Wine Finishing: Testing and achieving protein and tartrate stability in wine

A note on clarity and increasing juice yield

2016 WIGA Conference
April 7-9th

OVERVIEW

Wine Stability – Why are we actually stabilizing?

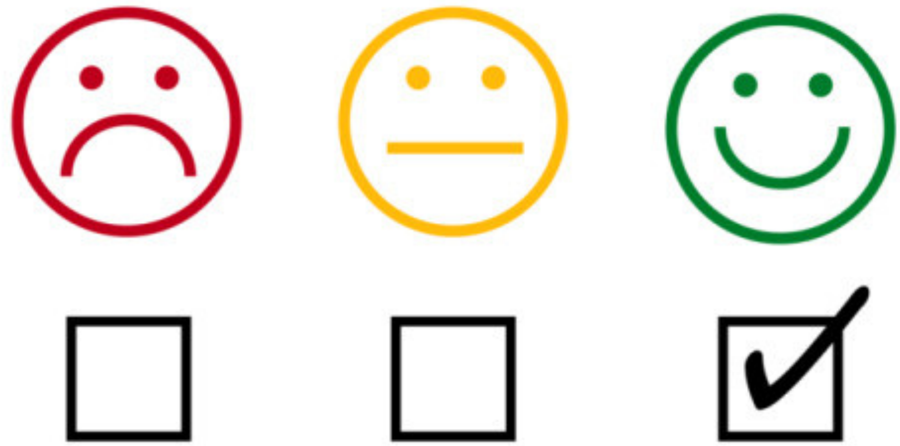
Protein Stability
- Factor affecting protein stability
- Latest products/methods
- Best practices

Tartrate Stability
- Factors affecting tartrate stability
- Latest products/methods
- Best practices

Juice clarity and Increasing Yield

Questions?

WINE STAB



Negative consumer perception of wine with haze/tartrates

Increased labour cost   Lost revenue   Consumer loyalty

Wine quality and sensory expression

Impression of quality

Protection during aging/transport

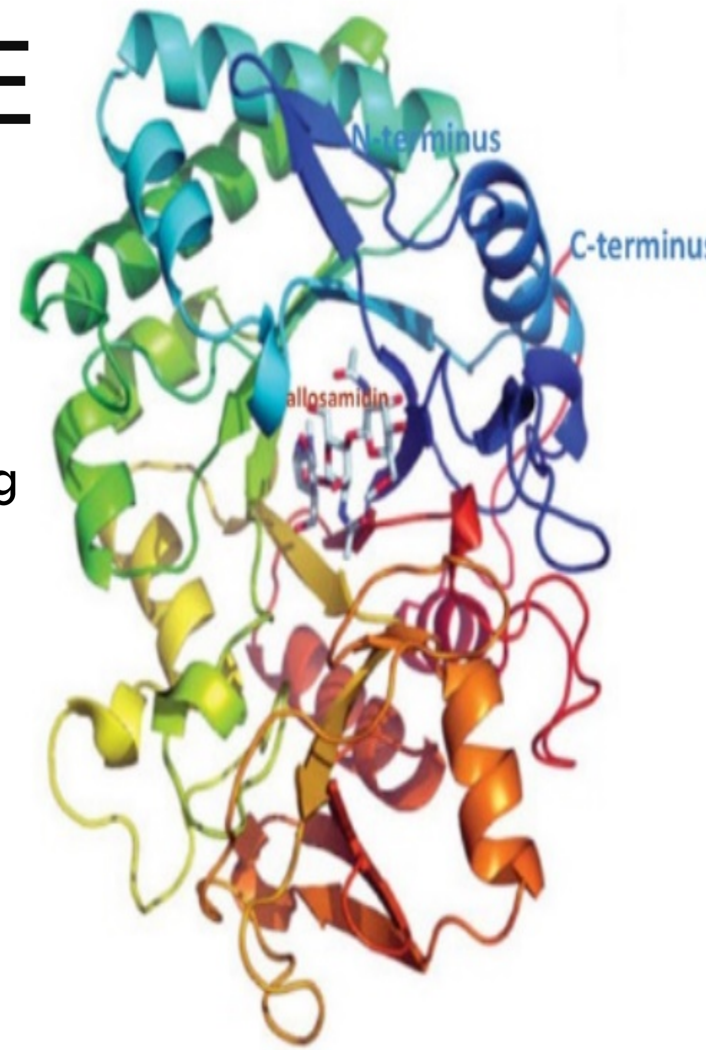
PROTEIN STABILITY

PROTEIN IN WINE

Derived from
- Grape berry constituents (skin, pulp)
- Microorganism metabolism

Depends on variety, maturity, climate, processing
- High protein varietals
  - Gew, vio, pinot gris, ortega
- Hot vintages increase protein content
  - Increase production of protein in the skin
- Processing practices can increase protein

Practices that increase protein in juice:
- Prolonged skin contact
- Sulfur additions during skin contact
- Crushing/destemming before pressing
- Pressing practices



PROTEINS IN GRAPES

predominant proteins in ripe grape pulp and skins are

- pathogenesis-related proteins
- Stress response and pre-emptive protection

Involved in fungal defence and stress

response for the berries

Insoluble, resist hydrolysis, heat sensitive

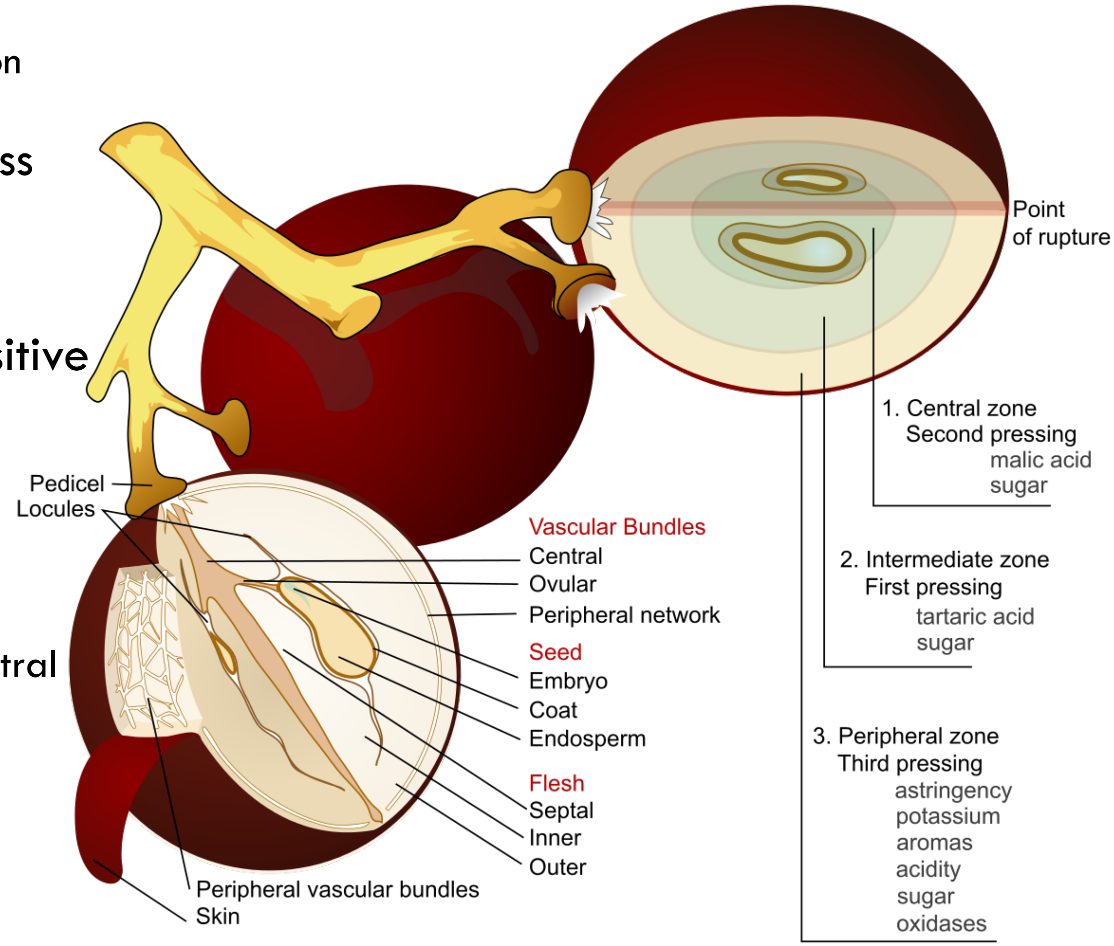
Implicated in haze formation

+ or – charge depending on pH

- Mostly + at wine pH
- High pH wines move proteins closer to neutral

Removed through Bentonite fining

- Possible alternatives:
- tannin, mannoproteins



BENTONITE

Montmorillonite clay

- Net negative charge
- Very large surface area
- Rapid action upon addition
- Little to no sensory impact on final wine
  - Contrary to popular belief most modern studies show no negative impacts
  - Taste trial before heating

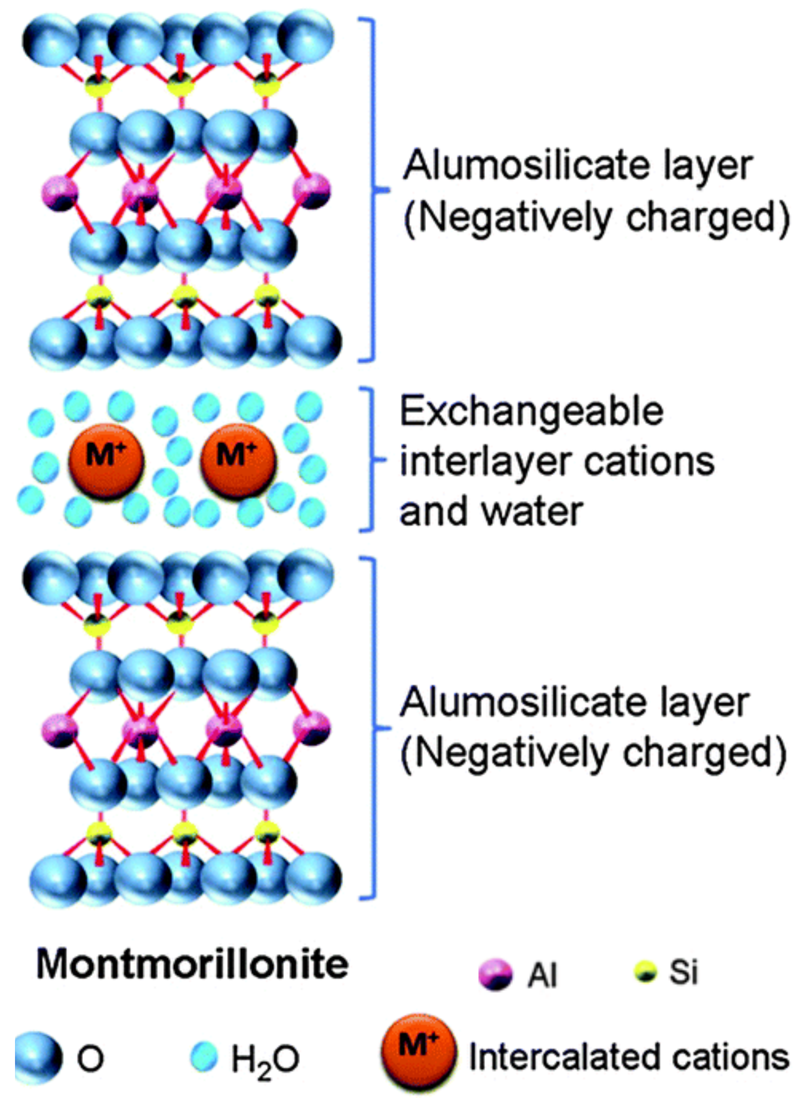
Adsorbs and expands

ADSORPTION

- Proteins adhere to the clay surface
- cation exchange capacity (CEC) Na^+ or Ca^{2+}

ABSORPTION

- Proteins integrate into clay particles and flocculate



PROTEIN FINING

Calcium Bentonite

Lower hydration/swelling capacity
- Ca^{2+} repels water

Less surface area

Settle quickly

More compact settling

Less effective at protein removal

Sodium Bentonite

Higher hydration/swelling capacity

Higher adsorption capacity

More surface area

Flocculates well

Settle slower

Less compact settling

TESTING PROTEIN STABILITY

Bentotest/TCA/ETOH/NH4 Sulfate

Precipitate all proteins

Chemically flocculate proteins

Overestimate bentonite requirement

Heat test $80^{0}C$ for 2-6hrs

Precipitate heat sensitive proteins

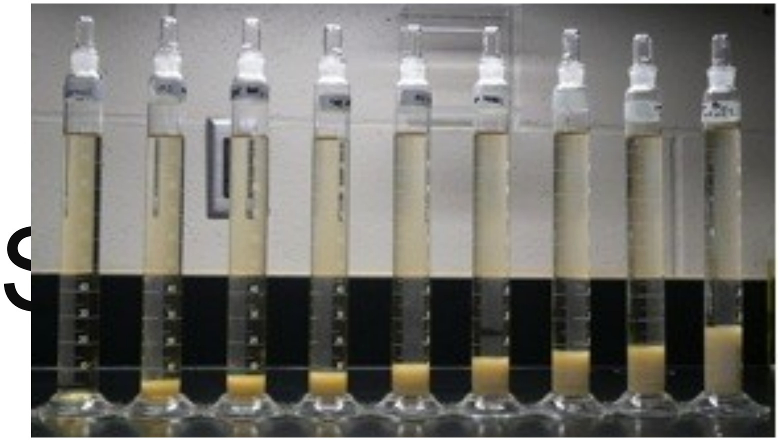
Physically flocculate proteins

Represents most accurate protein levels/ bentonite requirements

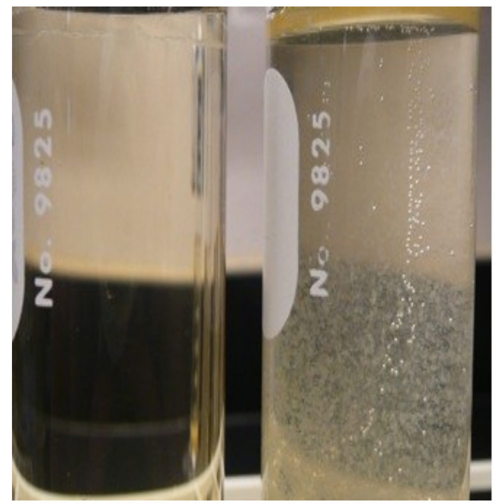
MIMIC PRODUCTION !

- Sample wine to be treated
- Same bentonite, rehydration and water
- Mix/contact time similar to production
- Settle then filter prior to testing

HEAT TEST
$80^{0}C$ @ 6HOURS



1. Prepare 5% (5g in 100ml) bentonite solution in warm water, let swell 3-4 hrs
2. Dose samples ranging from 0g/L to 4.0g/L depending on wine
   - 0.2g/L bentonite (0.4mL 5% bentonite in 100mL wine)
   - 0.4g/L bentonite (0.8mL 5% bentonite in 100mL wine)…
3. Mix and let settle overnight
4. Sterile filter samples and test NTU's (if possible)
5. Place sealed test tubes/jars in 80 degree water bath for 6 hours
6. Remove after 6 hours and leave overnight or cool to room temp
7. Assess turbidity at room temperature the following day
8. Change in NTU pre to post heating <2 indicates protein stable dose
9. Visual assessment possible in dark room with flashlight – least refractive sample is most stable



MOST IMPORTANT FACTOR IS TO BE CONSISTENT

VISUAL OBSERVATION OF PROTEIN

BEST PRACTICES - PROTEIN STABILITY

Limit skin contact

Whole bunch press when possible

Lighter pressing/press fractioning

Barrel/tank aging on fine lees

Proper stability tests (80 degrees, 6 hours recommended)

Bentonite only once wine is racked off lees and final blend achieved (stable pH)

pH and phenol changes in wine can impact protein stability

Consider treating juice with gallic tannins/ bentonite/protease enzymes

At the moment, Bentonite remains the only effective protein removal method to control protein haze in wine

TARTRATE STABILITY

TARTRATES IN W

Tartaric acid is main acid component in grapes

- Unique to grapevines
- Relatively strong acid

At wine pH tartaric acid forms both potassium and calcium tartrate salts in solution

- Potassium bi tartrate (KHT) most common tartrate salt formed
- Naturally high potassium levels in wine create a supersaturated solution with tartaric acid
- KHT salts strongly insoluble at low temperatures and in high alcohols

Factors that effect tartrate stability:

- Grape ripeness/acid content
- Lees aging increases stability
- De-acidification techniques
- Clarity of wine

TARTRATE STABILITY

Known as the wine's ability to resist the precipitation of tartrates

- Currently and potentially

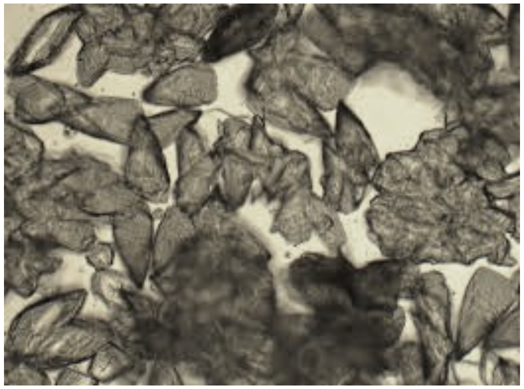
Low consumer tolerance for crystals/tartrates in wine

Negative impact in sparkling wines if tartrate crystals form

- lead to the formation of too many bubbles when the bottle is opened
- causing excessive effervescence known as 'spraying

Stabilized through removal or inhibition

- Traditional cold stabilization
- Mannoproteins
- Carboxymethylcellulose (CMC)
- Ion exchange
- Membrane processes such as electrodialysis (ED)



TESTING TARTRATE STABILITY

Refrigerator/Freeze Test

100ml wine at 0-4^{0}C for 4-6 days

Inspect for crystals

Simple/practical but unreliable and time consuming

DIT Test

-4° C for 4 hours and reports a percentage change in conductivity. If less than 5% considered stable
Performed with the Stabilab automated instrument

Mini Contact Test

Seed a wine sample with 10 g/l of cream of tartar and measure the drop in conductivity at 0◦C.

If, in the 5–10 min after seeding, the drop in conductivity is no more than 5%

If the drop in conductivity is over 5%, the wine is considered unstable.

Performed with a conductivity meter

MIMIC PRODUCTION

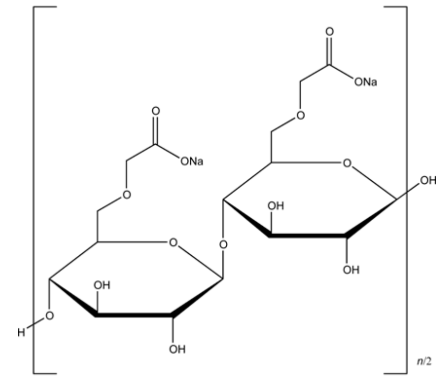
- Sample wine to be treated
- Same conditions achieved in winery

TRADITIONAL COLD STABILIZATION

1. Make bentonite/fining additions and blends prior to cooling
2. Ensure wine is clean and clear
3. Cool to below 0^0 for at least 2 weeks
4. Test tartrate stability, crystal seed if necessary
   - Cream of tartar (30-40g/HL) while agitating wine for 1hour. Wine must be racked if seeding
5. Filter wine with filter apparatus of choice WHILE WINE IS STILL COLD
6. If additional blending takes place tartrate stability may be affected

MOST IMPORTANT FACTOR IS TO BE CONSISTENT

CMC – CARBOXYMETHYL CELLULOSE



cellulose polymer of vegetal origin

Its action results in an inhibition of microcrystal nucleation and growth phases (via disorganisation of the surface of the crystal, which arrests crystal formation

competes with other ions present in wine to bond on the surface of crystals which slows their growth (nucleation), reduce their size and consequently the appearance of precipitates in the bottle

Added 48 hours before final filtration/bottling. Last addition before bottling

Wine must be clear, protein stable and not treated with lysozyme

Dosage: 1ml/L celstab = 100ppm CMC

there is a strong risk of CELSTAB® interaction with colouring matter in red and rose wine that can lead to the formation of haze and/or a precipitate

MANNOPROTEINS

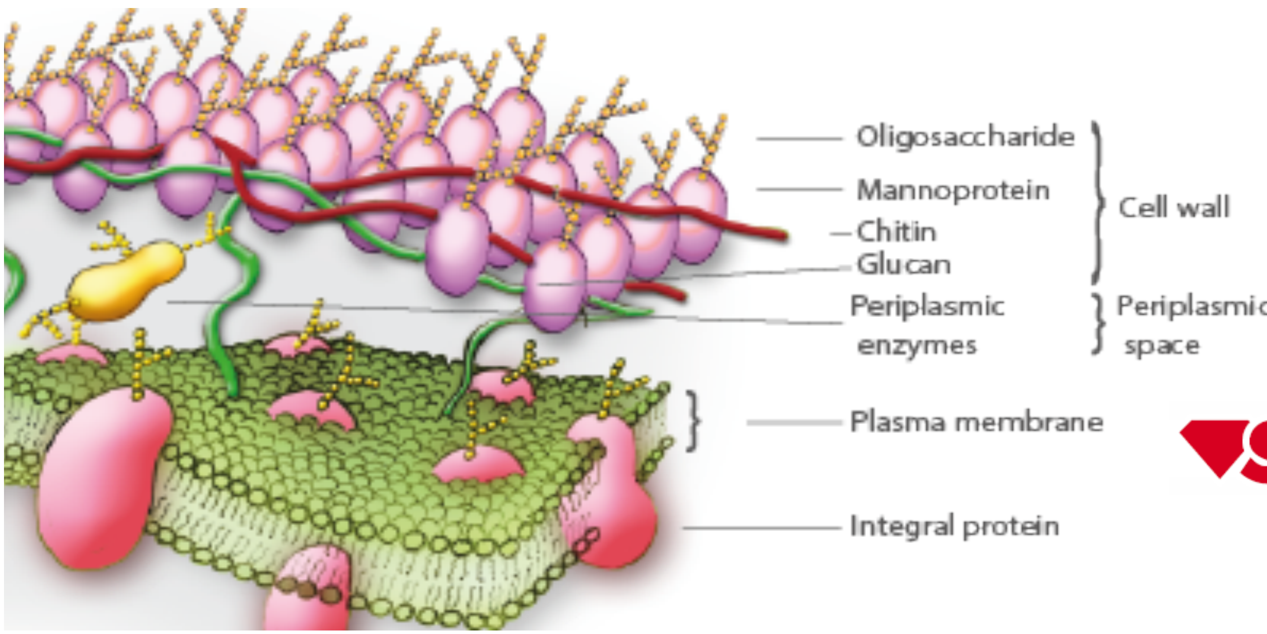
Macromolecules naturally present in yeast cell walls that act as protective colloids

Inhibits crystallization by coating the nuclei site

stable and have a durable protective effect on tartrate crystallization

Common dose 10-40g/HL determined by bench trials. Over adding reduces effectiveness

Added between pre filtration and bottling, at least 24hrs before bottling



MANNOSTAB®
BREVET N° 2726284

SUPER-MANN

BEST PRACTICES - TARTRATE STABILITY

Precipitation is enhanced by wine clarity – bento before cold stab

Shorten cooling time by adding 30–40 g/hl of small tartrate crystals and agitating for 24 hours.

Oxygen dissolves more at cool temps so careful with oxidative procedures

Filter at cold stab temperature to ensure stability

CMC/Mannoproteins are a cost effective, efficient alternative to traditional cold stabilization

Bench trials must be run to determine effectiveness

JUICE CLARITY AND INCREASING YIELDS

- Enzymes specialized in:
  - increasing free run juice yield
  - increasing press yield (especially hard to press varieties)
  - aiding in clarity/settling
- Crushing/destemming increases yield
- Optimizing pressing operations
  - Keeping hard pressings to treat and reincorporate
  - Long low pressure cycles
- Lees filtration/Juice recovery
  - RDV, cellulose fibre, resettling

**The dosage must be adapted according to the grape variety, level of ripeness, wine style as well as the sanitary state of the grapes and maceration temperature

THANK YOU!

Questions?

GELATIN + Charged proteins that interact with tannin/polyphenols/Neg charged protein

It attracts tannins which are primarily negatively charged. Once this neutralization has occurred the turbid particles tend to agglomerate which in turn causes them to settle out.
Acts on both proteins(-) and tannins. Careful not to over add and leave protein in the wine
Gelatin can also be used to preserve clarity, and improve the sensory qualities, soften the wine and balance the composition
Use before bento addition as bento will remove any excess gelatin in the wine

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