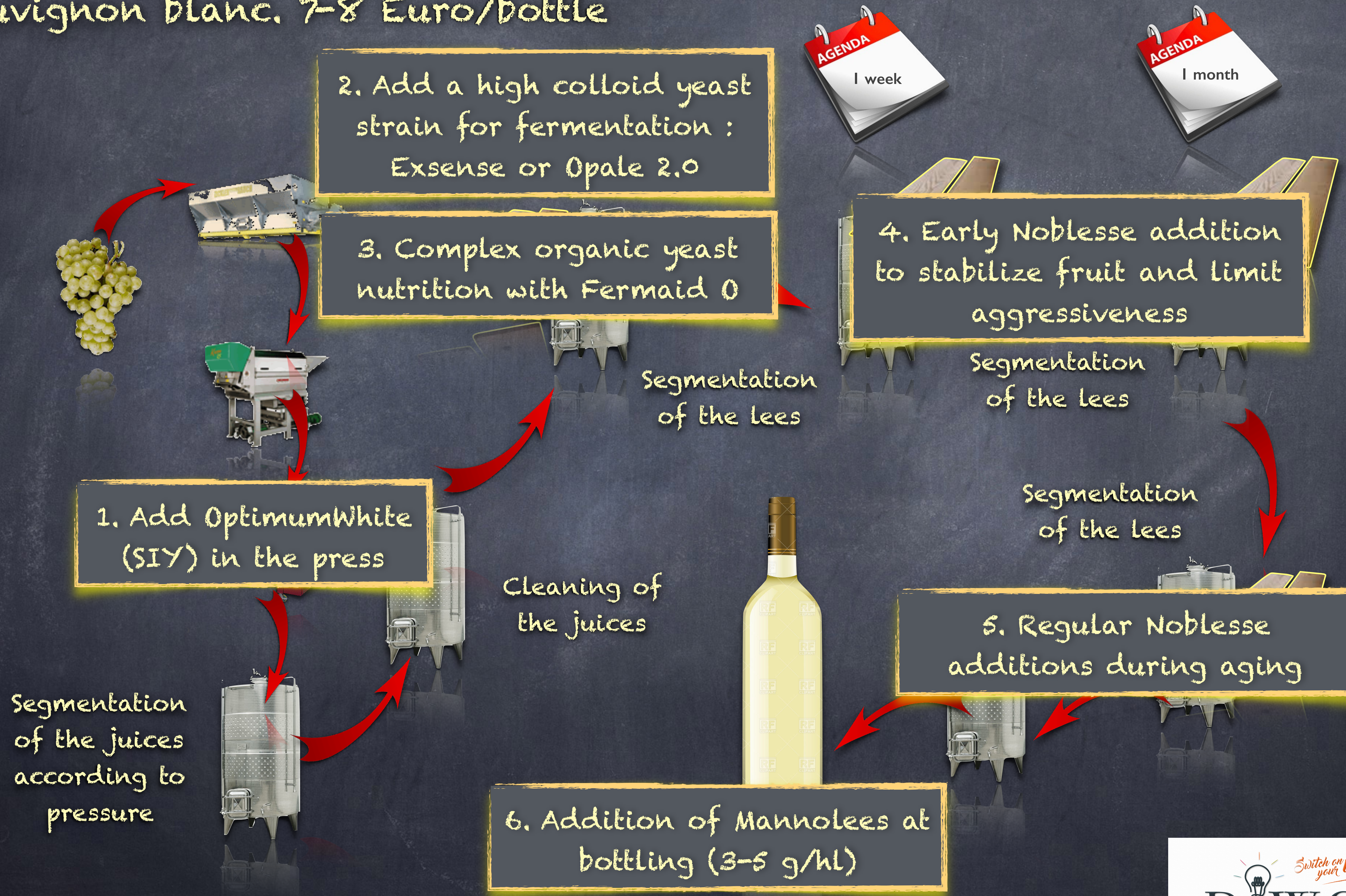
I week

I month

Build the colloidal matrix with yeast colloids

- Many occurrences of interesting sponge effect
- Without too much aggressive unstable fermentation aromas
- Without excess of buttery aromas and burning mouthfeel

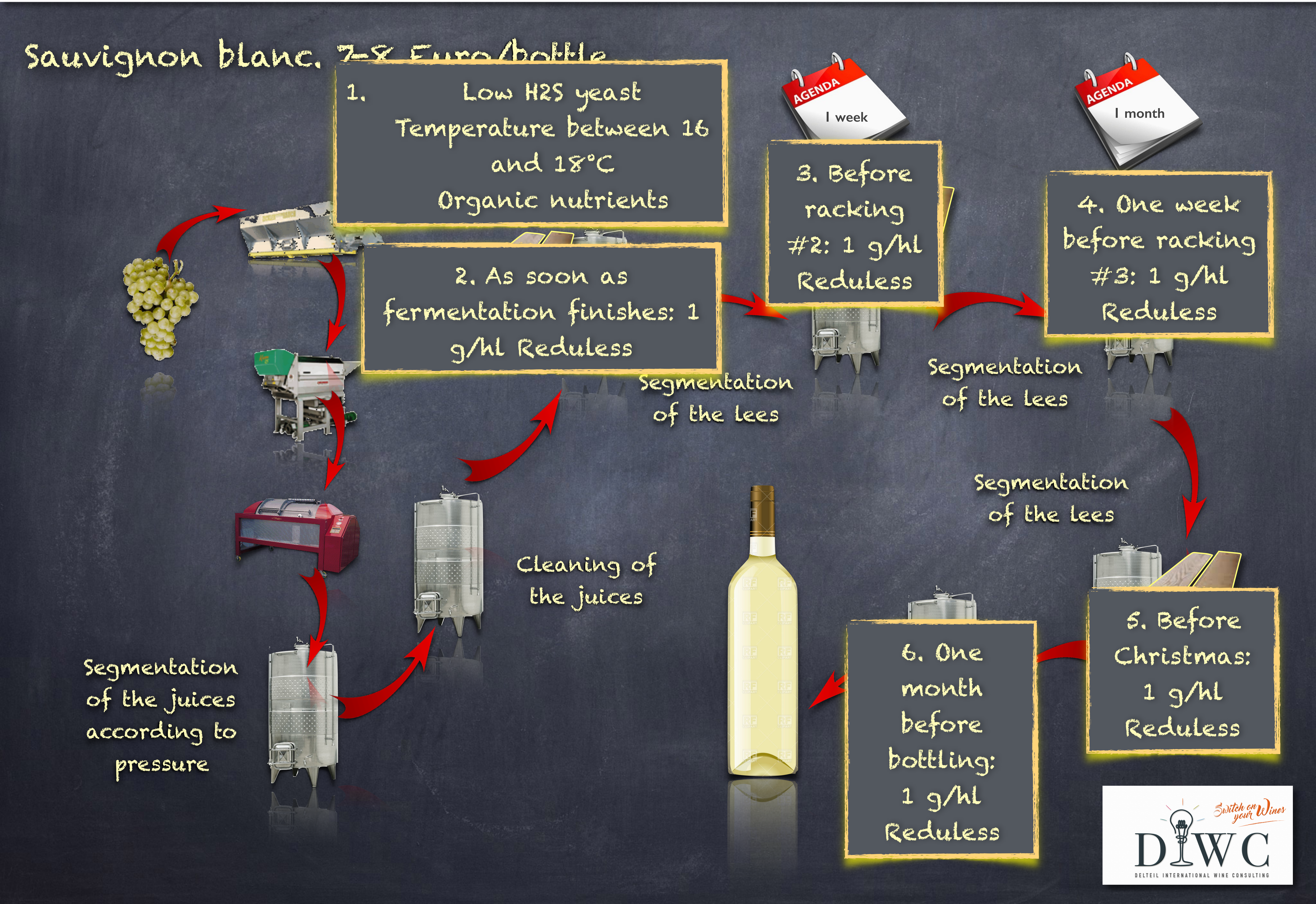
Sauvignon blanc. 7-8 Euro/bottle



Avoid excess of unstable sulfur compounds

- Non integrated sulfur compounds are very aggressive on the nose and on the palate
- They are the main cause of Atypical Aging

Reduless good practices: Specific Inactivated Yeast with chelated copper that does not go into solution into the wine



Sauvignon blanc. 7-8 Euro/bottle
1. Low H2S yeast
Temperature between 16 and 18°C
Organic nutrients
2. As soon as fermentation finishes: 1 g/hl Reduless
AGENDA
I week
3. Before racking #2: 1 g/hl Reduless
AGENDA
I month
4. One week before racking #3: 1 g/hl Reduless
Segmentation of the lees
Segmentation of the lees
Segmentation of the lees
Cleaning of the juices
Segmentation of the juices according to pressure
5. Before Christmas: 1 g/hl Reduless
6. One month before bottling: 1 g/hl Reduless
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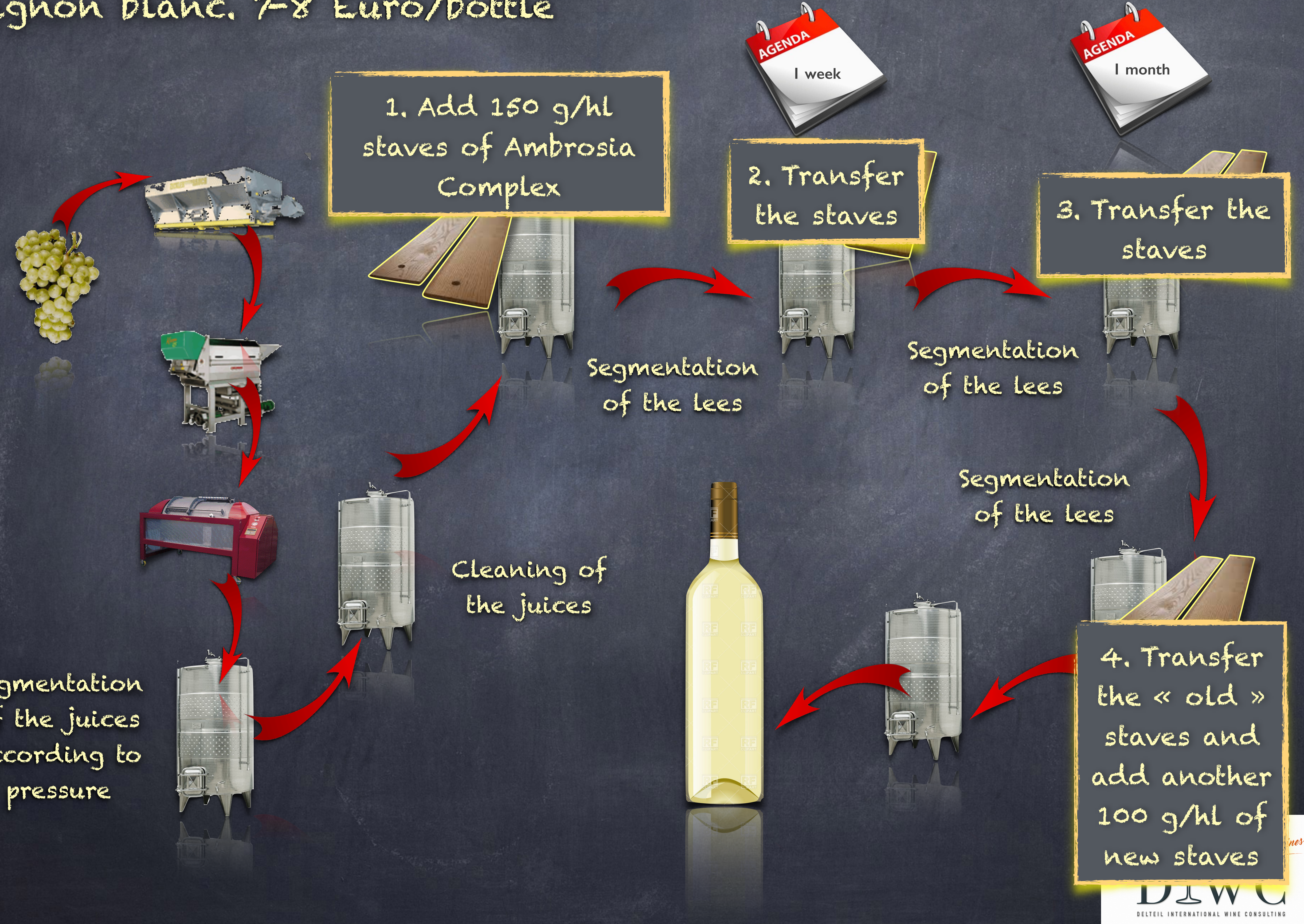
Avoid excess of unstable herbaceous and sulfur compounds
Stabilize the varietal fruity aromas

- Use the oak sponge effect
- Avoid excess of vanilla aromas and tannins that work against fresh mineral Sauvignon style: avoid short matured oak, avoid non-toasted oak, avoid American oak, avoid small oak fragments (difficult to manage intense extractions versus sponge effect)

Staves good practices to make a fruity mineral Sauvignon

Sauvignon blanc. 7-8 Euro/bottle



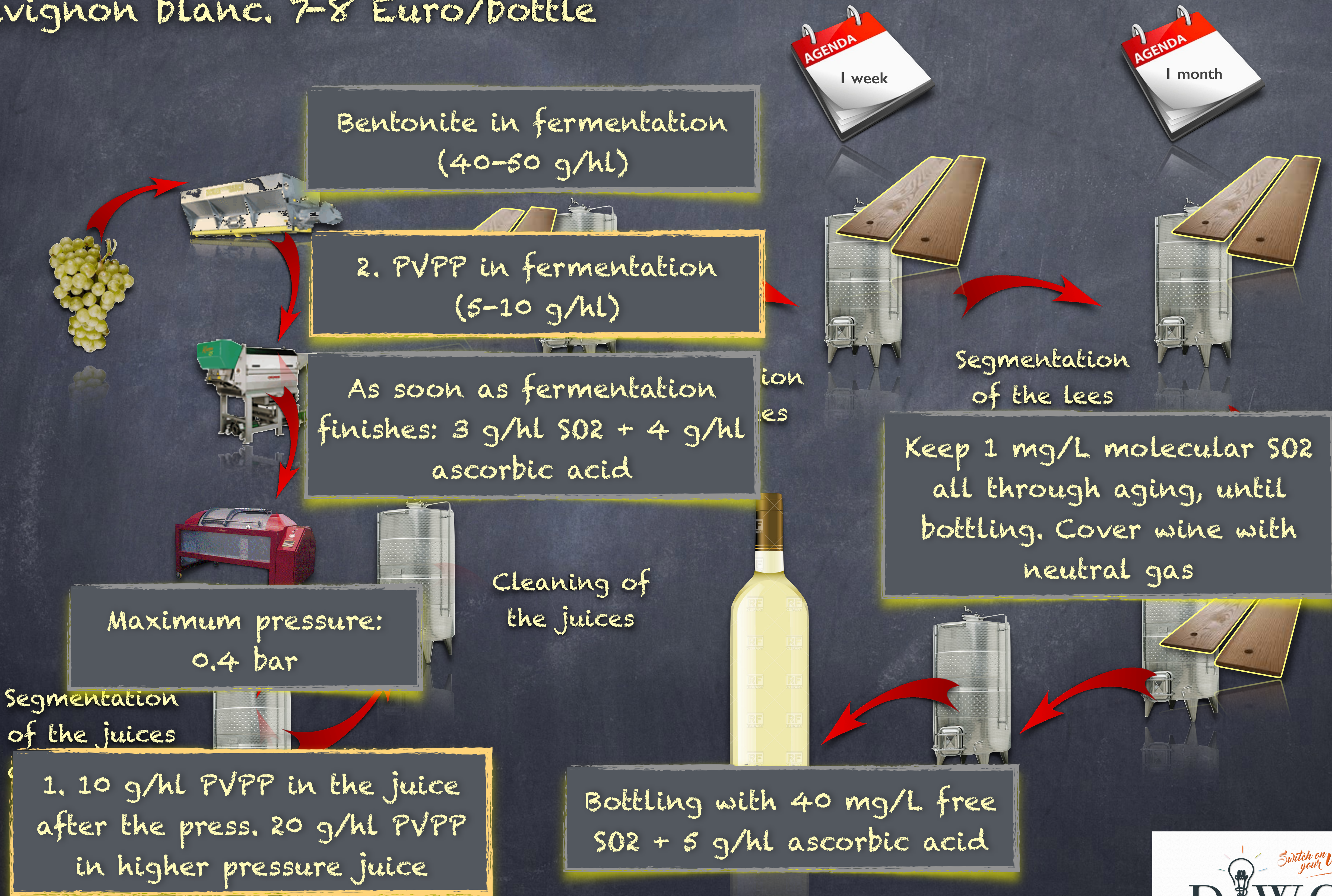
Avoid pinking

- Coming from excess of uncolored tannins that come with catechins
- Those tannins turn pink when they oxidize

So:

1. Avoid excess of extraction of catechins and tannins
2. Eliminate possible excess of tannins with PVPP after the press and in fermentation
2. Avoid oxidation until the consumer's glass. Ascorbic acid is Number One anti-pinking agent

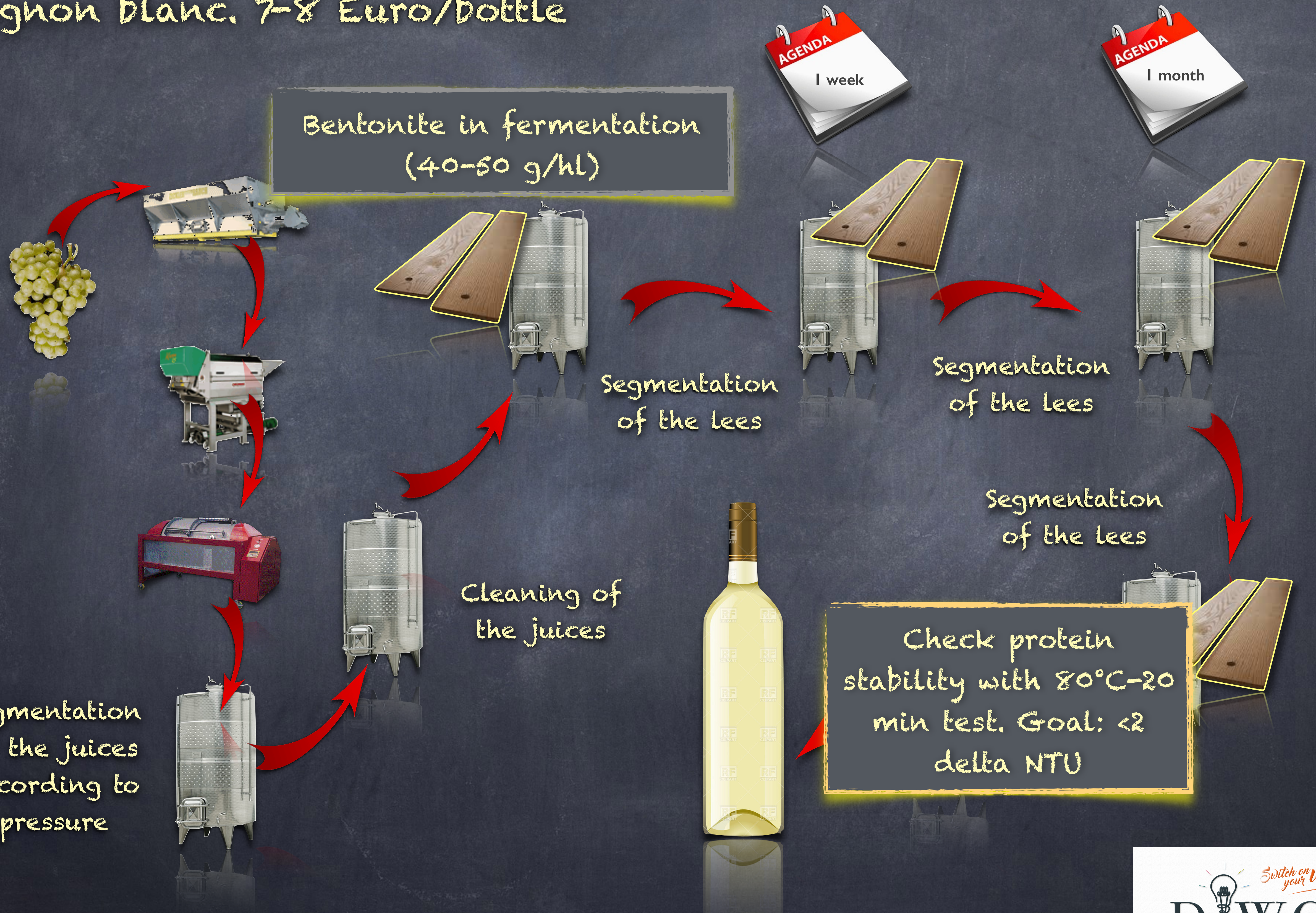
Sauvignon blanc. 7-8 Euro/bottle



Build protein stability

- Unstable white wine proteins are grape proteins
- Produced by grape as stress defense proteins
- So they are very stable and only eliminated by bentonite, not by tannins
- Bentonite is far more efficient in the fermenting juice, than in finished wine
- The most accurate test to evaluate protein stability is the « 80°C - 20 minutes » test

Sauvignon blanc. 7-8 Euro/bottle



Avoid tartrate crystals precipitation in bottle

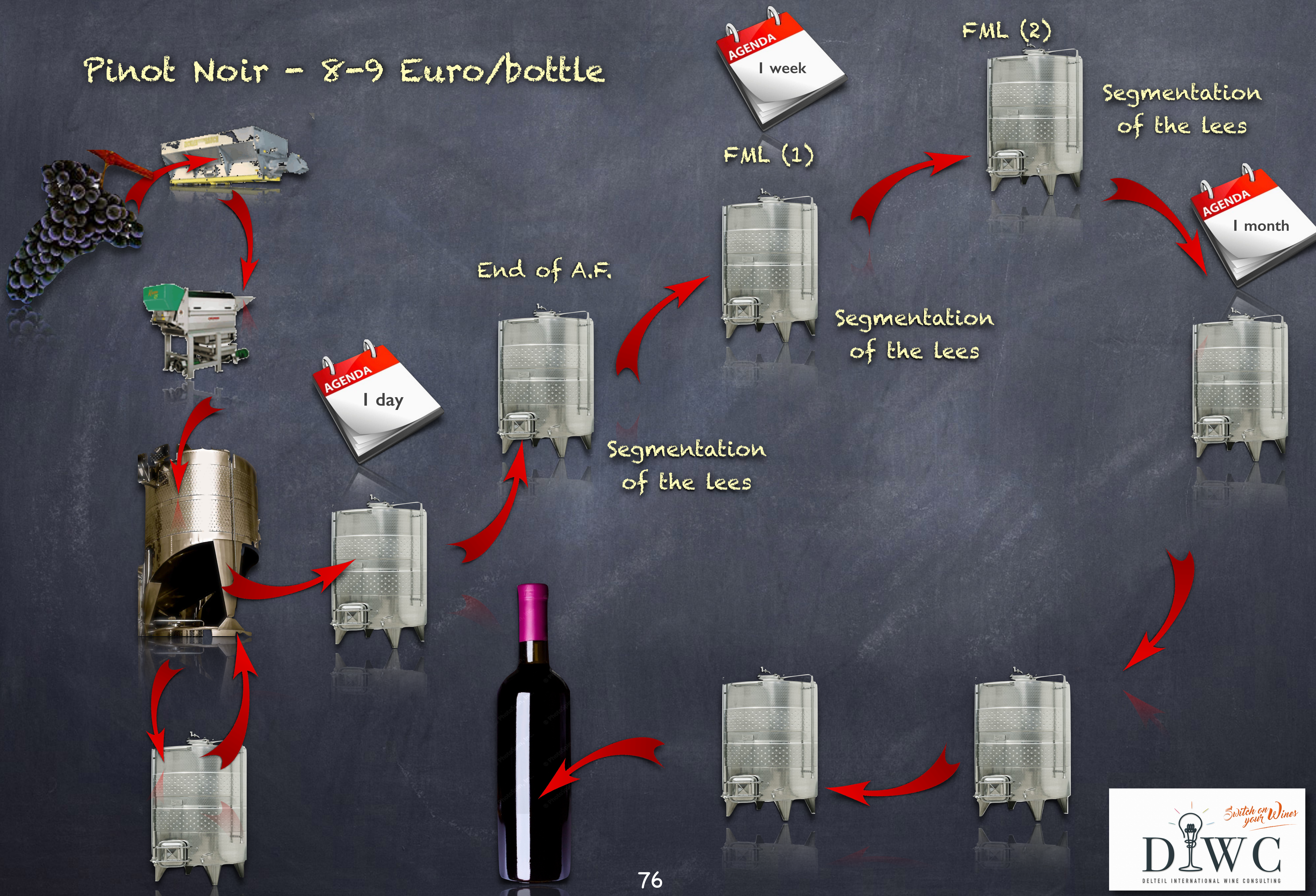
- If you don't de-acidify with calcium carbonate, the only potential precipitation is potassium bi-tartrate
- pH ajustement with tartaric acid or ion exchange resin helps in stabilizing the wine by early elimination of potassium excess
- In white wines, CMC is efficient when added before bottling

Microbial stability

- Avoid development of indigenous yeast and bacteria during harvest and pre-fermentation step: hygiene of equipment
- Avoid development of indigenous yeast and bacteria during fermentation: selected yeast direct inoculation as soon as the juice is clarified: see fermentation slide
- Avoid development of indigenous yeast and bacteria during aging: the right SO2 addition and the right molecular level against oxydation are far enough to ensure a good microbial stability: see anti-oxidation slide

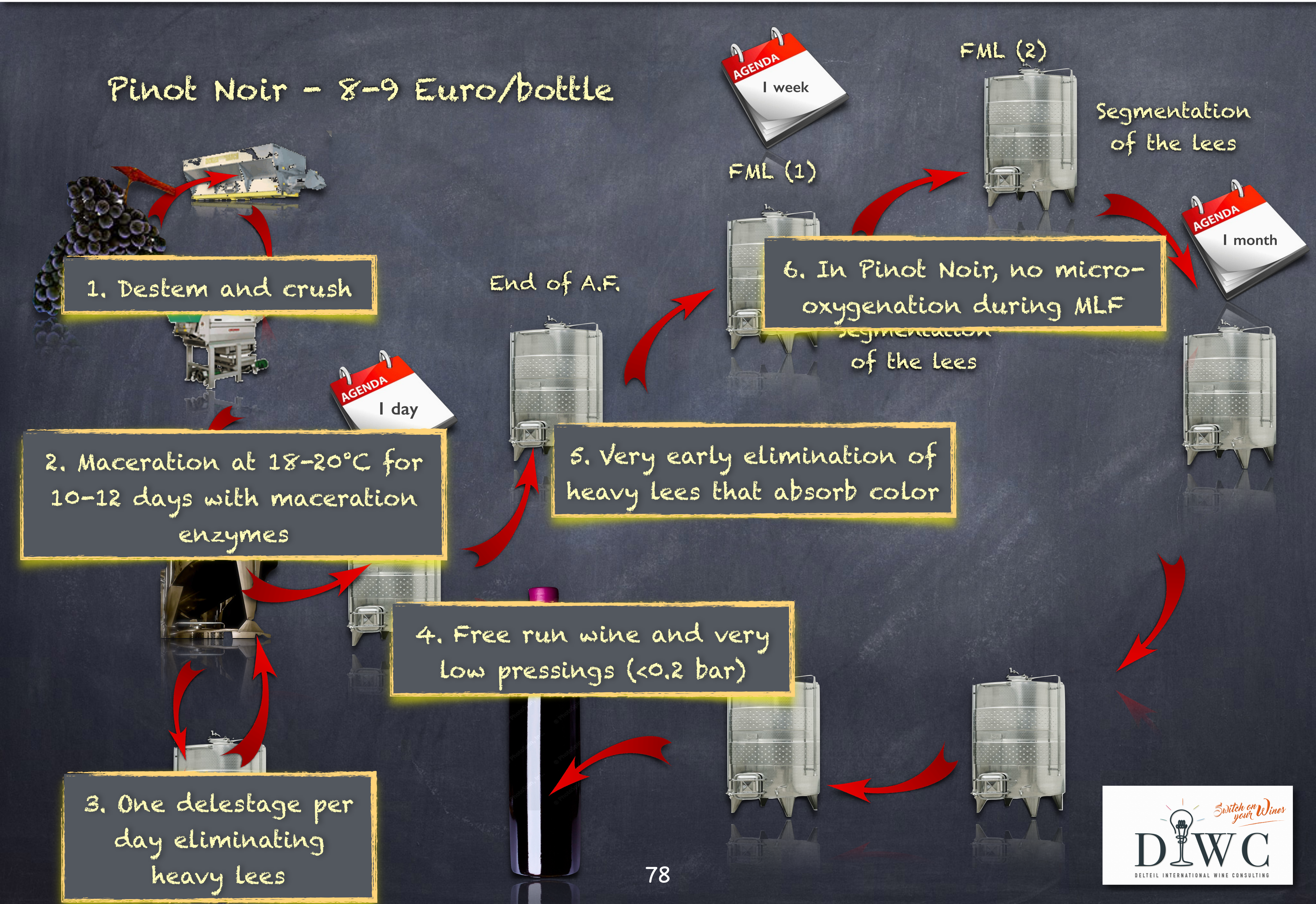
Red wines

Pinot Noir - 8-9 Euro/bottle



Build the colloidal matrix with grape colloids, pigments and tannins

- Without too much aggressive tannins extraction


Pinot Noir - 8-9 Euro/bottle
1. Destem and crush
AGENDA
1 day
2. Maceration at 18-20°C for 10-12 days with maceration enzymes
3. One delestage per day eliminating heavy lees
4. Free run wine and very low pressings (<0.2 bar)
End of A.F.
5. Very early elimination of heavy lees that absorb color
AGENDA
1 week
FML (1)
of the lees
FML (2)
Segmentation of the lees
6. In Pinot Noir, no micro-oxygenation during MLF
AGENDA
1 month
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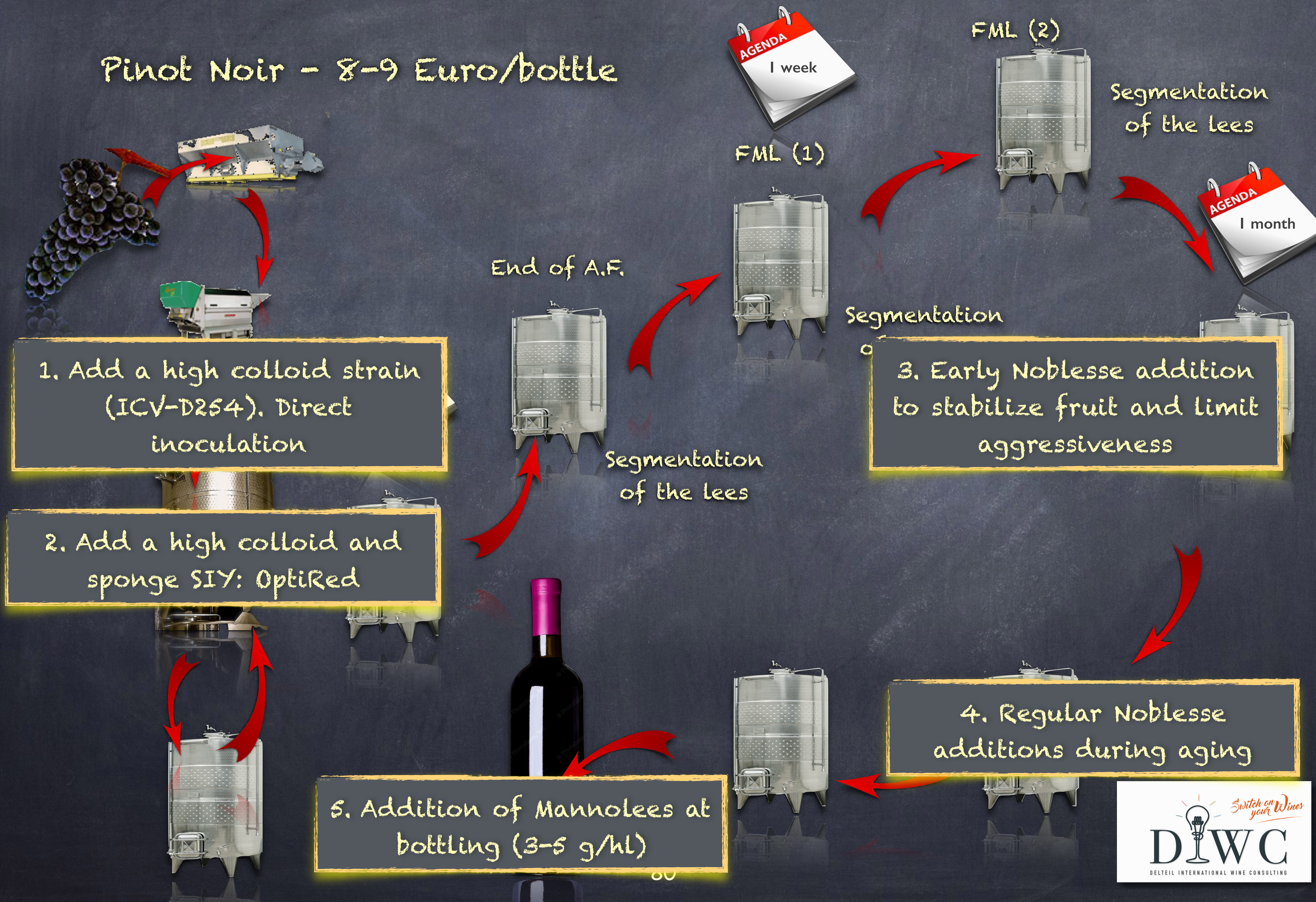
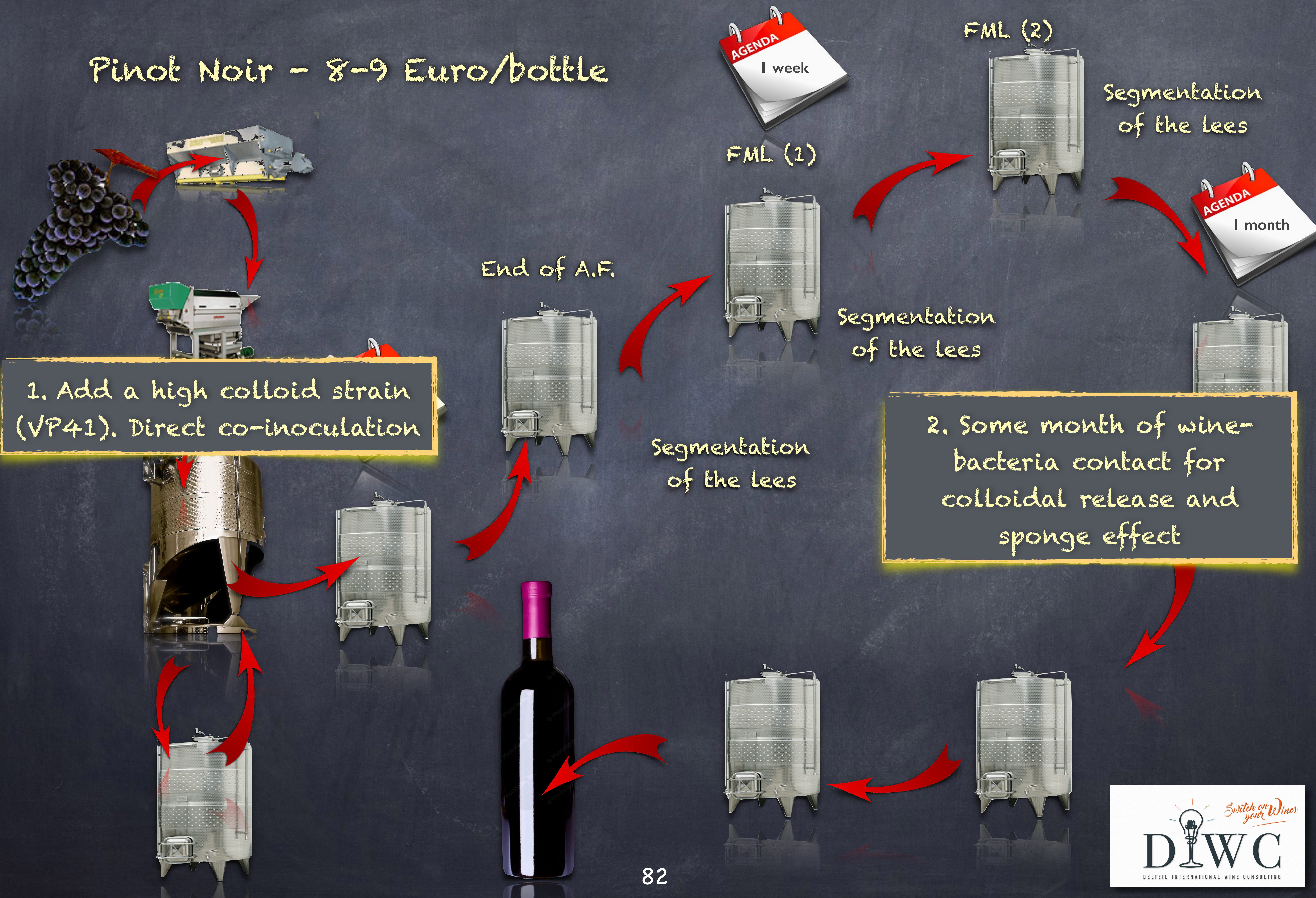
Stabilize the grape colloidal/pigment/tannin matrix with yeast

Pinot Noir - 8-9 Euro/bottle



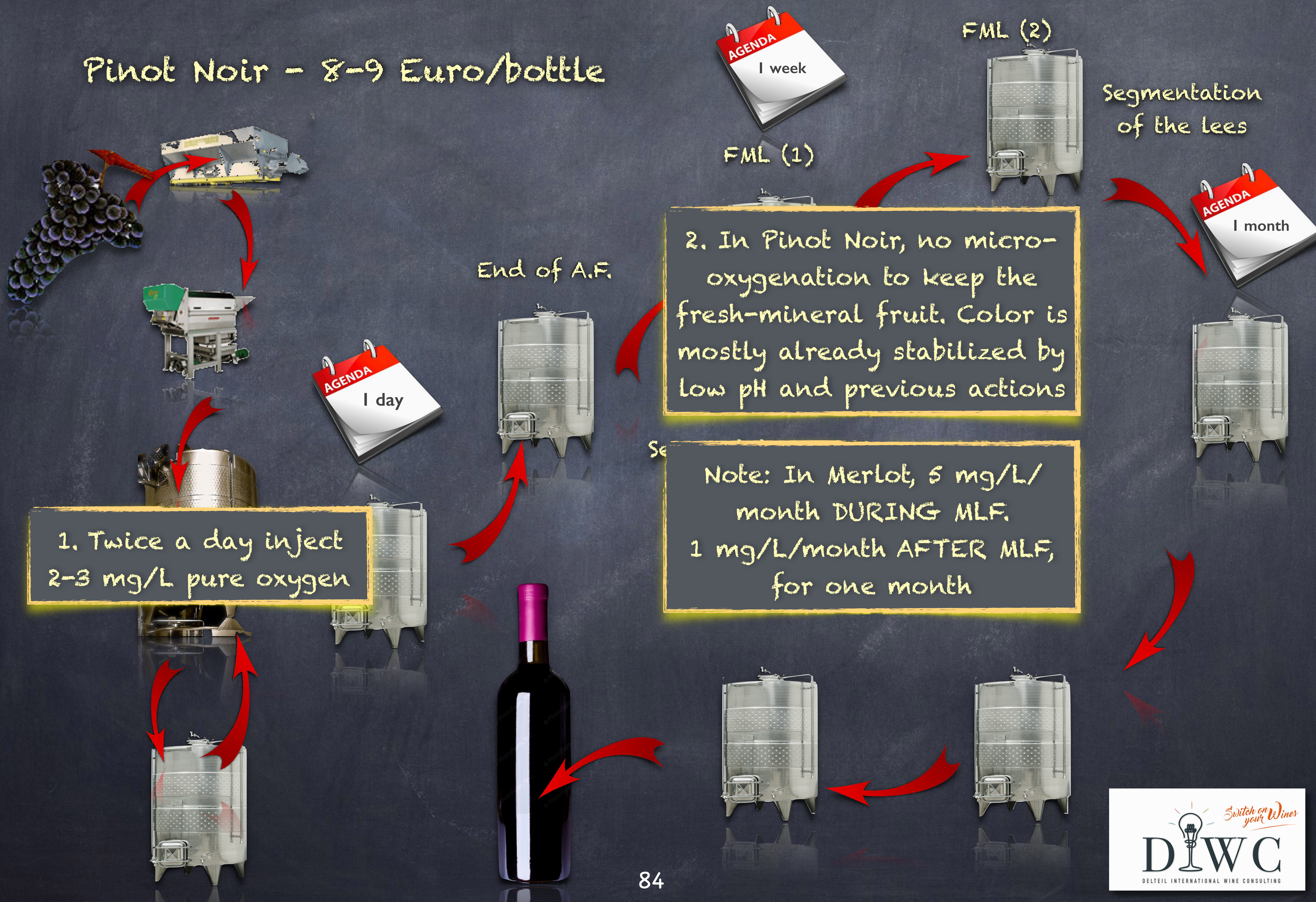
Stabilize the grape colloidal/ pigment/tannin matrix with lactic acid bacteria

Pinot Noir - 8-9 Euro/bottle

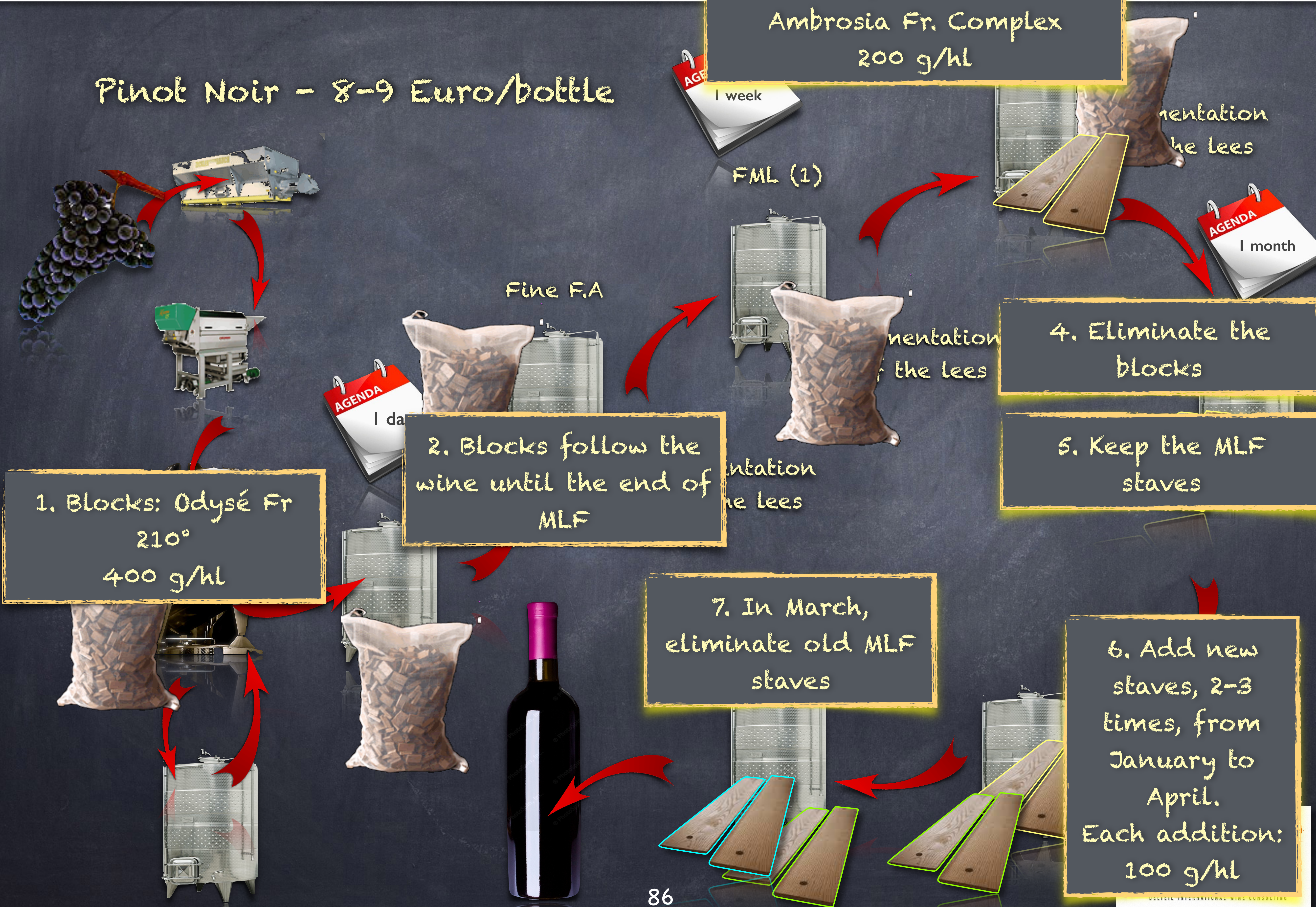


Stabilize the grape colloidal/pigment/tannin matrix with oxygen

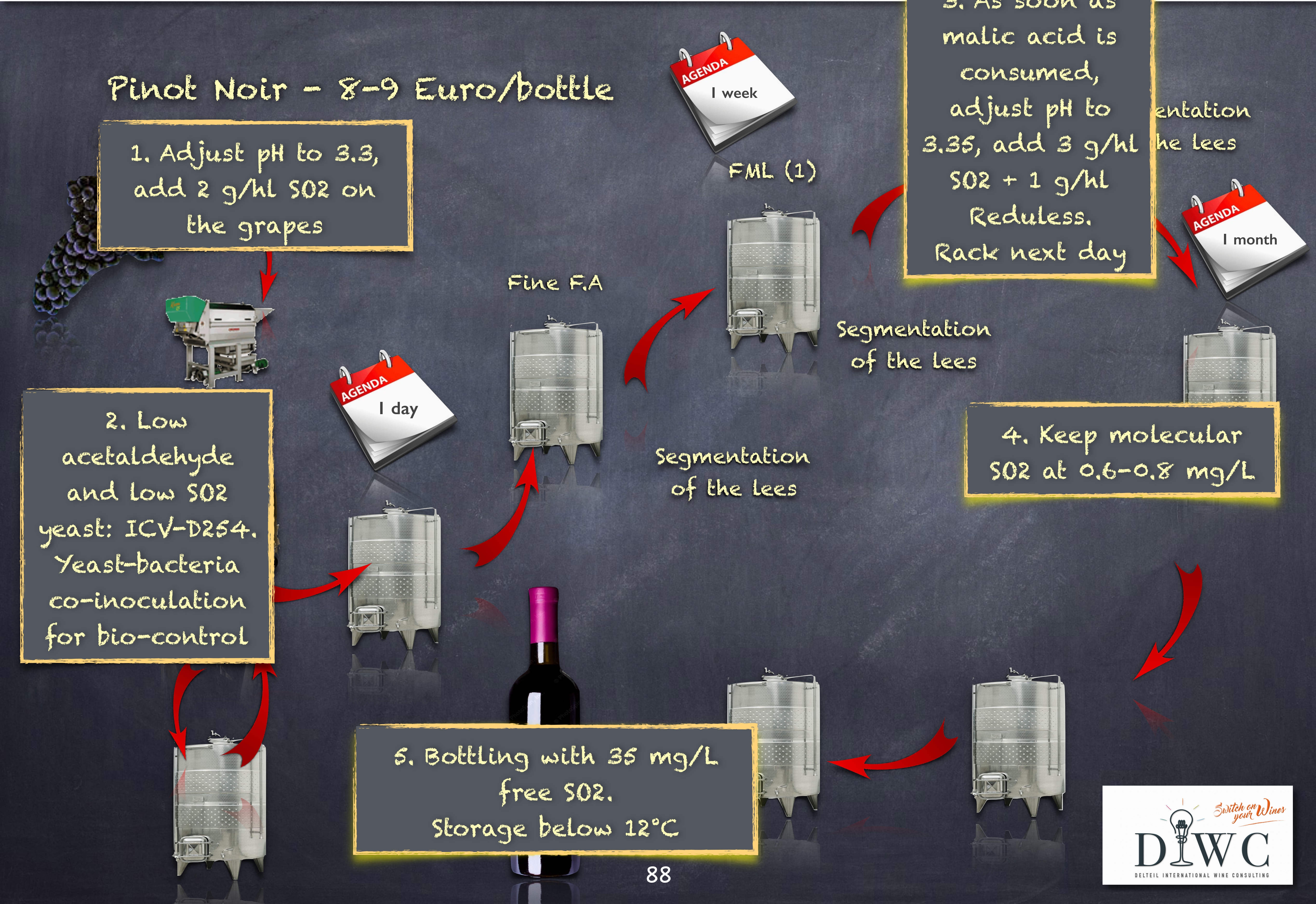
Pinot Noir - 8-9 Euro/bottle



Stabilize the grape colloidal/pigment/ tannin matrix with oak


Pinot Noir - 8-9 Euro/bottle
1. Blocks: Odysé Fr
210°
400 g/hl
AGENDA
2. Blocks follow the wine until the end of MLF
Fine F.A
1 week
FML (1)
3. For MLF, add new staves.
Ambrosia Fr. Complex
200 g/hl
AGENDA
1 month
4. Eliminate the blocks
5. Keep the MLF staves
6. Add new staves, 2-3 times, from January to April.
Each addition:
100 g/hl
7. In March, eliminate old MLF staves

Stabilize the colloidal matrix, prevent oxidation and microbial spoilage with SO2 good practices


Pinot Noir - 8-9 Euro/bottle
1. Adjust pH to 3.3, add 2 g/hl SO2 on the grapes
2. Low acetaldehyde and low SO2 yeast: ICV-D254. Yeast-bacteria co-inoculation for bio-control
AGENDA
I day
Fine F.A
Segmentation of the lees
AGENDA
I week
FML (1)
Segmentation of the lees
3. As soon as malic acid is consumed, adjust pH to 3.35, add 3 g/hl SO2 + 1 g/hl Reduless. Rack next day
AGENDA
I month
4. Keep molecular SO2 at 0.6-0.8 mg/L
5. Bottling with 35 mg/L free SO2. Storage below 12°C
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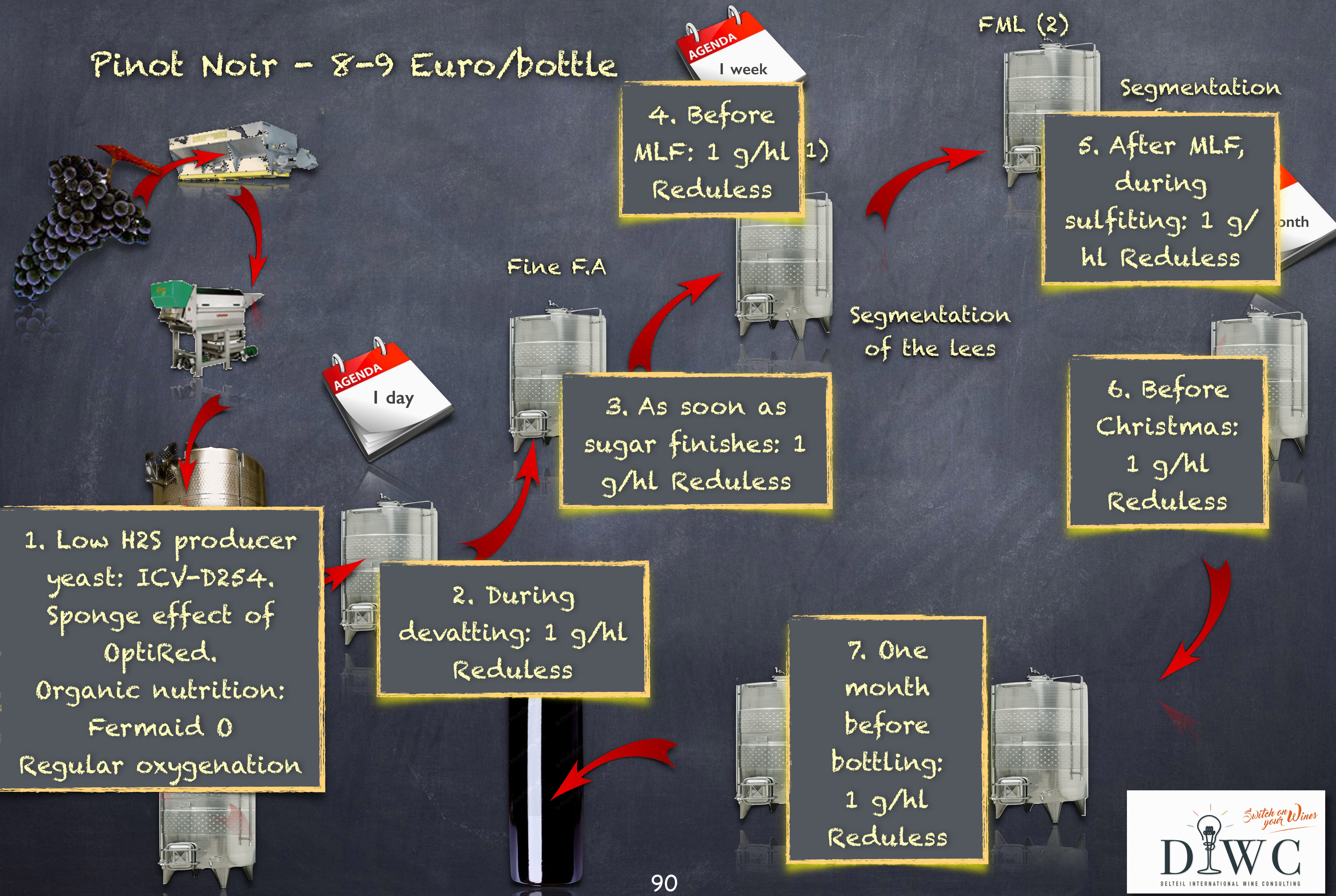
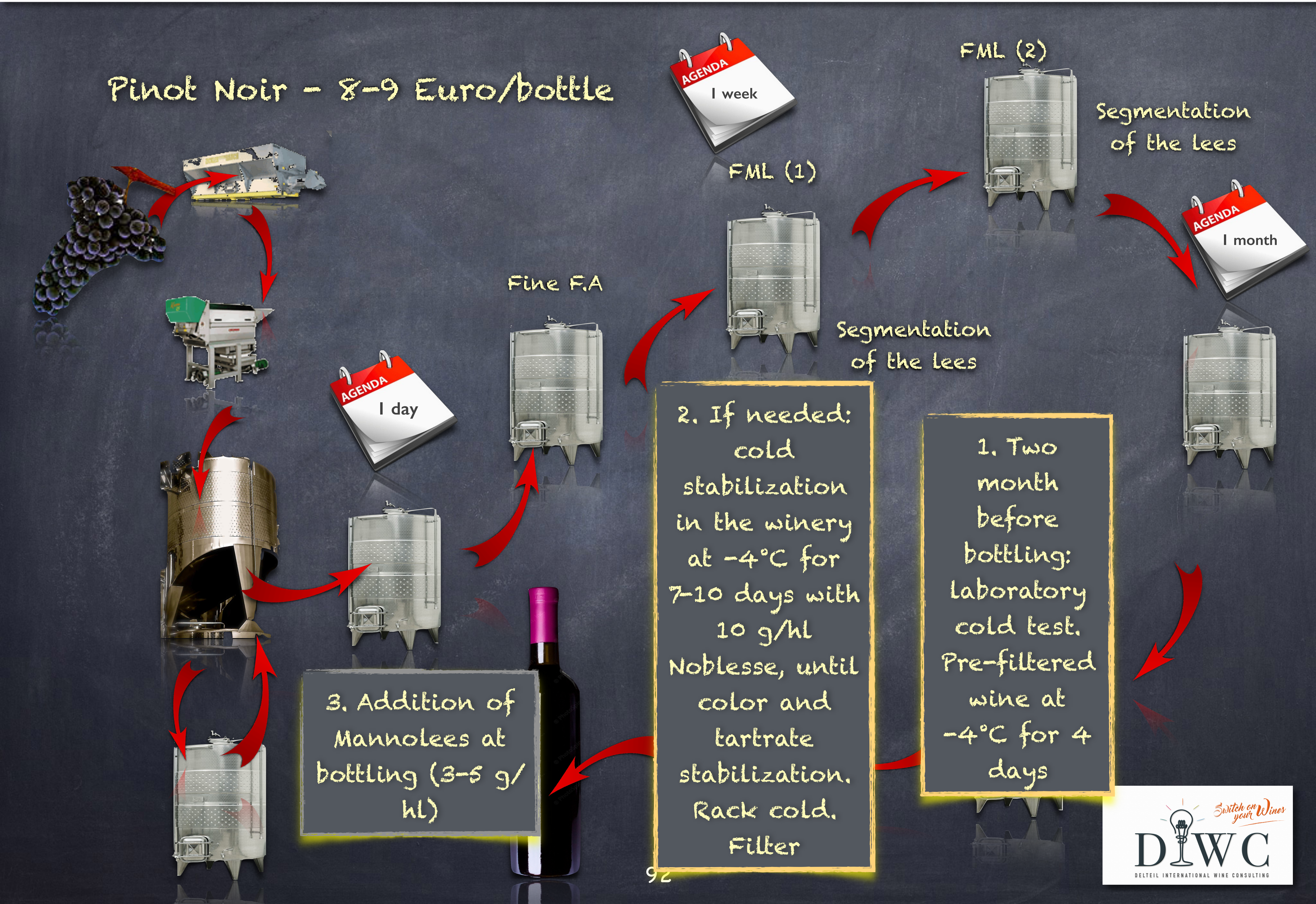
Prevent sulfur-off flavors: they bring dirty aromas and metallic bitterness and push hard aggressive tannins

Pinot Noir – 8-9 Euro/bottle



Pre-bottling color and tartrate stabilization to avoid deposit in the bottle… if needed

Until now we talked about general color, fruit and balance stabilization


Pinot Noir - 8-9 Euro/bottle
AGENDA
1 week
FML (2)
Segmentation of the lees
FML (1)
AGENDA
1 month
Fine F.A
Segmentation of the lees
AGENDA
1 day
2. If needed: cold stabilization in the winery at -4°C for 7-10 days with 10 g/hl Noblesse, until color and tartrate stabilization. Rack cold. Filter
1. Two month before bottling: laboratory cold test. Pre-filtered wine at -4°C for 4 days
3. Addition of Mannolees at bottling (3-5 g/hl)
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