Q&A

PROTEIN STABILITY

1. What is protein instability?

Protein hazes are formed either slowly during storage or quickly on exposure to heat; they have a haze-inducing, light-dispersing effect, without sediment, or may form an amorphous deposit at the bottom of the bottle.

This instability occurs when proteins within a wine, upon exposure to heat, unfold and begin to flocculate in suspension, thereby creating a haze in wine. This is most important in white and rosé wines due to their transparent nature. Even red wines with high amounts of proteins and low concentrations of grape and oak tannins may exhibit protein instability.

Protein (heat) stabilization currently has only one solution – bentonite clay. This is negatively charged and pulls out the positively charged proteins. Since bentonite is a naturally occurring material, quality varies greatly from one site to another. **MICROCOL® ALPHA** is sourced from the highest-quality sites making it extremely effective in binding with proteins while minimally affecting aromatics and flavors.

2. How do I test for protein stability?

There are multiple effective tests available based on combinations of temperature and time. Most common in the U.S. wine industry are heating the wine to 80°C / 176°F for 2 hours or heating the wine to 60°C / 140°F for 24 hours. **LAFFORT®** recommends 80°C / 176°F for 30 minutes. Holding for 2 hours at 80°C / 176°F gives very similar results.

Measuring Heat Stability:

- Measure the wine turbidity.
- If > 2 NTU, filter the wine (cellulose ester membrane, 0.65 µm)
  #turb1
- Heat 40 mL of wine for 30 minutes at 80°C / 176°F.
- Let it cool for 45 minutes at room temperature.
- Measure the wine turbidity again.
  #turb2
- If turb2 – turb1 > 2, the wine is not stable.

Testing different levels of bentonite additions will allow you to decide on the minimum dose rate required to achieve protein stability.

3. What influences how much bentonite I need for protein stability?

The amount of bentonite needed to achieve protein stability (defined as ≤ 2 NTU after 30 minutes at 80°C / 176°F) depends on the pH of the wine, the concentration of heat-unstable proteins within the wine, the type of bentonite being used, and the quality of the bentonite. These parameters are affected by varying factors in the vineyard, in the production of bentonite, and cellar practices.

In the vineyard, heat-unstable proteins increase with grape maturity as does pH. The rise in pH makes it more difficult to remove heat unstable proteins with bentonite because the proteins will have only a slight positive charge or none at all in high pH environments. This change from positive to neutral or negative charge is due to the isoelectric point of the heat unstable proteins. In high pH wines, more bentonite may be needed to achieve protein stability. **MICROCOL® ALPHA** performs well even in high-pH wines.

Factors like vintage variation, varietal (e.g., high-protein Sauvignon Blanc and Gewürztraminer), and fruit soundness can also affect the protein-pH relationship.

Once fruit has arrived at the cellar, exposure to solvents like SO_2 can extract more proteins from the skins and pulp. Reducing SO_2 during processing through bio-protection (**ZYMAFLORE® ÉGIDE***TDMP*) and/or sacrificial tannins (**TANIN VR SUPRA®**, **TANIN GALACOOL®**) will lower protein instability downstream. Minimizing skin contact will also reduce protein extraction – if skin contact is important for wine style, expect to need more bentonite for stability.

4. Are there any interactions to avoid when using bentonite?

Only one. Do not add enzymes with bentonite. Bentonite inactivates proteins. Enzymes are proteins. If you add enzymes with bentonite, the enzymes will be deactivated.

5. When is the best time to add bentonite?

Bentonite can be added to juice and/or finished wine. Calcium bentonite, such as MICROCOL® FT is ideal for settling juice. The plate structure does not swell nearly as much as sodium bentonite, so a higher dose is required, typically twice as much. However, calcium bentonite settles more compactly than sodium bentonite, and as a rule, adding twice the amount of calcium bentonite will result in one-quarter of the volume of lees, a big improvement in processing.

Sodium bentonites like **MICROCOL® ALPHA** are gentler in wine while remaining highly effective and require lower dose rates compared to calcium bentonite. Sodium bentonite, such as **MICROCOL® ALPHA**, will always require less to achieve protein stability compared to calcium bentonite and is best used after fermentation.

6. Are there alternatives to bentonite for heat stability?

Tannins can contribute to heat stability by binding with proteins and forming a precipitate, as is normally the case in red wines with higher amounts of grape and barrel or oak alternative tannins. With white and rosé wines, small (50-100 ppm) additions of **TANIN GALALCOOL® SP** can be beneficial in reducing bentonite needs, however tannins are not desirable in whites and thus bentonite is still the only way to achieve complete heat stability.

7. What happens if the bentonite is not properly prepared?

If not properly prepared and swelled, bentonite may clump or not be fully expanded, reducing the surface area available and the effectiveness of the bentonite-protein binding. If the preparation in the cellar is not as efficient as the preparation in the lab, this may lead to under dosing and potential instability in the wine. It is important to have a protocol and train cellar staff on thorough bentonite hydration.

8. Won't bentonite strip my wine?

Bentonite can certainly remove positive aromatic compounds from a wine. This depends on the quality of the bentonite and the aromatic levels of the wine being treated. A highly aromatic wine treated with a premium bentonite is less likely to become stripped. A lower aromatic wine also benefits from premium bentonite as it needs to retain as much aroma as possible. The MICROCOL® series of bentonites are sourced from top quality sites and are known for being highly effective at protein stabilization yet gentle on aromatics.

Bench trials are highly recommended before any bentonite addition to determine the best balance of stability and aromatics.

9. What is the difference between sodium and calcium bentonite?

Bentonite, a.k.a. montmorillonite, is a hydrated aluminum silicate member of the smectite class of clays, comprised mainly of oxides of aluminum and silicon. In the substructure, occasionally aluminum is replaced with a different metal such as iron, manganese or magnesium, generating a deficiency in positive charge and the lattice takes on a net negative charge. This negative charge allows the bentonite to react with positively charged proteins in wine in an ion exchange process with the inter-laminar cations.

In many bentonites used for wine fining, the dominant cation is sodium, producing a high-swelling and high-exchange capacity, at the expense of slowly formed and diffuse lees. Other bentonites have calcium as the dominant inter-laminar cation, giving reduced swelling and exchange capacity, but allowing faster settling and vastly superior lees compaction.

With calcium bentonite, settling can be so rapid that the solution used for fining must be resuspended immediately prior to and during the addition process to ensure complete dispersion. Settling in tank can also be rapid, so that without continued and adequate mixing after addition, a below-optimal protein removal result will be obtained.