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ENARTIS NEWS
STABILIZING PROTEINS FROM THE BEGINNING

Protein stability has always been a challenge in winemaking. In the last three decades, we have observed a general increase in protein instability levels in white wines all over the world. This translates to much more bentonite being required to fully stabilize wines. This may be due to the changing climate or to modifications in vineyard management and harvesting, which trends towards higher quality rather than quantity.

The amount of bentonite needed to achieve protein stability can vary from 0.1 g/hL up to 1-3 g/L for aromatic varieties like Sauvignon Blanc. Some wines, especially those with high pH levels or those from grapes grown in warm climates, may need even higher dosages.

Though effective, bentonite fining generates different problems. First, this treatment is not selective to just proteins and can affect wine quality by stripping aromas and flavors. Secondly, bentonite fining causes wine volume losses, estimated between 3% and 5%, that represent the most significant cost of using this treatment. Finally, the disposal of spent bentonite constitutes a considerable amount of waste.

For these reasons, Enartis has outlined proactive practices winemakers can take for protein stabilization that will help maintain quality, reduce costs and increase sustainability.

TOOLS FOR ACHIEVING PROTEIN STABILITY

Bentonite

Despite the problems related to its application, bentonite fining remains the most common and effective practice for protein stabilization in the wine industry. For this reason, it is worthwhile taking a deeper look into its use.

There are several types of bentonite in the market and not all are effective for protein stability in the same way. Their enological properties and application mainly depend on the nature of the main exchangeable cation (Table 1). The presence of impurities (quartz and minerals other than montmorillonite) or big particles that can damage winery equipment (filters, membranes, pumps, centrifuges etc.) making them less suitable for the enological application.

Table 1: kinds of bentonite and their main enological properties (4 more efficient; 1 less efficient)

		Main exchangeable cation	Swelling capability	Protein removal	Clarification activity	Lees compaction
Natural Bentonites	Sodium bentonite	Sodium	💧💧💧	💧💧💧	💧💧	💧
	Calcium bentonite	Calcium	💧	💧	💧💧💧	💧💧💧
Activated bentonites*	Calcium bentonites activated by sodium carbonate	Sodium	💧💧 / 💧💧💧	💧💧💧	💧💧	💧 / 💧💧

* Activated bentonites' properties depend on the level of activation. They can have an intermediate behavior between calcium and sodium bentonite or equal or even superior to this last one.

Another criterion that should guide the choice of bentonite is tasting. For the most, winemakers tend to consider bentonite just like a tool for removing proteins, without any organoleptic effect.

The reality is that bentonite is the enological adjuvant with the highest average dose/liter (0.5–1 g/L) after oak alternatives. Bentonite does have a clear sensory impact and using one product or another can make a huge difference.

When to use bentonite?

With wines requiring the highest dosages of bentonite, the common question asked is if it is better to treat the juice or the wine? Must is richer in protein than wine, this of course reduces the effect of bentonite. Considering that one of the main costs related to the use of bentonite is wine aromatic quality downgrades, it is highly recommended to treat the juice instead of the wine. In the juice, most of aromatic compounds are present in bound form, less absorbable by bentonite. Moreover, by treating the juice, the aromatics produced during the fermentation are not removed.

Table 2: Enartis bentonite guiding table (4 more efficient; 1 less efficient

	Kind of bentonite	Physical form	Swelling capability	Protein removal	Clarification activity	Lees compaction
Bentolit Super	Calcium bentonite sodium activated	Powder	💧💧	💧💧	💧💧💧	💧💧💧
Pharmabent	Calcium bentonite sodium activated. Pharmaceutical quality	Granulated	💧💧💧💧	💧💧💧💧	💧	💧
Pluxbenton N	Natural sodium bentonite	Granulated	💧💧💧	💧💧💧	💧💧	💧💧
Pluxcompact	Calcium bentonite sodium activated	Granulated	💧	💧	💧💧💧💧	💧💧💧💧

HOW TO REDUCE BENTONITE FINING?

Even though there is no current economic and effective alternative to bentonite, the use of tannins, mannoproteins and enzymes can help to reduce its dosage and minimize all the negative effects related to its application.

Tannins

Tannins can react with proteins and make them precipitate. Among the different classes of enological tannins, the condensed tannins (extracted from grape, quebracho and other exotic wood) are the most reactive (Table 3). Additionally, gallic and ellagic tannins can be very effective for this application.

Table 3: classes of tannin and their enological effect

	Antioxidant effect	Colour stability	Aroma cleanliness	Protein removal	Metal chelation
Gallic tannin	💧💧💧	💧	💧	💧	💧💧
Ellagic tannin	💧💧💧	💧💧	💧💧💧	💧💧	💧💧💧
Condensed tannin	💧	💧💧💧	💧	💧💧💧	💧

Tannin efficacy in improving wine protein stability is far lower than bentonite. Nevertheless, small additions of tannin starting from the juice stage and continuing all long the maturation period, can help to reduce wine protein content whilst contributing antioxidant protection of colour and aroma. For improving protein stability, tannin addition at the juice stage or in fermentation is the best practice. In the early phase of vinification in fact, addition rate can be high (up to 10-15 g/hL) without any risk of altering the sensory profile of the wine. Close to bottling, only small additions, and by consequence very little effective, are possible.

Table 4: Enartis tannins that can improve protein stability during the fermentation stage

	Composition	Protein removal	Antioxidant effect	Sensory effect			
				Structure	Astringency	Softness	Aroma
EnartisTan Antibotrytis	Gallic, digallic and ellagic tannins	💧💧	💧💧💧💧💧	💧💧	💧💧	💧	Neutral
EnartisTan Arom	Gallic and digallic tannins + inactivated yeast rich of sulphur peptides	💧💧	💧💧💧💧💧	💧💧	💧💧	💧💧	Pineapple, passion fruit, grapefruit
EnartisTan Blanc	Gallic tannin	💧	💧💧💧💧💧	💧💧	💧💧	💧	Neutral
EnartisTan Citrus	Gallic and condensed tannins	💧💧💧	💧💧💧💧	💧💧	💧💧	💧💧	Citrus, white flower
EnartisTan Clar	Ellagic tannin	💧💧💧💧	💧💧💧	💧💧💧	💧💧💧	💧	Neutral, wood
EnartisTan Elegance	Condensed tannin from exotic wood and white grape skin	💧💧💧💧	💧💧💧💧	💧💧	💧	💧💧💧💧	Stonefruit, white flower
EnartisTan Skin	Condensed tannin from white grape skin	💧💧💧	💧💧💧	💧💧	💧💧	💧💧	Stonefruit, pineapple, passion fruit

Yeast mannoproteins

It is well-known that keeping dry wines on their lees results in a reduced dosage of bentonite needed before bottling. The effect can be explained due to the presence of yeast mannoproteins that are released naturally during fermentation or by autolysis during wine ageing.

As a matter of fact, mannoproteins have been shown to protect wines from protein precipitation. The mechanism of haze protection remains unclear: they may protect protein against heat denaturation or, once proteins are denatured, protect against formation of large insoluble aggregates.

In order to increase wine mannoprotein content and its beneficial effect on protein stability, yeast derivatives can be added during the fermentation stage or during wine ageing.

Table 5: yeast derivative products that can improve wine protein stability

		Composition	Antioxidant protection	Aroma enhancement	Mouthfeel improvement	Anti-ageing effect
Fermentation	**EnartisPro Arom**	Inactivated yeast rich in sulfur peptides	💧💧	💧💧💧 (more thiols)	💧	💧💧
	EnartisPro Blanco	Inactivated yeast rich in mannoproteins and sulfur peptides	💧💧	💧💧💧 (more thiols)	💧💧	💧💧
	EnartisPro FT	Inactivated yeast rich in mannoproteins and sulfur peptides + PVI-PVP	💧💧💧	💧💧💧 (more thiols)	💧💧	💧💧💧
	EnartisPro R	Inactivated yeast	💧	💧	💧	💧
	EnartisPro Uno	Inactivated yeast rich in mannoproteins	💧	💧	💧💧	💧
	EnartisPro XP	Inactivated yeast rich in mannoproteins + PVI-PVP	💧💧💧	💧	💧💧	💧💧💧
Maturation	**Surlì Elevage**	Yeast cell walls	💧💧	💧	💧💧💧	💧
	Surlì Natural	Inactivated yeast	💧💧	💧	💧💧💧	💧💧
	Surlì One	Inactivated yeast enzymatically treated	💧💧	💧	💧💧💧	💧💧

Enzymes

Achieving protein stability with enzymes is a particularly appealing alternative to bentonite as it minimizes wine volume and quality loss.

Since the 1950s, research has focused on finding proteases that can destroy haze-forming wine proteins under winemaking conditions. The difficulty in adopting this solution is the fact that the proteins are generally associated with wine instability. The proteins most involved are: chitinase and thaumatin-like proteins, both are very resistant to proteases in their natural form. In fact, after a flash-pasteurization, haze-forming proteins unfold and become more susceptible to protease activity. Nevertheless, the application of proteases in wine fermentation can lead to a 20-25 % reduction of bentonite required for stabilization.

ENARTISZYM AROM MP

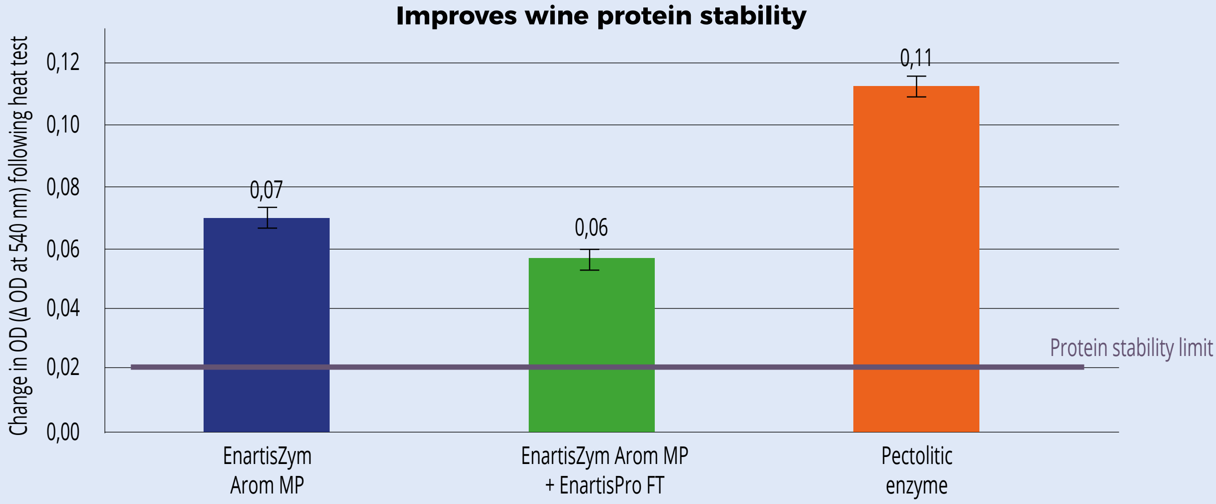
Micro-granulated enzymatic preparation for maceration of white grapes and rosé wine vinification. Its secondary activities, hemicellulases and proteases, break cell walls and membranes localized in the skin. This not only causes the solubilization of aromatic precursors contained in the vacuole, but also those bound to solid cell structures. Wines treated with EnartisZym Arom MP have an aromatic profile characterized by intense fruit aromas with complexity and persistence. Additionally, the protease activity contributes to protein stabilization thus reducing bentonite additions by 20-25% (Graph 1).

Application: maceration of white and red grapes; production of fruity white, red and rosé wines; improved protein stability.

Dosage: 20-40 g/ton

Packaging: 250 g - 1 kg

Graph 1: The effect of EnartisZym Arom MP on wine protein stability.
Below are results of treated wines, following a heat stability test (2 hours at 80°C). Wine is protein stable when the change in optical density at 540 nm, is below 0.02.
The treatments are as follows:
BLUE: Wine from grapes treated with EnartisZym Arom MP during maceration.
GREEN: Wine from grapes treated with EnartisZymArom MP during maceration and EnartisPro FT at time of yeast inoculation.
ORANGE: Control - Wine from grapes treated with pectolytic enzyme. Average results are shown from treatments in triplicate. Treatment with EnartisZym Arom MP increased the wine protein stability level.



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