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IMPROVEMENT THROUGH BIOTECHNOLOGY

- Since 1963 -

# *Winemaking Handbook*





## Winemaking Handbook

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*AEB started supplying wineries in Northern Italy back in the mid '60's. At the time it was mostly a chemical company fabricating detergents and basic products for clarification. In the '70's and '80's AEB started exporting its products and expertise to the rest of Europe, South America and South Africa. Shortly after, AEB started collaborations with Universities and published books that were used in Italian winemaking schools.*

*In the early 2,000's AEB was acquired by investing funds that started promoting R&D in biotechnologies. Production plants and research labs started to flourish in Cape Town, Paris, Alsace, Mendoza, Barcelona and of course in Brescia, Italy. At the same time, AEB Oceania and AEB USA were incorporated in Melbourne, AUS and San Francisco, CA.*

*Today AEB has offices and distribution across the globe and our R&D staff collaborates with the most prestigious Universities. Our core business is still wine but we are exporting our expertise in other sectors like beer brewing and cider making.*

*We can proudly say that we were there at the beginning and that we have been part of the great history of modern winemaking.*

## Wine yeast

Type	Commercial Name	Species	Characteristics	Suggested Utilization	Average YAN	Ethanol Tolerance
Big Reds	Fermol Premier Cru	cervisiae	Ferments elegant big reds keeping intact the main characteristics of the varietal fermented	Bordeaux varietals, Syrah, Sangiovese, Nebbiolo, Norton, Aglianico & Sagrantino	270 ppm	16%
	Fermol Méditerranée	cervisiae	Ferments rich reds adding a fruity and jammy layer	Merlot, Pinot Noir, Rhône varieties, Shiraz, Malbec, Tempranillo, Baco Noir	200 ppm	16%
	Fermol Super 16	cervisiae	Ferments high alcohol reds and enhances extraction	Cabernet Sauvignon, Zinfandel, Primitivo, Passito style reds and whites. Ice wine.	265 ppm	17%
Fruity Reds	Fermol Red Fruit	cervisiae	Ferments fresh and fruity reds with low YAN needs	Fruity red varieties like Gamay, Grenache, Cinsault, Zweigelt, Lagrein, Marechal Foch, Frontenac	220 ppm	15%
	Fermol Rouge	cervisiae	Workhorse for reds	Fruity reds in general, Sangiovese, Montepulciano	250 ppm	16%
Flowery Whites	Fermol Fleur	cervisiae	Works on cysteine to build flowery bouquets	Pinot Grigio, Sauvignon Blanc, Grüner Veltliner, Trebbiano/Ugni Blanc, Prosecco primary	280 ppm	15%
	Fermol Lime	cervisiae	Enhances general citrus aromas	Pinot Grigio, Kerner, Pinot Gris, Muller Thurgau, Prosecco primary	280 ppm	15%
	Fermol Arome Plus	cervisiae	Short lag-phase for clean and aromatic whites	Pinot Grigio, Moscato, Ribolla Gialla, Riesling, Gewürtz	340 ppm	14%
	Fermol Sauvignon	cervisiae	Enhances 4MMP in Sauv Blanc	Sauvignon Blanc, Verdicchio, Tocai	250 ppm	15%

## Wine yeast

Type	Commercial Name	Species	Characteristics	Suggested Utilization	Average YAN	Ethanol Tolerance
Flowery Whites	Fermol Elegance	cervisiae x bayanus	Producer of phenylethyl alcohol (flowers) and is incapable of assimilating sulphur (minimal H <sub>2</sub> S)	Pinot Grigio, Albariño, Chenin	200 ppm	15%
	Glutaferm 1	cervisiae	Enhances the typical notes of the variety fermented. It produces high amounts of the antioxidant glutathione	Sauvignon Blanc, Pinot Grigio, Chenin, Gruner Veltliner	260 ppm	15%
Tropical Fruity Whites	Fermol Tropical	cervisiae	Targets certain amino acids for the production of tropical esters	Chardonnay, Viogner, Vignoles, Vidal, Seyval Blanc	280 ppm	15%
	Fermol Chardonnay	cervisiae	Quick autolysis of the cell for optimized sur lie and viscosity	Chardonnay, Viogner, Ribolla gialla	245 ppm	15%
Stone-fruit Fruity Wines	Fermol Blanc	bayanus	Rapid dominance, clean fermentation with little influence from nutrition and temperature. Also good for restarts.	Fruit-wine and fruity white wines in general, Prosecco base and secondary fermentation.	250 ppm	16%
	Fermol 2	bayanus	White wines workhorse. Ferments in most conditions of stress.	Generic fruity wines, fruit-based wines, meads, cider	250 ppm	16%
Rosé	Fermol PB 2033	cervisiae	Selected in the Côtes de Provence for "Provence-style" rosé wines production.	Floral and fruity at the same time. Ferments in a broad range of temperatures giving good results also in short fermentations	200 ppm	15%

## Wine yeast

Type	Commercial Name	Species	Characteristics	Suggested Utilization	Average YAN	Ethanol Tolerance
Sparkling	Levulia Cristal	bayanus	Killer positive yeast, certified for Champagne production in France. Utilized for the première fermentation and la prise de mousse	Méthode Champenoise	250 ppm	16%
	Fermol Charmat	bayanus	Low nutrition requirement and highly cryophilic. Ideal for prise de mousse (secondary fermentation)	Prosecco base and secondary fermentation with Charmat method. Fruit-based wines, meads, cider	220 ppm	15%
Non-Sacch for biodynamic protection	Primaflora VR	Metschnikowia pulcherrima	Strong anti- Brettanomyces activity. Also, a strong enzymatic activity contributes to the release of aromas and Nitrogen enrichment of the must	For red grapes to replace SO2 Apply in the vineyard, or at the earliest moment that is convenient in between picking the grapes and crushing them.	n/a	3%
	Primaflora VB	Metschnikowia pulcherrima	Diminishes volatile acidity. Is active against Brettanomyces, B. bruxellensis; P. guilliermondii; P. manshurica; P. membranifaciens. Its enzymatic activity also contributes to the release of aromas and simple sugars release.	For white grapes to replace SO2. Apply in the vineyard, or at the earliest moment that is convenient in between picking the grapes and crushing them.	n/a	3%
Non-Sacch for low alcohol conversion	Levulia Alcomeno	Lachancea thermotolerant Ex Kluyveromyces thermotolerant	Carries out the lactic fermentation from sugars and allows bringing wine freshness and balance to the mouth. The result is a high increase of total acidity and a decrease of the alcohol content. Can ensure the alcoholic fermentation at least up to 7%	For wines in need of more equilibrium between acidity and alcohol.	Average	7.2%



## *Yeast for white wines*

### ***Fermol Arome Plus:***

A yeast selected by the Université de Reims and commercialized by AEB since 2001. It is used for white and rosé wines to perform two main tasks:

1. To prevail on apiculate yeast like Kloeckera, even at low temperature. Because of its short lag-phase, it quickly gains dominance and starts a clean fermentation.
2. To produce aromatics, thanks to its esters metabolism and terpenes release.

In fact, this yeast is a producer of  $\beta$ -glucosidase enzymes, an activity able to release terpenes, like linalool and nerol, floral with a touch of sweetness. When supplied with nutrients from the Fermoplus line, it will also produce a complex bouquet of esters, with citrus notes. For its characteristics it has been one of the main yeast of choice in the Asti region of Italy, for the production of the most famed Moscato wines. In the US it has been largely used for the fermentation of Pinot Grigio in order to boost the aromatics of this complex variety. It's easy to stop by starvation and cold for the production of wines with residual sugars.

AEB clients have experienced worldwide with good results the co-fermentation of Fermol Aroma Plus with Fermol Chardonnay.

This combination should be done by simply rehydrating the two yeast together and adding them to the must fermenting at around 14 Celsius. When using this strain be aware of the high YAN demand.

**Available in 10 kg bags and 500 grams packs**

### ***Fermol Elegance:***

Thanks to the selection technique applied during its isolation, Fermol Elegance is unable to process sulfur compounds coming from the vineyards or from excess additions of potassium metabisulfite. This results in a bouquet that is elegant and clean from reduction problems. It is a strain obtained by natural hybridization and it stands out for the excellent fermentation kinetics and for the broad spectrum of aromatics that is able to highlight. It has a positive action toward the release of glycosylated terpenes and increases the synthesis of phenylethyl esters, reminiscent of flowers and honey.

**Available only in 500 grams packs**

### ***Fermol Glutaferm 1:***

It has been isolated through an adaptive evolution strategy that has conditioned the colonies to react to stress. The plates were “poisoned” with molybdate and the colonies that survived did so through production of reduced glutathione (GSH). Glutathione in fact chelates the molybdate and allows the yeast to resist. The colonies that survived were labeled as high GSH producers, and were further selected for the quality of the fermentation.

The aromatic profile obtained by fermenting musts with Glutaferm ONE is complex and rich in floral and tropical fruit nuances, with clear notes of passion fruit and grapefruit. If the must is processed with hyper-reduction, the perceived notes become of “sage” and “herbs of the forest”. The quantity of glutathione present in the wine at the end of the fermentation often reaches values above 5 mg/L. GSH adds an antioxidant component, preserving the fresh aromas and the color of delicate wines. Yeast selected in collaboration with Unimore Microbial Culture Collection – University of Modena and Reggio Emilia (Italy) – Bio-bank directed by Prof. Paolo Giudici.

**Available in 500 grams packs**

### ***Fermol Blanc:***

A bayanus yeast selected by AEB in the Trentino region of Italy, in collaboration with the Université de Reims, Laboratoire de Microbiologie. It carries the typical characteristics of the Bayanus strains, it simply brings consistent fermentation curves and clean aromas to white and rosé wines and is respectful of the varietal.

It can be used to restart stuck fermentations or even as champagne yeast for the secondary fermentation in the bottle. In a study conducted by AEB on several strains for white wines, Fermol Blanc was the strain affected the least by the source of Nitrogen fed (mineral or  $\alpha$ -amino nitrogen), and even if its peaks of speed were always lower, with respect to the other strains, it was ultimately the most regular strain and the fastest toward the end of the fermentation. This characteristic was more marked with higher alcohol contents. Its resistance to adverse conditions, like low nutrition, cold temperatures or high alcohol, makes this strain also ideal for cider, fruit wines and mead.

**Available in 10 kg bags and 500 grams packs**



### ***Fermol Chardonnay:***

A yeast isolated from Chardonnay grapes picked in Bourgogne, and selected for AEB in collaboration with the microbiology department at Reims University (France). It is a high producer of glycerin, characteristic that results in wines with slightly lower alcohol and a pleasant sweet sensation, without residual sugars. The aromatic profile of the wines fermented with Fermol Chardonnay tends to express tropical and summer fruits as well as sweet nuances of honey. Because of its nature the yeast originates very fine lees that immediately release polysaccharides into the media, giving a smooth and viscous mid-palate which is desired not only in Chardonnay but for all the wines matured sur-lie.

When utilized for barrel fermentation, it will accentuate its tropical notes. When it ferments at temperatures below 55 °F it will express more floral nuances. It is a high malic consumer and it will deplete up to 30% of the initial content of malic acid during primary fermentation. AEB has experienced worldwide with good results the co-fermentation of Fermol Aroma Plus with Fermol Chardonnay. This combination should be done by simply rehydrating the two yeast together and adding them to the must fermenting at 13°C-55°F.

**Available in 10 kg bags and 500 grams packs**

### ***Fermol Sauvignon:***

A strain selected by Université de Reims-Laboratoire de Microbiologie, in the Sancerre region of France. Its killer phenotype and very short lag-phase, even at low temperatures, are characteristics that guarantee a quick dominance and a clean fermentation. It is cold resistant and can ferment well at 10°C–50°F. Its enzymatic production during fermentation facilitates the expression of aromatic thiols such as 4MMP (4-mercapto-4-methylpentan-2-one) reminiscent of box tree and passion fruit. Also, it highlights the synthesis of monoterpenes reminiscent of aromatic herbs, such as  $\beta$ -Tujone. In some cases, and according to the grape varietal, citrus (grapefruit) notes emerge clear and fine. The intense olfactory expression of wines obtained with Fermol Sauvignon, matches with a balanced taste and a very persistent after-taste rich in honeydew and herbal notes.

**Available in 10 kg bags and 500 grams packs**

## *Yeast for reds and rosé wines*

### ***Fermol Fleur:***

Strain resulted from hybridization in order to enhance certain characteristics in amino-acids processing and the consequent development of esters. Suggested for all types of winemaking for which we wish floral aromatic notes well marked both in the nose and mouth, and well-defined bouquets. Widely used in whites but also for the development of modern rosé wines, where winemakers look for a very pronounced and intense bouquet. Because of its low consumption of malic acid, it's also indicated for fermentations of musts from hot regions, to maintain freshness. The bouquet that develops with Fermol Fleur is reminiscent of white flowers, with balsamic and menthol notes that are very noticeable also in the aftertaste.

The aromatic profile is linked to the presence of specific precursors such as cysteine and glutathione. When fed with the modern nutrients based on amino-acids like Fermoplus Floreal, the production of esters is increased.

**Available in 500 grams packs**

### ***Fermol Lime:***

It naturally enhances the citrusy profile of varieties that are known for their bouquet rich in lime, lemon and grapefruit notes. When fed with the most modern, amino-acids based, yeast nutrients like Fermoplus Floreal, the characteristics of citrus and herbal aromas are boosted.

Because of its low consumption of malic acid, it's also indicated for fermentations of musts from hot regions, to maintain freshness. It is highly recommended for co-fermentation with Fermol Fleur for the production of modern and fragrant Pinot Grigio, Sauvignon Blanc, Grüner Veltliner and other cold-climate varieties.

**Available in 500 grams packs**

### ***Fermol Méditerranée:***

A strain selected in the Côtes du Rhône region of France by AEB, in collaboration with the Université de Reims-Laboratoire de Microbiologie. Recommended for modern reds, Rhône varieties and lush Pinot Noirs, it releases a rich bouquet of spirit-preserved red fruits enhancing sweet nuances, with an earthy finish. It yields wines that are highly extracted and rich in polysaccharides, facilitating a quick stabilization of the anthocyanins and lowering the redox potential. It has extremely low nutrition needs, making it ideal also for organic winemaking.

It carries a killer phenotype that helps the strain to quickly dominate the fermentation minimizing VA. It has an average production of glycerol of 6,5 g/l, low foam, lower than average yield sugar/alcohol. It has minimal or none SO<sub>2</sub> production, facilitating ML.

It doesn't do well at low temperatures, and for this reason it can be used in those fermentations that need to be arrested with freeze and left with residual sugars.

**Available in 10 kg bags and 500 grams packs**

### ***Fermol PB 2033:***

A strain selected specifically for rosé wines, by the Université de Reims Laboratoire de Microbiologie, in the Côtes de Provence region of France. Its killer phenotype and very short lag-phase, even at low temperatures, are characteristics that guarantee a quick dominance and a clean fermentation. Thanks to the limited hydrophilic characteristics of the cellular wall, this strain limits adsorption and fixation of the anthocyanins to the cellular walls, promoting an optimized rosé color. The typical bouquet respects the primary aromas of the grapes and develops pleasant secondary aromas that integrates with the typical bouquet of the light-red cultivars. When tasting wines fermented with PB 2033, sensory descriptors are reminiscent of red currant, sour black cherry, raspberry, strawberry and white flowers. It is also a good strain for the production of Sangiovese, Lambrusco, Dolcetto, Bardolino, and for all young wines.

**Available in 10 kg bags and 500 grams packs**

### ***Fermol Premier Cru:***

A yeast selected by AEB in collaboration with Institut Universitaire de la Vigne et du Vin de Dijon. It has a neutral killer phenotype, making it ideal for co-fermentation.

It has minimal or none SO<sub>2</sub> production, facilitating ML. Thanks to the cellulase enzymes produced during its activity, it yields wines that are highly extracted and rich in polysaccharides. This also facilitates the stabilization of anthocyanins and full expression of the varietal fermented and enhances its typical characteristics, yielding complex bouquets of red fruits, violets and herbs. Recommended for Bordeaux varietals, Syrah, Sangiovese, Nebbiolo, Norton, Aglianico and Sagrantino.

**Available in 10 kg bags and 500 grams packs**

### ***Fermol Rouge:***

One of the very first strains selected by AEB in collaboration with the Université de Reims, Laboratoire de Microbiologie. Often used in Europe in the 90's for classic "food friendly" wines, it is mainly recommended for fruity reds and modern rosé wines. It shows a very short lag-phase, followed by a fast and regular fermentation curve. These characteristics make Fermol Rouge ideal for optimizing tank turnover. It quickly completes fermentation with high resistance to stressing factors like wild yeast contamination and high temperatures. It is killer-factor "neutral", so it can be used in co-fermentations.

**Available in 10 kg bags and 500 grams packs**

### ***Fermol Super 16:***

A very versatile yeast, which in California has found its match with Zinfandel and high-end Cabernet Sauvignon. In fact, comparative trials have showed how Fermol Super 16 has an higher than average production of extractive enzymes and facilitates maceration. Fermol Super 16 has been isolated from grapes picked in the island of Samos (Greece), the island is a historic producer of wines coming from extremely mature grapes often dried in a "passito" style. As a result of its origins, this strain is adapted to high sugar content and extreme osmotic conditions. It's ideal for batches made with high percentages of raisins and overripe grapes. Complements a clean fermentation with a bouquet of fresh and straight fruit. It yields wines with a crisp and clean edge that show a long and complex finish in the mouth. It can perform at very high temperatures and high alcohol. The cells flocculate very well and the wine is easy to filter just a few days after the end of the fermentation.

**Available in 10 kg bags and 500 grams packs**

## **Stuck fermentation re-start yeast:**

### ***Fermol Complete Killer Fru:***

Selected for its fructophilic characteristics, it is utilized to restart stuck fermentations in red and white wines.

In fact, Fermol Complete Killer Fru is able to metabolize the sugar fraction composed by fructose, when other strains often leave it behind. Thanks to its killer phenotype, it quickly gains dominance reducing the existing population of wild yeast, and because of its high alcohol tolerance, it can be inoculated in partially fermented musts. It's highly cryophilic so it's ok to use in wines that are not at ideal temperatures due to sluggish conditions.

**Available in 500 grams packs**





## Restarting a stuck or sluggish fermentation procedure:

1. Rack the wine off the gross lees into a sanitized tank.
2. While racking, add 18 g/hL (1.5 lb. /1000 gal.) of Celloferm to the receiving tank. Celloferm will help to purify the compromised must from toxins and contaminants.
3. In a tub, bring 250 mL water for every hL of stuck wine to treat (2.5 gal water/1000 gallons wine) to 40°C (104°F).
4. Add 6 g/hL (½ lb./1000 gallons) of Fermoplus Energy Glu rehydration nutrient.
5. To this mixture add 25 g of Fermol Complete Killer Fru yeast for every hl of stuck must to be treated (2 lbs./1000 gallons).
6. Using a paddle, mix the yeast and nutrient thoroughly.
7. Allow the yeast to rehydrate for 20 minutes.
8. Note the temperature of the yeast mixture before going on to step 9.
9. Take out of of the problematic tank 250 mL of stuck must per hL of its total volume (2.5 gallon/1000 gallons).
10. Add this to the yeast mixture, making sure that during the addition the temperature does not change more than 5°C.
11. Add 25 grams of light white grape concentrate (or similar) per hL (2 lbs/1,000 gallons) of total stuck wine to the yeast slurry.
12. Take a sample of this starter and measure the RS if possible.
13. Cover and hold for 12 hours in a warm part of the cellar. Around 21°C (70°F) is best.
14. Check the RS. Make sure that there are signs of active fermentation before moving to the next step (a RS drop will confirm yeast activity).
15. Transfer yesterday's start-up from the tub into a the small wine tank.
16. Slowly add 750 mL of stuck wine per hL of total volume of stuck wine (7.5 gallons/1000 gallons) and 15 grams of light grape concentrate per hL total stuck wine to the small tank, and stir well.
17. Record the RS and hold over night. Make sure the small wine tank is vented.
18. Again, confirm that the mixture is actively fermenting before moving on.
19. Add 10 more liters of stuck wine foe each hL of total wine to the small tank and mix well. Hold for another night.
20. Transfer the small tank to the stuck wine tank and mix well. If possible, maintain the tank temperature between 21 - 24°C (70 - 76°F). Monitor RS regularly.

## Low SO<sub>2</sub> winemaking with bio-protection of musts

### **Primaflora, (certified organic product):**

Developed at the AEB R&D lab of Colmar in Alsace back in 2010 and improved in collaboration with the University of Dijon; this technology is based on adding non-Saccharomyces yeast to grapes or musts, in order to establish a biodynamic equilibrium that pushes out undesired contaminants by colonizing the media and consuming the dissolved oxygen. It actively depletes the must from Lactobacillus, Brettanomyces and other contaminants.

Primaflora is based on Metschnikowia pulcherrima non- Saccharomyces yeast. Among the characteristics of this strain there is a strong anti-Brettanomyces activity due to the fact that the pulcherrimic acid produced depletes the media from iron, creating unfavorable conditions for Brett (Oro et al., 2014). Through its enzymatic activity, Metschnikowia pulcherrima, also contributes up to a certain extent to the release of aromas and Nitrogen enrichment of the must. Its main enzymatic activities are:

- *Activity Cys-β-Liasi: release of thiols (Zott, 2009)*
- *Activity β-glicosidasi: release of terpenes (Günata et al, 1990)*
- *Aspartate protease activity: release of peptides or amino acids (Theron et al., 2017).*

**Dosage:** Primaflora VB: For white or rosé musts: from 30 to 50 ppm during or before pressing, or on grape harvesters. Primaflora VR: For red musts: 40 ppm on grape harvesters or during maceration and up to 80 ppm with grapes that are damaged or warm, or with a pH value of 4 or more.

**Utilization:** rehydrate 500 g of Primaflora in 10 liters of mineral or non-chlorinated water (4.2 lb of Primaflora per gallon of water) at 25-30°C or 77-86°F, sugared with 50 g/L (5%) for 15 minutes. Distribute onto the grapes or add to the must and homogenize. Do not store the Primaflora solution for more than 45 minutes or viability will decline. Double the volume with grape must to prolong the life of the solution of 3 hours. Increase five folds the volume with grape must to prolong the life of the solution of 12 hours. Do not use on sulfited must.

**Shelf life and storage:** store in the original sealed pack, in a dry, cool and odorless place. After opening the pack, use quickly. Store in the fridge and in the original sealed container. Mortality < 20% per year.

**Packaging:** 1 kg packets.

## Yeast rehydration and acclimation

- 1.** Using clean and sanitized equipment, prepare 10 liters of warm water per kilogram of yeast (1.2 gallons of water per pound). Ideal temperatures are 39°C (102°F) for *Saccharomyces cerevisiae* and 41°C (105°F) for the *Bayanus* strains. While stirring, slowly add 0.25 kilograms of the rehydration nutrient Fermoplus Energy GLU per kilogram of yeast. Be sure that all clumps are broken up and well-mixed. Slowly mix-in the yeast, again making sure to break up all clumps. Do not mix using a drill or any aggressive mixing technique that might cause shearing of the yeast cells. Make sure that the mixture gets plenty of oxygenation. This along with the nitrogen supplied by the Fermoplus Energy Glu, will build a bigger and stronger yeast biomass.
- 2.** After 20 - 30 minutes the yeast is fully rehydrated and will now need a sugar source to stay viable.
- 3.** Portions of must are gradually added to the yeast mixture in small increments while gently stirring. Normally an equal amount of must is slowly mixed into the yeast mixture over 5 minutes. While adding the must, monitor the temperature and make sure it does not drop more than 5°C at any time during this must addition.
- 4.** After 15 minutes, slowly add an equal amount of must to the mixture, making sure the temperature does not drop more than 5°C.

*Repeat this step every 15 minutes until the yeast mixture is within 5°C of the tank temperature. Add the inoculum to the must in the tank and ensure that the tank is properly vented to release pressure.*



## How much YAN do fermentations need?

**YAN** stands for **Yeast Available Nitrogen**. It is a measure of the amount of nitrogen available to the yeast in the grape juice. YAN is measured in parts per million (ppm) or milligrams per liter (mg/L), which is the same thing. It is composed by two fractions: Ammonia (NH<sub>4</sub> present in must and added with DAP) and free alpha-amino nitrogen or FAN (from the amino-acidic fraction of must or nutrients). The need of YAN to complete a fermentation will depend on three main variables:

1. Brix.
2. Yeast strain.
3. Temperature (that conditions the length of the process)

<i>Fermol Blanc</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	180	12,4
	22	220	13,0
	23	250	13,6
	24	280	14,2

<i>Fermol Chardonnay</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	200	12,8
	22	220	13,4
	23	245	14,0
	24	270	14,6

<i>Fermol Charmat</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	225	12,6
	22	250	13,2
	23	275	13,8
	24	300	14,4
	25	325	15,0

<i>Fermol Complete Killer</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	220	12,8
	22	240	13,4
	23	260	14,0
	24	280	14,6
	25	300	15,3

<i>Fermol Lime &amp; Floral</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	225	12,6
	22	250	13,2
	23	275	13,8
	24	300	14,4
	25	325	15,0

<i>Fermol Mediterranee</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	170	12,4
	22	180	13,0
	23	200	13,6
	24	240	14,2
	25	260	14,8

<i>Fermol Premier Cru</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	230	11,8
	22	250	12,3
	23	280	12,9
	24	300	13,4
	25	310	14,0

<i>Fermol PB 2033</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	170	12,6
	22	180	13,2
	23	200	13,8
	24	240	14,4
	25	260	15,0

<i>Fermol Red Fruit</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	180	12,6
	22	200	13,2
	23	220	13,8
	24	260	14,4
	25	280	15,0

<i>Fermol Rouge</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	225	12,6
	22	250	13,2
	23	275	13,8
	24	300	14,4
	25	325	15,0

<i>Fermol 2</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	180	12,4
	22	220	13,0
	23	250	13,6
	24	280	14,2
	25	300	14,8

<i>Fermol Arome Plus</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	280	12,0
	22	300	12,5
	23	340	13,1
	24	360	13,7
	25	400	14,3

<i>Fermol Sauvignon</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	200	12,8
	22	225	13,4
	23	250	14,0
	24	275	14,6
	25	300	15,3

<i>Fermol Super 16</i>	<i>Brix</i>	<i>Average YAN Required</i>	<i>Average Alcohol Produced</i>
	21	220	12,8
	22	240	13,4
	23	265	14,0
	24	280	14,6
	25	300	15,3

<b>Glutaferm 1</b>	<b>Brix</b>	<b>Average YAN Required</b>	<b>Average Alcohol Produced</b>
	21	220	12,8
	22	240	13,4
	23	260	14,0
	24	280	14,6
	25	300	15,3

<b>Levulia Cristal</b>	<b>Brix</b>	<b>Average YAN Required</b>	<b>Average Alcohol Produced</b>
	21	225	12,6
	22	250	13,2
	23	275	13,8
	24	300	14,4
	25	325	15,0



## Yeast-nutrients & bio-regulators

<b>Yeast Nutrient</b>	<b>PPM of YAN added for 120 ppm addition of product</b>	<b>Characteristics</b>
Fermoplus DAP Free	8-10	Adds to the amino acids content. Geared to bring a generic boost of aromatics and to promote a healthy fermentation
Fermoplus Floral	8-10	Adds to the cistein and amino acids content. Geared to boost floral aromatics and to promote a healthy fermentation
Fermoplus Tropical	8-10	Adds to the amino acids contents. Geared to boost tropical aromatics and to promote a healthy fermentation
Fermoplus Integrateur	18	High increase of YAN paired with the benefits of amino-acids
Fermoplus Blanc Varietal	13	High increase of YAN paired with the benefits of amino-acids
Fermoplus Premier Cru	14	High increase of YAN paired with the benefits of amino-acids
Fermoplus Energy Glu 3.0	N/A	Added during hydration to boost the biomass from 3 to 6 folds
Fermocel P	11	Adds a component for toxins adsorption plus facilitates nucleation and dispersion of the yeast cells. Also provides high YAN
Enovit P	25	DAP and Vit. B1 (thiamine)
Celloferm	0	Adds a component for toxins adsorption plus facilitates nucleation and dispersion of the yeast cells

***Fermoplus integrateur:***

A complex nutrient based on DAP and yeast lysate. It has an high NH4 content to quickly increase the YAN. It also has all the benefits of an yeast extract, including a boost in aromatics given by the amino acidic content, vitamins, micro elements and sterols to keep the yeast healthy. It also contains 0.06% thiamine hydrochloride\*

**Usage:** Dissolve in must or wine and add to the tank. It is preferred to add Fermoplus Integrateur in three steps, but it is most important at the beginning of the fermentation.

**Dosage:** an addition of 120 ppm (12g/hl or 1lb/1000 Gallons) yields about 18 ppm of YAN. We recommend 2lb/1,000 gallons divided in 2-3 additions.

**Packaging:** 1kg vacuum-sealed packs, 5 and 20 kg bags.

**Shelf life and storage:** stable at room temperature for at least two years.

***Fermoplus Blanc Varietal:***

An upgraded version of Fermoplus integrateur geared for enhancing the varietal qualities of white wines. It is rich in both amino acidic and mineral N and it also contains specific components like casein, natural antioxidants and amino acids in order to guarantee the development of enhanced aromatics during fermentation. Like all the Fermoplus line it also contains thiamine (0.06%)\*.

**Usage:** Dissolve in must or wine and add to the tank. It is preferred to add Fermoplus Blanc Varietal in three steps, but it is most important at the beginning of the fermentation.

**Dosage:** an addition of 120 ppm (1lb/1000 Gallons) yields about 13 ppm of YAN. We recommend 2lb/1,000 gallons divided in 2-3 additions.

**Packaging:** 5 kg bags.

**Shelf life and storage:** stable at room temperature for at least two years.

***Fermoplus Premier Cru:***

An upgraded version of Fermoplus Integrateur geared for enhancing the varietal qualities of red wines. Rich in ammonia and natural amino acids specific for enhancing the red wine profile. Like the all Fermoplus line it also contains thiamine\*, natural mannoproteins, and B vitamins.

**Usage:** Dissolve in must or wine and add to the tank. It is preferred to add Fermoplus Premier Cru in three steps, but it is most important at the beginning of the fermentation.

**Dosage:** an addition of 120 ppm (1lb/1000 Gallons) yields about 14 ppm of YAN. We recommend 2lb/1,000 gallons divided in 2-3 additions.

**Packaging:** 5 kg bags.

**Shelf life and storage:** stable at room temperature for at least two years.

***Enovit P:***

Mainly composed of nitrogen salts of DAP bringing a large amount of ammonia (NH4) for a quick boost of the YAN (yeast available nitrogen). Utilized at 30 g/hl (300 ppm) it brings 60 ppm of YAN (about 20%). It also contains thiamine\* to promote a shorter lag-phase and to avoid the formation of ketonic acids that can combine SO2 and diminishing its efficiency. The average YAN yield for a 120 ppm (1lb/1000 Gallons) addition of Enovit P is 24 ppm.

**Dosage:** standard addition is 12-36 g/hl (1-3 pounds/1,000 Gallons).

**Packaging:** 25 kg bags.

**Shelf life and storage:** Stable at room temperature for at least two years.

***Fermocel P:***

Nutrient/bio-regulator widely used in Europe where juice fining is pushed to the extreme and musts need some haze to ferment properly. The cellulose contained in Fermocel P helps with yeast nucleation, adsorption of toxins and long chain fatty acids. Nitrogen salts (DAP) bring a large amount of ammonia nitrogen that immediately raises the YAN level. It creates the perfect environment for fermentation of juices that are extremely clarified, like white musts, fruit wines, cider or mead. The dispersing agents in the mix provide support for the yeast cells to be homogeneous in the all fermentation vessel. The average YAN yield for a 120 ppm addition (12g/hl or 1lb/1000 Gallons) is about 12 ppm. It also contains thiamine hydrochloride\*.

**Dosage:** standard addition is 12-36 g/hl (1-3 pounds/1,000 Gallons)

**Packaging:** 25 kg bags.

**Shelf life and storage:** stable at room temperature for at least two years.

### **Celloferm:**

A bio-regulator in powdery form, based on very pure celluloses with long polysaccharide chains. It absorbs the substances inhibiting or slowing down the yeast activity and rapidly activates fermentations. The addition of Celloferm to the clear must facilitates the yeast in the lag-phase, especially in musts where the sugar concentration is very high, or where environmental conditions are very difficult. It acts on the must by binding to the residues of plant protection products, such as fungicides, acaricides, and copper-based products. The particular composition of Celloferm enables the interaction with positive metal ions, as the cellulose is negatively charged and binds with positive ions, such as Fe<sup>+++</sup> and Cu<sup>++</sup>. Under this aspect, it contributes to reduce the oxidative effects caused by these elements. Furthermore, the long-chained celluloses carry out an adsorption action towards metabolites yielded by the yeasts during fermentation and fixes toxic fatty acids and their ethyl esters, granting a regular and constant run. Celloferm has a high support action during fermentation, as it facilitates the homogeneous dispersion of the yeasts in the mass.

**Utilization:** make a slurry in 20 parts of must or stuck wine and add to the tank right after having pitched the yeast.

**Dosage:** 120-240 ppm (12-24 g/hL or 1-2 lb/1,000 gallons).

**Packaging:** 10 kg bags.

**Shelf life and storage:** sealed containers will last for 2 years stored at room temperature in a non-humid environment.



## ***DAP Free, Fermoplus Tropical and Fermoplus Floral***

### ***Why amino-acid based nutrients are important, where and when to use them.***

Amino acids are used by the yeast to build biomass. Because of that, we want to try use these nutrients early and especially at the rehydration stage (using Fermoplus Energy Glu 3.0). Generally speaking Amino Acid transport is strongly inhibited by DAP and ethanol. Yeast takes up amino acids early in fermentation, when the ethanol concentration is relatively low, accumulates and stores them in vacuoles and uses them later when needed for metabolic activity. This approach also gives the yeast cell a competitive advantage because it depletes nutrients from the medium, and thus deprives other organisms like bacteria from Nitrogen.

In trials ran by AEB with different musts adjusted with different nutrition strategies, we can consistently observe a consumption of amino acids which starts in the early hours of the primary fermentation, and this pattern is not dependent on the yeast strain, the nutrition strategy adopted or sugar concentration.

### ***How amino acid based nutrients contribute to make wines better:***

Esters from fusel compounds are produced by the yeast during amino acid biosynthesis or degradation for *2 main survival reasons*:

- 1.** Detoxification mechanism: esters are less toxic than their alcohol or acidic precursors.
- 2.** Esters attract insects that are vectors for spreading the yeast.

Esters produced in fermentation derive from the combination of an alcohol with an acid. The alcohol can be ethanol or any alcohol produced as a degradation byproduct by the yeast cells. Aside from ethanol, common alcohols found in esters derive from the degradation of amino acids. During active biomass accumulation, ester formation is stimulated by the presence of free alpha amino acidic nitrogen (FAN), indicating that biosynthetic reactions are the source of these compounds.

Once biomass growth has diminished, amino acid are degraded and additional esters and fusel compounds may be produced. The fusel compounds come from the degradation of amino acids as nitrogen sources via the Ehrlich pathway.

**Ehrlich pathway: Amino Acid (transamination) -> alpha-keto-acid (decarboxylation) -> Fusel Aldehyde (reduction) -> Fusel Alcohol**

There are two main categories of flavor-active esters in fermented beverages:

1. Acetate esters: formation of acetate esters essentially comes from two substrates: an alcohol and acetyl-CoA. The acid group is acetate, the alcohol group is ethanol or a fusel alcohol derived from amino acid metabolism.
2. Medium-chain fatty acid (MCFA) ethyl esters: the alcohol group is ethanol, the acid group is a medium-chain fatty acid precursors of CoA.

The most important thing for the rate of acetate ester formation is the concentration of the two substrates, acetyl-CoA and a fusel alcohol. We can increase the fusel alcohol part by adding amino acids.

### How they contribute to make fermentation “healthier”:

These yeast extract based nutrients also provide adsorbing media to detoxify the must from fatty acids like decanoic and octanoic acids. This is a very important feature. Fatty acids participate in the synthesis of sterols, a very important component of the yeast membrane. Under aerobic conditions the fatty acids are all used up in sterol production. However, during fermentation under anaerobic conditions, the sterol synthesis slows down and stops. Decanoic and octanoic acids accumulate in the cell wall. This adversely affects cell membrane function, consequently sugar metabolism diminishes and fermentation ceases. Also these nutrients all have a high natural content of B Vitamins like Thiamine, Riboflavin, Niacin, Pyridoxine and Cobalamin. B vitamins facilitate N assimilation (including the one from an eventual DAP addition), and make aroma synthesis more efficient.

#### **Fermoplus DAP Free:**

Natural nutrient derived from yeast lysis containing amino-acids, B vitamins and yeast hulls, as described in the introductory section above. Add at the beginning of the fermentation and half way through. Later additions are still effective but with less impact. High alcohol and high DAP concentration will diminish assimilation of the amino acids contained in this product, so use it separately from DAP additions.

**Usage:** Dissolve in must or wine and add to the tank. It is preferred to add Fermoplus DAP Free in three steps, but it is most important at the beginning of the fermentation.

**Dosage:** standard addition is 25-40 g/hl (2-3 pounds/1,000 Gallons).

**Shelf life and Storage:** stable at room temperature for at least two years.

**Packaging:** 5, 10 and 25 kg bags.

#### **Fermoplus Tropical:**

Natural nutrient derived from yeast lysis containing amino-acids, vitamins and yeast hulls as described in the introductory section. Mainly indicated for white and rosé fermentations, Fermoplus Tropical is particularly rich in specific amino acids that are essential for the characterization of wines with an aromatic “tropical” profile. The utilization of this nutrient in the must allows to perceive more clearly these aromas, typical of varieties that naturally possess precursors, while its addition into different varieties facilitates the production of hints related to these notes. Add at the beginning of the fermentation and half way through. Later additions are still effective but with less impact. High alcohol and high DAP concentration will diminish assimilation of the amino acids contained in this product, so use it separately from DAP additions.

**Usage:** dissolve in must or wine and add to the tank. It is preferred to add Fermoplus Tropical in three steps, but it is most important at the beginning of the fermentation.

**Dosage:** standard addition is 25-40 g/hl (2-3 pounds/1,000 Gallons).

**Shelf life and Storage:** stable at room temperature for at least two years.

**Packaging:** 5kg bags





## Why Glu?

This product features a natural high glutathione content. AEB achieves this by selecting a yeast strain that has an extract with glutathione in higher concentration than average. Glutathione is a natural antioxidant that the yeast uses to protect its organs from free radicals and to ensure that yeast cells are not damaged by the high oxidative activity existing during rehydration.

When yeast are dry they don't have an immediate availability of glutathione and therefore they can benefit from the addition supplied with Fermoplus Energy Glu 3.0.

**Usage:** dissolve directly in the rehydration water along with the yeast

**Dosage:** 1:4 compared to yeast inoculum. i.e. 25 grams/Hl of yeast will need 6 grams/Hl of Fermoplus Energy Glu. 2lb/1000 Gallons of yeast will need 1/2 lb of Fermoplus Energy Glu.

**Packaging:** 1kg vacuum-sealed packs, 20 kg bags.

**Shelf life and storage:** Fermoplus Energy Glu is stable at room temperature for at least two years.

### **\* Thiamine hydrochloride:**

According to TTB, Thiamine hydrochloride is used as a yeast nutrient to facilitate fermentation of wine. The amount used shall not exceed 0.005 lb/1000 gals. (0.6 mg/L) of wine or juice. 21 CFR 184.1875 (GRAS).

*The values in the chart are our suggestions. AEB cannot be held accountable or responsible for violating TTB rules.*

<b>Product</b>	<b>Percentage Vit B1</b>	<b>Max level of dosage</b>
Fermoplus Integrateur	0.06%	8.3 lbs/1,000 Gallons (100g/hl)
Fermoplus Premier Cru	0.06%	8.3 lbs/1,000 Gallons (100g/hl)
Fermoplus Blanc Varietal	0.06%	8.3 lbs/1,000 Gallons (100g/hl)
Fermoplus Energy Glu 3.0	0.3%	1.6 lbs/1,000 Gallons (20g/hl)
Fermocel P	0.1%	5 lbs/1,000 Gallons (60g/hl)
Enovit P	0.2%	2.5 lbs/1,000 Gallons (30g/Hl)

### **Fermoplus Floral:**

Natural nutrient derived from yeast lysis containing amino-acids, vitamins and yeast hulls as described in the introduction on page 26. Fermoplus Floral was developed by studying the amino acidic composition of floral varieties like Grüner Veltliner. It's indicated for white and rosé fermentations to highlight the aromatic profile. The utilization of this nutrient in the must allows to perceive more clearly floral aromas, typical of varieties that naturally possess precursors, while its addition into different varieties facilitates the production of hints related to these notes. Add at the beginning of the fermentation and half way through.

Later additions are still effective but with less impact. High alcohol and high DAP concentration will diminish assimilation of the amino acids contained in this product, so use it separately from DAP additions.

**Usage:** dissolve in must or wine and add to the tank. It is preferred to add Fermoplus Floral in three steps, but it is most important at the beginning of the fermentation.

**Dosage:** standard addition is 25-40 g/hl (2-3 pounds/1,000 Gallons).

**Packaging:** 5kg bags

**Shelf life and Storage:** stable at room temperature for at least two years.

## Rehydration Nutrient:

### **Fermoplus Energy Glu 3.0:**

Booster for the yeast biomass, to be added in the rehydration tab. It accelerates multiplication speed improving the biomass.

This ultimately facilitates dominance of the selected yeast strain. Ammonia (NH4+) and amino-acids, are the predominant nitrogen-containing compounds that are utilized by the Saccharomyces. GAP (General Amino Acid Permease) transports several amino acids inside the yeast cell, but is inhibited by NH4+. It is therefore active when the must is depleted of ammonium ions, or before the yeast is inoculated into the must. For this reason it is important to feed amino acids in the rehydration tub, in absence of NH4, using Fermoplus Energy Glu 3.0. The purity of the extract in terms of amino acids is guaranteed by a centrifugation process that ensures that the size of the molecules present in the extract are less than .5 Kilo Dalton. This is the size that a yeast cell can immediately metabolize. For this reason the rate of addition of Fermoplus Energy GLU 3.0 is much lower than most re-hydration nutrients available.

## ML Bacteria

<b>Product</b>	<b>Number of strains</b>	<b>Type</b>	<b>Characteristics</b>	<b>Packaging</b>
Malolact Acclimatée	3 strains combined	direct add	For clean and consistent ML fermentation (high alcohol & tanins)	2.5 grams, 25 grams, 250 grams, 1kg
Malolact Acclimatée 4R	4 strains combined	direct add	For complicated ML fermentations (high alcohol and high tannins)	2.5 grams, 25 grams, 250 grams
Malolact Fresh	Single strain	direct add	Fast and consistent ML fermentation	1kg

Malo-lactic fermentation is an important step that nowadays is considered an opportunity to give a specific aromatic feature to the wine. At the same time malolactic fermentation is a stabilization process that, if desired, needs to happen as soon as possible. In simple, a specific bacteria converts malic acid into lactic acid. One mole of malic acid will yield one mole of lactic acid. The molecular weight of these two acids is very different (134 for malic and 90 for lactic), therefore the total acid content will diminish during the process. Also, malic acid carries two carboxylic groups, whereas lactic only has one. This translates in less H<sup>+</sup> being released in the media by lactic and therefore a higher pH. After MLF also expect total acidity to be diminished.

### **Malolact Acclimatée:**

Frozen culture at -20°C. Multi strain direct inoculum of *Oenococcus oeni* for malolactic fermentations. Malolact Acclimatée is ideal for white, rosè and red wines. It's constituted of three genetically different strains of *Oenococcus oeni*, equally effective in conducting the malolactic fermentation. This combination helps to improve competition in the event of a high population of indigenous bacteria. Malolact Acclimatée has been selected for its capacity to highlight the typical aromas of the cultivar from which the wine was made, integrating them with pleasant fruity nuances. It improves the taste profile of wines enhancing roundness and fullness and prolonged after taste sensations. The appearance of bitter or green nuances, which often characterize wines at the end of spontaneous malolactic fermentation, are absent.

**Utilization:** remove Malolact Acclimatée from the freezer 30 minutes before use. Malolact Acclimatée works as a direct add, but its activity can be boosted by a simple rehydration for 24 hours (see section at the end of this chapter).

**Dosage and packaging:** 10 ppm 1g/Hl. Comes in pre-dosed packets for 66 gal, 660 gal, 6,600 gal, or 26,400 gal of wine (2.5 grams, 25 grams, 250 grams and 1 kg).

**Storage and shelf life:** Malolact Acclimatée is stable for two years (with minimal loss of activity) when stored in a freezer (-4°C /-17°C).



### **Malolact Acclimatée 4R:**

Frozen culture at -20°C. Multi strain direct inoculum of *Oenococcus oeni* for malolactic fermentations. Malolact Acclimatée 4R is a direct add ML inoculum ideal for big red wines. In this product you'll find an aggregate of four *Oenococcus oeni* strains especially selected for working in red wines characterized by high phenolics. When developing this culture the selection has been mostly focused on having a strain not only resistant to ethanol and SO<sub>2</sub>, but also to high levels of tannins. Malolact Acclimatée 4R has been selected under the following conditions: pH: 3.2; Temperature: 18 °C; Alcohol level: 14.5%; Total SO<sub>2</sub> 60 ppm; concentration of polyphenols: 80 (by total polyphenol index).

**Utilization:** remove Malolact Acclimatée 4R from the freezer 30 minutes before use. It works as a direct add, but its activity can be boosted by a simple rehydration for 24 hours.

**Dosage and packaging :** 10 ppm 1g/Hl. Comes in pre-dosed packets for 66 gal, 660 gal, 6,600 gallons of wine (2.5 grams, 25 grams and 250 grams).

**Storage and shelf life:** the lactic bacteria's activity of Malolact Acclimatée 4R is stable for two years (with minimal loss of activity) when stored in a freezer (-4°C /-17°C).

**Malolact Acclimatée F:**

vigorous, single strain direct inoculum, selected to focus on the ability of the bacteria to complete the malolactic process in the shortest time possible, given the conditions of the wine. Malolact Acclimatée F has a noticeable tolerance towards low temperatures, sulfur dioxide and high alcohol and is intended to be added directly to the wines. One of the main selection goals of this strain has been the lack of biogenic amine production.

**Utilization:** Remove Malolact Acclimatée F from the refrigerator 15 minutes before use. Malolact Acclimatée F works as a direct add, but its activity can be boosted by a simple rehydration for 24 hours.

**Dosage:** dose at 1g/Hl. 1 kg pack is good for 26,400 Gallons.

**Storage and shelf life:** the lactic bacteria's activity of Malolact Acclimatée F is stable for two years (with minimal loss of activity) when stored in a freezer.

**Packaging:** 1 kg Pre-dosed packets for 26,400 Gallons of wine.

**Fermoplus Malolactique:**

Specific nutrient for malolactic bacteria. Malolactic bacteria are typically nutritionally demanding. To grow and develop they need amino acids and vitamins, which are rarely present in the fermented wine, as yeasts tend to deplete them completely during the course of the primary alcoholic fermentation. Fermoplus Malolactique re-balances nutritional conditions and reduces the lag-time for the start and completion of the malolactic fermentation. The inoculation of malolactic bacteria with the support of Fermoplus Malolactique, at the end of the alcohol fermentation, helps the onset of malolactic fermentation. Using Fermoplus Malolactique to improve nutritional conditions results in successful malolactic completion and cleaner wines.

**Utilization:** dissolve dose in wine to be treated along with the dose of malolactic bacteria.

**Dosage:** 50-200 ppm (5-20 grams/hl or 0.5-1.5 lb/1000 gallons). Higher dosage is for when used in co-inoculation early on.

**Shelf life and storage:** Fermoplus Malolactique is stable at room temperature for at least two years.

**Packaging:** 500 grams packs and 5 kg bags.

## Checklist for stuck ML

- *Malolact can work only with very low quantities of SO<sub>2</sub>. 50 ppm of molecular SO<sub>2</sub> is considered the limit that Malolact bacteria can stand.*
- *Low pH's are difficult environments for all malolactic bacteria. Malolact can stand pH's of 3.1. If the pH is lower it is possible to use products like Deacid (page 98) in order to diminish the acidity.*
- *ML bacteria do not have significant activity below 10 degrees Celsius (50 °F), are very slow between 10-15 °C (50-60 °F), and have their ideal conditions at 18°C (65 °F). Once the bacteria start, they can continue working even below 10 degrees Celsius (50 °F), producing very little VA, but at a very slow rate.*
- *Wine's red-ox potential, which during ML often is reduced to 300 mV or lower, can be an obstacle for a regular malolactic fermentation. In fact Oenococcus species have major issues in reductive environments. Racking and a brief oxygenation will often be a good cure for sluggish ML fermentations.*
- *Bacteria cannot use inorganic nitrogen (NH<sub>4</sub> from DAP), but only protein and amino acidic based.*

## Propagation of direct add:

Direct add bacteria can be propagated to increase population and efficiency.  
Here is a procedure that can benefit all kinds of direct add ML Bacteria:

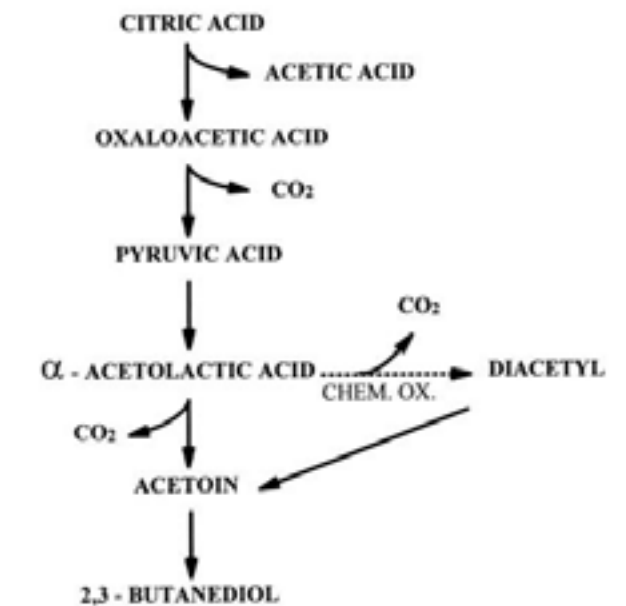
- Draw a small portion of the wine to be inoculated.
- Use 100 liters (26 Gal) for 250 Hl (6600 Gal).
- Add 60 ppm of Fermoplus Malolactique.
- Adjust pH to 3.5 – 4 and inoculate with the Malolact of choice.
- Maintain a constant temperature of 24°C (75°F) for 24 hrs.

*The next day that portion of wine will have a much more aggressive population to quickly start the ML process in the rest of the tank.*

## How to make all bacteria produce Diacetyl for buttery nuances:

AEB's Malolact Acclimatée Oenococcus oeni bacteria can produce none or considerable diacetyl depending on conditions. One variable that can boost this buttery aroma component is citric acid paired with oxygen. In fact, the biosynthesis of diacetyl is dependent on the citric acid metabolism and the fact that under partially aerobic conditions, Malolact strains convert citric acid into diacetyl. Citric acid is first degraded to acetic acid and pyruvic acid. Most of the pyruvic acid is then metabolized to lactic acid with a portion going to diacetyl, acetoin, and 2,3-butanediol. In anaerobic conditions the pathway will favor formation of acetoin and butanediol. This is because the formation of diacetyl requires an oxidative reaction.

According to our research, additions of 1 gram per liter of Citric acid in partially aerobic conditions, can double the amount of diacetyl in the final wine.



### ***Here are a few tips for winemaker looking into a boost in diacetyl:***

The bulk of the conversion will start after Malic acid is all depleted and will be diminished by the presence of SO<sub>2</sub>. If diacetyl is desired it is better to wait a few days after completions of MLF before SO<sub>2</sub> addition. Diacetyl is adsorbed by the lees. The practice of leaving wine on the lees diminishes Diacetyl concentration, both because the lees will adsorb it and because the cell of bacteria that are still viable will convert Diacetyl into acetoin. Adding products like AEB Super-mann, Elevage Glu or Batonnage Elevage, can give the same impact of a good sur-lies, without the risk of losing diacetyl. If diacetyl is desired do not co-inoculate ML with yeast. Faster ML produces less diacetyl. For higher diacetyl play with temperature and pH to ensure Malo-Lactic fermentation lasts about 2 weeks.

## Enzymes for wines and ciders

<i>Enzyme</i>	<i>Type</i>	<i>Activity</i>	<i>Dosage</i>
<b><i>Pectinases for must clarification</i></b>			
Endozym Active	Granular pectinase enzyme	To break down pectins before must settling or flotation	20-40 grams per ton of grape
Endozym Flotation	Liquid pectinase enzyme for must clarification through flotation or cold settling	Fast acting, it promotes the hydrolysis of the pectins and the separation of juice from the pomace	5-10 ml per ton of grapes (5.75 - 11.5 grams per ton)
Endozym Ice	Extra rapid liquid pectinase enzyme	Very fast de-pectinization that also prevents the inhibition of limiting factors like cold, low pH or SO <sub>2</sub>	2-6 ml per ton of grapes (about 2.3-6.9 grams per ton)
Endozym ICS 10 Éclair	High concentration liquid pectinase enzyme	The higher concentration guarantees a longer shelf life & makes the package very easy to store in a small, refrigerated space.	1.5 to 5 ml per ton of grapes (about 1.7-5.75 grams/ton)
Endozym Micro	Liquid pectinase enzyme	Promotes the hydrolysis of the pectins & the separation of juice from the pomace, resulting in an increase of free-run juice yield	2-6 ml per ton of grapes (about 2.3-6.9 ml per ton)
Endozym Muscat	Granular pectinase for "harder to clarify" varieties	Arabanase and rhamnosidase are key ingredients that allow Endozym Muscat to quickly de-pectinize the most challenging varieties	20-40 grams per ton of grape

## Enzymes for wines and ciders

<i>Enzyme</i>	<i>Type</i>	<i>Activity</i>	<i>Dosage</i>
<b><i>Aromatic cold maceration enzyme</i></b>			
Endozym Cultivar	Granular enzyme for cold maceration of white grapes	Used at the press or added to the must going to the cold maceration tank. It weakens the cell walls in the pulp facilitating aromas extraction	20-40 grams per ton of grapes
<b><i>Color enzyme</i></b>			
Endozym Contact Pelliculaire	Granular maceration / color-extraction enzyme	Facilitates the dissolution of anthocyanins and improves tannin extraction from skins	20-40 grams per ton of grapes
Endozym ICS 10 Rouge	Liquid maceration / color-extraction concentrated enzyme	Allows must to penetrate the cellular walls, enabling rapid color and phenolic extraction	1 to 3 ml per ton of grapes (1.15-3.45 grams/ton)
<b><i>Aroma and glucanase enzymes</i></b>			
Endozym β-Split	Granulated Beta-Glucosidase specific for aroma extraction	Beta-Glucosidase for aroma enhancement	2 to 4 g/hl or 20-40 ppm or 1/3 lb/1,000 gllons
Endozym Thiol	Liquid carbon-sulfur lyase	It favors the hydrolysis of the thiols precursors and enhances their expression in the wine	20-40 ml (23-46 g) per ton of grape, or 20-40 ppm on must
Endozym Glucapec	Glucanase/Pectinase	To facilitate filterability in wines rich in glucans and to extract polysaccharides from lees	2 to 4 g/hl or 20-40 ppm or 1/3 lb/1,000 gllons

## Enzymes for wines and ciders

Enzyme	Type	Activity	Dosage
<b>Flash-Détente technology and Thermo</b>			
Endozym TMO	Pool of enzymatic activities	For the clarification of heat extracted musts.	2 to 4 ml/hl or 22-44 ppm or 1/3 lb/1,000 gllons
<b>Apple enzymes</b>			
Endozym AlphamyI FJ	α-amylase enzyme for the clarification of cider and perry	To avoid possible starch related haze and to facilitate ultra filtration	2-6 ml/100Kg of apples at 45-50°C. Contact time 60 minutes. If heat isn't available, use 20ml/100Kg and double the contact time
Endozym Pectofruit PR:	Cellulase for increasing yield and help clarification of cider and perry	Insures total degradation of the fruit structure before pressing	30 ml/100Kg of apples at 45-50°C. If heat isn't available use 70 ml/100Kg



## Pectinases for winemaking:

Pectin is a structural polysaccharide present in grapes, its content varies depending on the degree of ripeness. Pectins are released into the must during the crushing operations, provoking an increase in its viscosity, making it difficult to press and to clarify. Ripe grapes contain large quantities of pectolytic enzymes, which are able to hydrolyze practically all the pectins present in soluble form in the pulp. Consequently, must generally contains few soluble pectins (from 0.5 to 1 g / l in the form of Galacturonic acid). However, in most cases, because of the treatments undergone by the grapes, even some of the non-soluble pectins will end up in the must, causing an increase in their concentration (it can rise up to 2.5 g / l) and making it necessary to treat the must with exogenous pectolic enzymes.

Clarification is a very important technological step in white and rosé winemaking. Wines obtained from fermentation of musts rich in solids may carry bigger protein instability, heavy aromas, vegetal characters, bitter flavors and an important phenolic fraction that can negatively affect color and reductive smells. For example methionol (associated with mushroom odors), is an aromatic that is often produced by the yeast when turbidity is bigger than 250 NTU. Clear musts on the contrary will translate in fruitier wines, with finer more stable aromatics.

The most popular technological processes used to achieve must clarity normally are must settling and flotation. Enzymes to facilitate these processes are: Endozym Active, Endozyme Ice, Endozyme ICS 10 Eclair, Endozym Flotation, Endozym Micro and Endozym Muscat.

### *Odors associated with turbidity*

<i>By-product</i>	<i>Descriptor</i>	<i>120 NTU</i>	<i>250 NTU</i>	<i>500 NTU</i>	<i>Sensory Threshold</i>
2-mercapto-ethanol	mercaptan	113 ppb	140 ppb	179 ppb	130 ppb
3-metiltiopionic acid	boiled potatoes	85 ppb	178 ppb	310 ppb	50 ppb
Methyl-2 tetrahydro-thiophenon	cabbage	102 ppb	131 ppb	191 ppb	70 ppb
Methionol	mushroom	1097 ppb	1958 ppb	3752 ppb	1200 ppb

#### **Endozym Active:**

Granular pectinase enzyme to be used to break down pectins before must settling or flotation. It promotes the hydrolysis of the pectic chains, facilitating the drainage of juice from pomace and yielding higher free-run juice as a result of its pectolytic and polygalacturonasic action.

Clarification of musts and wines is significantly accelerated, also resulting in more compact lees. As a result of a cleaner must the wine will have cleaner aromas, less unstable proteins and it will be easier to filter.

**Utilization:** dissolve directly in 20-30 parts of non-sulfurized must or de-mineralized water and add to must or directly onto the grapes. The activity of Endozym Active is reduced by lower temperatures. If the grapes aren't too rich in phenolics, the product can be added directly into the receiving line, thus allowing for good contact time with must before refrigeration. Precaution needs to be taken in order to avoid the enzyme coming into contact with high dosage levels of SO<sub>2</sub> or bentonite.

**Dosage:** 20-40 grams per ton of grape depending on contact time, temperature and SO<sub>2</sub> content.

**Shelf life and storage:** Endozym Active is stable at room temperature for at least two years, with a loss lower than 5% per year starting from the third year.

**Packaging:** 500g vacuum-sealed cans

#### **Endozym Antibotrytis:**

Granular acid protease and beta-glucanase, to eliminate laccase and prevent plugging. Endozym Antibotrytis is a purified enzymatic preparation, with activities useful to solve problems deriving from the presence of Botrytis Cinerea in the must. Endozym Antibotrytis indirectly acts towards polyphenoloxidases (tyrosinase-laccase) present in the must, inactivating them and enabling aromatic precursors to be preserved together with the coloring matter. To guarantee pectins hydrolization and color extraction, Endozym Antibotrytis should be used in association with normal clarification or color extraction enzymes. The treatment with Endozym Antibotrytis is decisive in musts obtained by grapes heavily attacked by grey mold, responsible for problems which cannot be solved either by sulphur dioxide or by other technological solutions.

**Utilization:** Dilute directly in 20-30 parts of non-sulfurized must or in de-mineralized water and add to must or wine.

**Dosage:** 30-50 grams per ton of grapes or 20-40 grams per hl of wine (1.5-3 lbs/1,000gallons). Treatments of musts or wines with a high infection, low temperature and high sugars need the higher dosages.

**Shelf life and storage:** Endozym Antibotrytis is stable at room temperature for at least two years, with a loss lower than 5% per year starting from the third year.

**Packaging:** 500g vacuum-sealed can

***Endozym Ice:***

Extra rapid liquid pectinase enzyme for must settling even at cold temperatures. Endozym Ice is a preparation developed on a solid media, which has been enriched in secondary activities that are able to process the most intricate pectins in the so-called “hairy zones”. This ability results in a very fast de-pectinization that also prevents the inhibition of limiting factors like cold, low pH or SO<sub>2</sub>.

**Utilization:** Dilute directly in 20-30 parts of non-sulfurized must or in de-mineralized water and add to must or directly onto the grapes.

**Dosage:** 2-6 ml per ton of grapes (about 2.3-6.9 grams per ton). The dosages vary according to the grapes to be treated or the vinification technology applied. Treatments of musts with a high percentage of pectins and suspended solids require the higher end of the dosage range.

**Shelf life and storage:** Endozym Ice should be stored at 5°C/40°F for a period not longer than 24 months.

**Packaging:** 1 Kg plastic bottle

***Endozym ICS 10 Éclair:***

High concentration liquid pectinase enzyme. It contains 35,000 Pectin-lyase units per gram, making its clarification activity significantly greater than any other enzyme in the market. It has been specifically formulated to break down grape pectin chains, enabling a rapid reduction of must viscosity and fast sedimentation. With the utilization of this preparation, yields in free run juice are increased and more compact sediment is obtained. The higher concentration guarantees a longer shelf life than any other liquid product and makes the package very easy to store in a small, refrigerated space.

**Utilization:** Dilute directly in 20-30 parts of non-sulfurized must or in demineralized water and add to must or directly onto the grapes. If grapes are too rich in phenolics the product may be added at the press discharge to avoid extraction. For Juice, the dosage should be maintained as the same that would be used for grapes to compensate for shorter contact time or lower temperature.

**Dosage:** 1.5 to 5 ml per ton of grapes (about 1.7-5.75 grams/ton).

**Shelf life and storage:** Endozym ICS 10 Éclair should be stored at 5°C/40°F for a period not longer than 24 months.

**Packaging:** 250 ml & 1kg plastic bottle.

***Endozym Micro:***

Liquid pectinase enzyme. Endozym Micro is a concentrated liquid pectinase enzyme, characterized by its high pectinlyase (PL) content of 16,800 PL units per gram. It promotes the hydrolysis of the pectins and the separation of juice from the pomace, resulting in an increase of free-run juice yield. This enzymatic suspension also speeds up clarification, resulting in more compact lees. As a result of a cleaner must the wine will be more protein stable and easier to filter.

**Utilization:** Dilute directly in 20-30 parts of non-sulfurized must or in demineralized water and add to must or directly onto the grapes. The product can be added directly into the crushed grape line, thus allowing for good contact time with must before refrigeration. Precaution needs to be taken in order to avoid the enzyme coming into contact with high dosage levels of SO<sub>2</sub> or bentonite. Lower temperatures reduce the activity of Endozym Micro.

**Dosage:** 2-6 ml per ton of grapes (about 2.3-6.9 ml per ton). Dosages vary according to the grapes to be treated or the vinification technology applied. Treatments at low temperatures and on musts with a high percentage of pectins and suspended solids require the higher end of the dosage range. Also, pH's lower than 3.2 require higher dosages.

**Shelf life and storage:** Endozym Micro should be stored at 5°C/40°F for a period not longer than 24 months.

**Packaging:** 10 & 25 Kg pales

***Endozym Muscat:***

Granular pectinase for must settling/flotation of “harder to clarify” varieties like Muscat, Gewürztraminer, Malvasia, Müller Thurgau. These grapes are all characterized by their high content in ramified pectins, and by the so called “hairy spots”. These are ramifications of the polygalacturonic acid molecule (pectin) that are much harder to process than regular ones. Secondary activities such as arabanase and rhamnosidase are key ingredients that allow Endozym Muscat to quickly de-pectinize the most challenging varieties. These secondary activities are all encoded on the DNA of the *Aspergillus niger* producing the enzyme, and expressed thanks to the inducers applied during the solid phase fermentation system in our production plant in Paris.

**Utilization:** Dissolve directly in 20-30 parts of non-sulfurized must or de-mineralized water and add to must or directly onto the grapes. Lower temperatures reduce the activity of Endozym Muscat. The product can be added directly into the receiving line, thus allowing for good contact time with must before refrigeration. Precaution needs to be taken in order to avoid the enzyme coming into contact with high dosage levels of SO<sub>2</sub> or bentonite.



**Dosage:** 20-40 grams per ton of grape depending on contact time, temperature and SO2 content.

**Shelf life and storage:** Endozym Muscat is stable at room temperature for at least two years, with a loss lower than 5% per year starting from the third year.

**Packaging:** 500g vacuum-sealed cans

### ***Endozym Flotation:***

Liquid pectinase enzyme for must clarification through flotation or cold settling. To carry over the flotation process successfully we need to be able to push solids against gravity. To do that first of all we need to make sure that fermentation has not started, that the must is not below 55°F/12°C and thoroughly de-pectinized before it hits the flotation unit. Endozym Flotation is a fast acting liquid pectinase enzyme that promotes the hydrolysis of the pectins and the separation of juice from the pomace, resulting in an increase of free-run juice yield and a juice that will be ready to “float” in a reasonable time, preventing risks of early fermentation starts.

**Utilization:** Dilute directly in 20-30 parts of non-sulfurized must or in demineralized water and add to must or directly onto the grapes. The activity of Endozym Flotation is reduced by lower temperatures. The product can be added directly into the press, thus allowing for good contact time with the must before its refrigeration. Precaution needs to be taken in order to avoid the enzyme coming into contact with high dosage levels of SO2 or bentonite.

**Dosage:** 5-10 ml per ton of grapes (5.75-11.5 grams per ton). The dosages vary according to the grapes to be treated or the vinification technology applied. Treatments at low temperature and musts with a high percentage of pectins and suspended solids require the higher end of the dosage range. Also, pH's lower than 3.2 require higher dosages.

**Shelf life and storage:** Endozym Flotation should be stored at 5°C/40°F for a period not longer than 24 months.

**Packaging:** 10 kg pales



### ***Pectin test:***

*Add 15 ml of ethanol to 5 ml of centrifuged must/wine. Let it sit for 60 seconds. If floccules appear after one minute, pectins are still present in the wine and they might cause problems with settling. Most times the test performed this way will give results that are practical enough to understand if the must is de-pectinized. A more accurate procedure requires the ethanol used in the reaction to be acidified. To prepare the “acidified ethanol” solution, pour 250 ml of alcohol, industrial ethanol, into a flask. Add 2.5 ml of chlorhydric acid to the alcohol and mix gently.*

## ***Enzymes for cold maceration of white grapes:***

These enzymes are used to weaken the cell walls of the pulp and to hydrolyze the soluble pectins. They also facilitates the release of the juice and increase yields, avoiding long cycles and high PSI's in the press. The cells of the pulp are more sensitive to the action of the enzymes, due to the low wall thickness and the low tannin content. The enzymatic preparations also act on the cells of the grape skin, but with a lower and decreasing effect on the peripheral areas of the berry, richer in tannins. Also, due to the presence of a protective lipid layer on their surface, enzymes do not have any effect on grape seeds. The enzymatic activities used during the pellicular maceration phase are pectinases (PG, PL, PME), but also some activities that allow the hydrolysis of the ramified areas of pectins. The addition of enzymes like Endozym Cultivar during cold maceration facilitates pressing and clarification, yielding musts that are richer in aromatic precursors.

### ***Endozym Cultivar:***

Granular enzyme for cold maceration of white grapes. Endozym Cultivar is best used at the press or added to the must going to the cold maceration tank. It weakens the cell walls in the pulp facilitating aromas extraction. It also has a very high β-Glucosidase activity to release terpenes from sugars and provides a PL and PG action that is comparable to enzymes used for must settling and yield.

**Utilization:** Dissolve directly in 20-30 parts of non-sulfurized must or de-mineralized water and add directly onto the grapes going to the press. Cold maceration is normally performed by leaving the crushed grapes at 5-8°C/40-46°F for about 24 hours. These low temperatures reduce the activity of Endozym Cultivar. The enzyme should be added directly on the truck/gondola or into the receiving line, thus allowing for good contact time before refrigeration. Precaution needs to be taken in order to avoid the enzyme coming into contact with high levels of SO2 or bentonite.

**Dosage:** 20-40 grams per ton of grapes depending on contact time, temperature and SO2 content.

**Shelf life and storage:** Endozym Cultivar is stable at room temperature for at least two years, with a loss lower than 5% per year starting from the third year.

**Packaging:** 500g vacuum-sealed cans.

## Color and macerating enzymes:

Enzymes known in the industry as “color enzymes” make it possible to extract from the grapes more color, more tannins, more aromatic components and more of their precursors. The musts obtained are typically more structured, easier to clarify and winemakers will get higher yields at the press. On the palate, treated wines are typically rounder, more structured and fruitier, while their color is improved and more stable due to the increased extraction of pigments and tannins.

The addition of these enzymes is carried out either directly on the red grapes at the crusher, or at the beginning of maceration, at the first pump-over. After that, the enzymatic activity is inhibited by the presence of alcohol, and also by the extracted tannins that will bind to the enzyme’s proteins, denaturing it. The extraction enzymes act on the cells of the berry peel, allowing a very rapid extraction of anthocyanins and tannins and a slow extraction of the tannin-polysaccharide complexes of the cell walls. They do not extract any component from the grape seeds, which are protected by an external lipid layer. The activity of these enzymes increases with higher dosages, longer contact time and warmer temperatures.

### **Endozym ICS 10 Rouge:**

Liquid maceration-color extraction concentrated enzyme. Endozym ICS 10 Rouge comes in the form of a super concentrated liquid product. It has been basically reduced down to the active ingredient and winemakers can dilute it down according to their needs. This makes the enzyme more practical to store and ship, avoiding the risk of being left around under the heat where it would quickly lose its activity. It contains 20,000 Pectinase units, making this product’s clarification activity significantly greater than average. The secondary activities (cellulase, polygalacturonase and hemicellulase) that characterize Endozym ICS 10 Rouge, allow it to penetrate the cellular walls, enabling rapid color and phenolic extraction. Wines obtained from grapes treated with Endozym ICS 10 Rouge will be more structured and complex. The pomace treated with this enzyme displays a higher permeability and increases the free-run juice quality and quantity. Its high PL concentration breaks down grape pectin chains, enabling a rapid reduction of must viscosity, faster and more compacted sedimentation.



**Utilization:** Enzymes are proteins and tend to be inactivated by tannins and alcohol. In a red must environment their activity will be limited in time. For this reason, we recommend adding the macerating enzymes only in optimal conditions. This would be at the first pump over, right before fermentation starts, and when the temperature is above 60°F-18°C. A pump over is also a perfect way to mix and homogenize the product.

**Dosage:** 1 to 3 ml per ton of grapes (1.15-3.45 grams/ton). The product should be diluted in 20-30 parts of sulfur-free must or in de-mineralized water. Higher doses must be used for grapes with low pH and cultivars or vintages for which the extraction of color might be particularly difficult.

**Shelf-life and storage:** Endozym ICS 10 Rouge should be stored at 5°C/40°F for a period not longer than 24 months.

**Packaging:** 250 ml & 1kg plastic bottle.

### **Endozym Contact Pelliculaire:**

Granular maceration/color-extraction enzyme. It facilitates the dissolution of anthocyanins and improves tannin extraction from skins, contributing to color stabilization. This pectinolytic enzyme pool with natural secondary cellulase and hemicellulase activities, speeds-up the color extraction process, decreases maceration time, and consequently prevents the extraction of unwanted bitter tannins.

**Utilization:** dilute directly in 20-30 parts of non-sulfurized must or de-mineralized water and add to the tank at first pump-over, or add directly onto the grapes on the truck or conveyer. Enzymes are proteins and tend to be inactivated by tannins and alcohol. In a red must environment their activity will be limited in time. For this reason, we recommend adding the macerating enzymes only in optimal conditions. This would be right when fermentation starts and when the temperature is above 60°F-18°C. A pump over is always a good way to mix and homogenize the product.

**Dosage:** 20-40 grams per ton of grapes depending pH, temperature and SO<sub>2</sub> content. Low pH, temperature and high sulfur, call for the higher end of the dosage range.

Shelf life and storage: Endozym Contact Pelliculaire is stable at room temperature for at least two years, with a loss lower than 5% per year starting from the third year.

**Packaging:** 500g vacuum-sealed cans.

## **Enzymes for the post-fermentative phase:**

These enzymes include activities like beta-glucosidase and carbon-sulphur-lyase activities for the release of aromas. In fact, in grapes and wines, many aromatics are in a combined form, with some terpenes and some thiols linked to a glucose molecule (terpenes) or to cysteine (thiols). These aromatic precursors are not volatile, but they become so thanks to the enzymatic hydrolysis that leads to the release of the aromatic fraction. These enzymes may originate from grapes but also “designer” yeast like Fermol Arome Plus or Fermol Sauvignon, produce a good amount of these enzymatic activities. Winemakers can also decide to boost these activities with commercial products like Endozym B-Split or Endozym Thiol, extracted from *Aspergillus niger*, and much more effective than those naturally present in grapes. This is especially true when the sugar content is lower than 50 g/L, since glucose has an inhibiting effect on the enzyme. Also, during the treatment temperature should not be lower than 16°C/60°F and the duration of the treatment, although varying according to the oenological objective, is not generally less than 15 days. In white wines these enzymes must be removed with Bentogran, to stop their activity. In red wines, richer in polyphenols, there will be no need for bentonite.

### **Endozym $\beta$ -Split:**

Granulated beta-glucosidase specific for aroma extraction. To be added to the fermentation of red rosé and white musts either mid-way through the fermentation or to the finished wines before bentonite addition. It is a beta-glucosidase for aroma enhancement, which has been developed in a solid phase media and therefore expresses a multitude of induced secondary activities. Thanks to these,  $\beta$ -Split is able to cleave aromatics not only from the beta-glucosides, but also from the pentoses non fermentable sugars like rhamnosium, apiosium, arabinosium etc, present in finished wines and often attached to and hiding aromatics.

**Utilization:** dissolve directly in 20-30 parts of non sulfurized must or in demineralized water and add to wine.

**Dosage:** 2- 5 grams per Hl or 20-50 ppm depending on contact time, temperature and SO<sub>2</sub> content. The activity of Endozym  $\beta$ -Split is reduced by high sugar and low temperatures so dosage must be increased accordingly.

Even if its usage is more effective toward the end of fermentation, this enzyme is often used successfully in finished wines. Precaution needs to be taken in order to avoid the enzyme coming into contact with high dosage levels of SO<sub>2</sub> or bentonite. In white and rosé wines, Bentogran should be utilized to neutralize the enzyme when the desired aromatic profile is achieved.

**Shelf life and Storage:** Endozym  $\beta$ -Split is stable at room temperature for at least two years, with a loss lower than 5% per year starting from the third year.

**Packaging:** 500g vacuum-sealed cans

### **Endozym Thiol:**

Liquid carbon-sulfur lyase to favor the hydrolysis of the thiols precursors and enhance their expression in the wine. Thiols are an important component of the bouquet of Sauvignon Blanc, Riesling and Gewürztraminer; however they come anchored to a Cysteine group, which makes them non-volatile. Endozym thiol promotes the conversion of Cys-4-MMP and Cys-3-MH into 4MMP (4-Mercapto-4-methyl-pentan-2-one ) reminiscent of gooseberry and MH (3-mercaptohexan-1-ol), reminiscent of grapefruit.

**Utilization:** Add to the fermenting tank midway through fermentation. Use Elevage Glu for protecting oxidation of the aromatic if this risk occurs.

**Dosage:** 20-40 ml (23-46 g) per ton of grape, or 20-40 ppm on must to be treated depending on time, temperature and SO<sub>2</sub> content.

**Shelf life and storage:** Endozym Thiol should be stored at 5°C/40°F for a period not longer than 24 months.

**Packaging:** 1 liter bottles

### **Endozym Glucapec:**

Enzyme to facilitate filterability in wines rich in glucans, like the ones obtained from *Botrytis* infected grapes. Endozym Glucapec is a  $\beta$ -Glucanase enzyme formulated for the treatment of wines that are rich in glucans and pectins derived both from *botrytis*-infected grapes and from yeast cell walls. *Botrytis cinerea* affected grapes in fact are rich in glucans, a polysaccharide that is considered the principal responsible for the increase in viscosity of musts and wines. The use of  $\beta$ -glucanase preparations obtained from *Trichoderma harzianum* makes it possible to considerably improve the filterability of wines: glucanase enzymes break down the glucan molecula, improving both filterability and the efficiency of wine fining practices. The  $\beta$ -glucanases are also used for the qualitative improvement of the wines kept on their lees. In fact this treatment accelerates the processes of cell-autolysis of the yeast. Autolysis brings in solution amino acids, nucleic acids and mannoproteins, improving the mid palate, the redox potential, the aromatics and even tartaric stability of wines. Ideally this enzyme should be utilized between 60 and 78°F (16-24 °C) , and is never to be used in conjunction with bentonite.

### **Endozym Glucapec activities:**

- *PL Pectinliase: for the degradation of both esterified and non-esterified pectins. It is a crucial activity for all AEB enzymes and allows faster clarifications.*
- *PG Poligalatturonase: for the degradation of non-esterified pectins. Its activity combined with the PE activity helps achieving clear juices.*
- *PE Pectinesterase: teams up with the PG to fragment pectins.*
- *BGU Glucanase: breaks up the b-1,3 and b-1,6 links of glucans.*
- *Arabanase: breaks up the polysaccharide araban (a polymer of a pentose sugar), which may cause haze and difficulties in filtration.*

**Utilization:** Dilute in 20-30 parts wine with low SO<sub>2</sub> or de-mineralized water. Add directly to the wine. The addition must be carried out at the end of the alcoholic fermentation, since the enzyme is strongly inhibited by the action of the yeasts.

**Dosage:** 2 to 4 g/hl or 20-40 ppm or 1/3 lb/1,000 gallons (higher temperatures allow the lower dosages).

**Shelf life:** Stable at room temperature (less than 75°F) for 3 years.

**Packaging:** 500g can.

## **Enzymes for Flash-Détente technology and Thermo.**

### **Endozym TMO:**

Liquid pool of enzymatic activities for clarification of heat extracted musts. It's characterized by strong secondary activities, able to intervene on pectic chains present in the skin. Coming out of thermo processing, these molecules heavily interfere with the brightness of the processed must and are usually harder than normal to degrade. Endozym TMO displays an optimal concentration in pectolitic units and is ideal to remove clogging polysaccharides. In fact this enzyme degrades them, resulting in a marked improvement of must clarity.

**Utilization:** Dilute directly in 20-30 parts of must to which no sulphur has been added or demineralized water. The product should be used immediately after the thermal treatment and after temperature has lowered under 40°C.

**Dosage:** from 20-40 ppm.

**Shelf life and storage:** can be kept for two years in the original sealed packaging and temperature below 10°C.

**Packaging:** 1 kg bottles and 10 kg pales.

## **Enzymes for the clarification of Apple juices for cider making**

### **Endozym Alphamyl FJ:**

α-amylase enzyme for the clarification of cider and perry. It's used on milled apples/pears, or juice, in order to degrade the starch. The α-amylases are able to hydrolyze intact starch granules with the formation of soluble products. They are responsible for the initial degradation of starch granules during malting. α-Amylases, acting on their own, are able to degrade amylose to a mixture of shorter linear α-glucan chains (linear α-dextrins), oligosaccharides, maltose, and glucose. Endozym Alphamyl FJ facilitates the clarification process before fermentation. It avoids possible starch related haze and facilitates ultra filtration.

**Utilization:** Dilute the product 5:10 times in deionized water and mix well into the media. Contact time varies from 1 hour at 45 Celsius (113 Fahrenheit) to 6 hours at 10 Celsius (50 Fahrenheit). Fungal α-amylase is active up to 60°-65°C(140°-149°F) and has optimal activity in the range of 52°-62°C (125°-144°F). The enzyme is completely deactivated above 70°C (158°F).

**Dosage:** will vary according to the temperature of the apples/pears and the maturity (early season fruit has normally more starch so it requires more enzyme). Use 2-6 ml/100Kg of apples at 45-50°C. Contact time 60 minutes. If heat isn't available, use 20ml/100Kg and increase contact time.

**Shelf life and storage:** can be kept for two years in the original sealed packaging away from light, and in a cool, dry, odor-free place at a temperature below 10°C. Do not freeze.

**Packaging:** 1 Kg bottles and 25 Kg pales



**Endozym Pectofruit PR:**

Cellulase for increasing yield and to help clarification of cider and perry. Endozym Pectofruit PR is an ultra-concentrated enzymatic preparation, specifically prepared for the treatment of macerated fruits before pressing. AEB realized this pectolytic enzyme with a particularly high content in pectinlyase (PL), for the total degradation of the fruit structure before pressing. Also, secondary activities like arabanase, cellulase and hemicellulase, work specifically for increasing yield and to help clarification. Advantages: better fruit extraction and viscosity improvement, yield increase during pressing, effective action on scraping or mash even with a limited contact time. Fruits where Endozym Pectofruit PR can be used with effectiveness other than apples include: red fruits, such as currant, raspberries and blackberries, summer fruits such as peach, plum and apricot.

**Utilization:** Dilute the product 5:10 times in deionized water and mix well into the media. Dilute the product 5:10 times in deionized water and mix well into the media. Contact time varies from 30 minutes at 45 Celsius (113 Fahrenheit) to 2-3 hours at 10 Celsius (50 Fahrenheit). It is normally used before pressing.

**Dosage:** Use 30 ml/100Kg of apples at 45-50 Celsius, if heat isn't available use 70 ml/100Kg

**Shelf life and storage:** can be kept for two years in the original sealed packaging away from light, and in a cool, dry, odor-free place at a temperature below 10°C. Do not freeze.

**Packaging:** 1 Kg bottles and 25 Kg pale.

**Tannins**

**Fermentation Tannins:**

It is pretty much agreed in the winemaking community that the addition of tannins to the fermentation brings advantages to color stability and also helps to have lower VA and overall a cleaner fermentation without the usage of SO2.

Some of these added tannins will be lost, leaving the natural tannins in solution and in fact, these so called "sacrificial tannins", will precipitate with proteins in the first stages of fermentation. These are proanthocyanidines derived from grapes or Quebracho, a wood rich in condensed tannins of natural high molecular weight. The balance of the proanthocyanidines left in solution will be the substrate for color stability and the backbone of the finished wine.

<b>EB Fruit Reserve</b>	Liquid oak tannin with nuances of maple syrup, caramel and vanilla
<b>Ellagitan Barrique Liquid</b>	Liquid oak tannin with nuances of vanilla, whisky lactone and coconut
<b>Ellagitan Barrique Rouge</b>	Powdery oak tannin with nuances of vanilla, Whisky Lactone and coconut
<b>EB XO</b>	Liquid oak tannin with nuances of Syringaldheyde (Smoky), spices and vanilla
<b>Ellagitan Chene</b>	Powdery oak tannin to elevate fruit expression
<b>Ellagitan Extreme</b>	Powdery oak tannin to elevate fruit and spices expression
<b>Ellagitan Refill</b>	Un-toasted oak tannin to re-establish the redox potential
<b>Fermotan</b>	Fermentation tannin with 60% proanthocyanidins and 40% ellagic tannins. For color stabilization and structure

<b>Fermotan Blanc</b>	Ellagic tannin for structure and protection from oxygen
<b>Fermotan Liquid</b>	Liquid version of Fermotan
<b>Gallovin</b>	Tannin from gallnuts to protect from oxygen and to neutralize laccase from Botrytis
<b>Gallovin Liquid</b>	Liquid version of Gallovin
<b>Protan Biopeel</b>	Organic liquid grape-skin-derived tannin
<b>Protan Bois</b>	Quebracho derived tannin for aging structure and color stabilization
<b>Protan Malbec</b>	Nutty and structured grape-seed derived tannin
<b>Protan Peel</b>	Liquid grape-skin derived tannin
<b>Protan Pepin Oxilink</b>	Old-world style grape-seed derived tannin
<b>Protan Raisin</b>	“Velvety” and structured grape-skin derived tannin
<b>Tanethyl</b>	Fast polymerizing, grape-seed-derived tannin
<b>Tanethyl Effe</b>	Tanethyl product blended with ellagic tannins
<b>Taniblanc</b>	Strong antioxidant, highly reactive, ellagic tannin
<b>Taniquerc</b>	Chocolate-mocha style, granulated oak tannin. Ideal for MOX processing



**Fermotan and Fermotan liquid:**

A highly reactive tannin developed for quick reaction both with proteins and with colored pigments. It contains 40% ellagic and 60% proanthocyanidinic tannins, and, when added during fermentation, it rapidly acts as “sacrificial tannin”, stabilizing red wine color and optimizing the level of noble tannins. Fermotan works best in presence of alcohol, during the first phase of fermentation, when color is released and needs to be stabilized. This normally happens in the first five days of maceration. Later additions of Fermotan will also benefit color stability and structure. This product is available both in liquid and powdered form.

**Utilization:** mix in a separate tub 1:10 with warm water (35°C/95 °F) or juice and then add to the fermenting must during pump over.

**Dosage (Powder):** 12-48 g/Hl (1-4 lb/1000 gal) in red must. Dosage (Liquid): consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. Average dosages in red must range 120-960 ppm or 10-80 ml/Hl (380 ml-3 lt/1,000 gallons or 1-8 lb/1000 gal).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging (Powder):** 1 kg packets, 15 kg bags.

**Packaging (Liquid):** 5 kg bottles, 25 kg drum (about 4.16-20.8 liters).

**Fermotan Blanc:**

Adds “oaky” structure to white musts and protects wines from oxygen and free radicals. It contains ellagic tannins from oak that have the capability to build a smooth structure and gallic tannins to protect the wine from oxygen. It produces wines with better structure, reduces roughness and preserves the aromatic freshness for a longer period of time. Fermotan Blanc acts in synergy with sulfur dioxide, retaining a higher percentage of free SO<sub>2</sub>, both at the beginning and at the end of fermentation. In this way SO<sub>2</sub> additions can be significantly reduced.

**Utilization:** Dissolve 1:10 in must or warm water (35°C/95°F) and add as early as possible to the grapes. The best application is to add it directly in the bins or gondola, or at the grape conveyer.

**Dosage:** 5 to 40g/Hl (1/2-3 lbs/1000 gal) in white musts.

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg packets

**Tanéthyl Effe:**

Tannin for color stabilization in cold soak and for rosé wines. It's a blend of ellagic tannins from oak and proanthocyanidinic tannins from grapes. The condensed tannin fraction is extracted from grape seeds by means of a patented system, which locks an active ethanal bridge into the tannin. Ethanal bridges have been shown to be greatly responsible for color stabilization and tannin polymerization. The utilization of Tanéthyl Effe is highly recommended for stabilizing color during cold-soak of red wines (and the first stage of fermentation). It provides the juice (or fermenting wine) with the ethanal bridges that would otherwise not be present due to low ethanol concentration. Tanéthyl Effe also contains simple ellagic tannins that give smoothness and promote color stabilization when fermentation begins.

**Utilization:** Mix 1:10 in a separate tub with warm water (35°C/95°F) and then add to the grapes or to fermenting must during pump over.

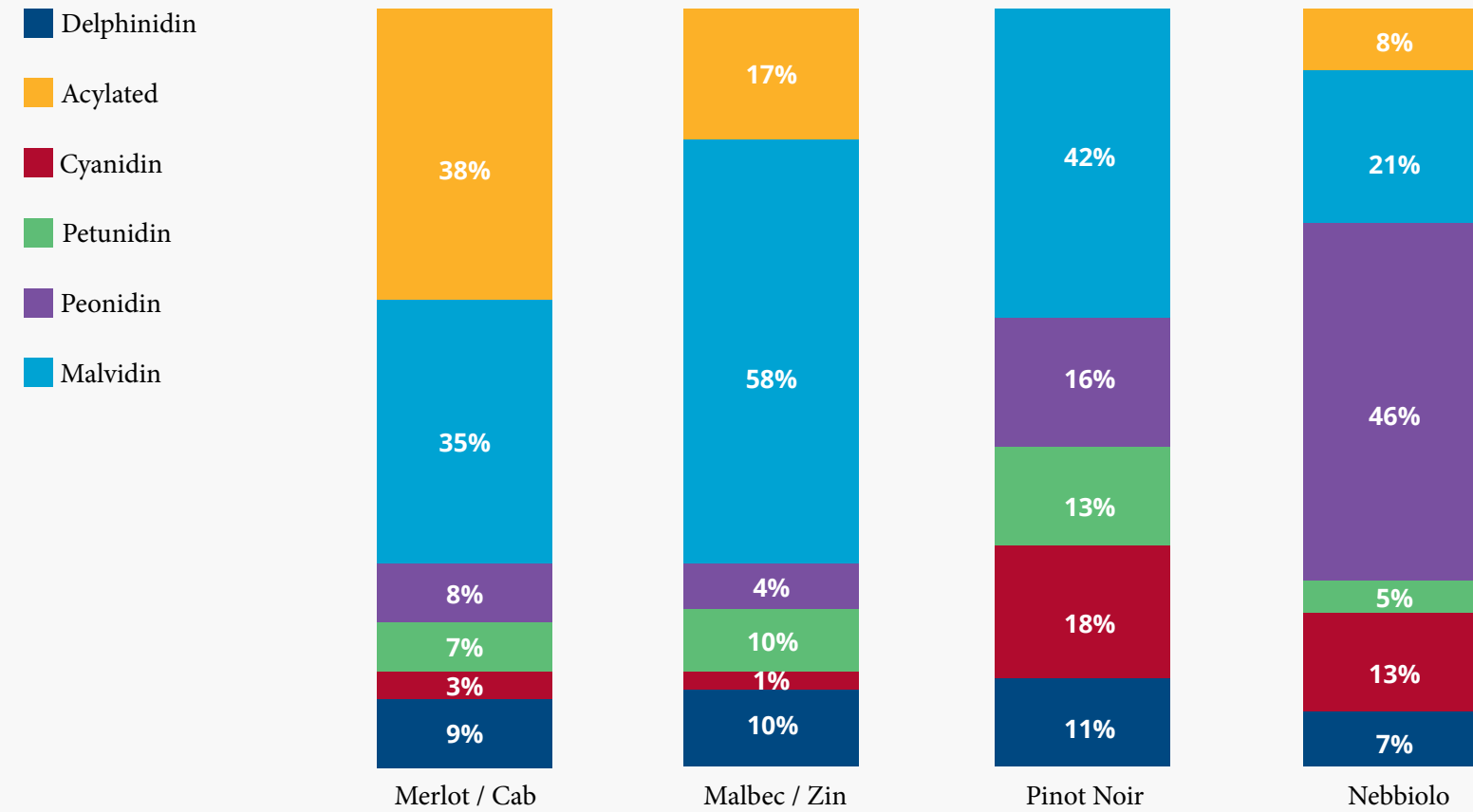
**Dosage: Rosé wines:** 4 to 12 g/Hl (1/3–1 lb/1000 Gal). **Red wines:** 12 to 36 g/Hl (–3 lb/1000 Gal).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg packets

## About color stability:

### A study on tannins additions during fermentation and the different needs among red varieties



Color, or better anthocyanins, are polyphenolic compounds present in red grapes located in the vacuoles of the skin cells and, in tenturier varieties, also in the pulp. They come in different forms that define their stability. Every variety changes the typical profile and the proportion of disubstituted forms (cyanidin and peonidine), less stable, trisubstituted forms (delphinidin, petunidin, malvidin), more stable and the acylated forms, even more stable where present. AEB R&D labs, in collaboration with the University of Turin, have carried out a study on different tannins additions for color stability applied to a pool of varieties representative of some commonly cultivated grapes. For the most common scenarios like for Malbec, Zinfandel, Cabernet, Merlot and even for delicate varieties like Nebbiolo, Sangiovese and Pinot Noir, skin tannins like Protan Raisin and Protan Peel seemed to have an improving effect on color stability, especially when added in the first 6 hours after crushing. For best results this addition was then complemented with Fermotan or Protan Bois.

For the most delicate varieties, like Nebbiolo and Sangiovese, an addition of Gallovin as antioxidant was also beneficial. For varieties where Malvidin is very prevalent, like in Syrah and Touriga Nacional, the addition that gave the best results was Protan Malbec or Protan Peel after 72 hours.

### Color stabilization strategies may vary, depending on grape variety

Cultivar	Anthocyanins	Best addition
Type Malbec/Zin	Tri-substituted	Protan Raisin in the first 6 hours and Fermotan after
Type Syrah	Malvidin-prevalent	Protan Malbec and Protan Peel after 72h
Nebbiolo	Mostly Di-substituted	Gallovin & Protan raisin to start and then Protan Bois.
Type Cab/Merlot	Balanced profile	Protan Raisin and Protan Bois in all scenarios



## Hydrolysable tannins

*(ellagic tannins from oak or gallic tannins from gallnuts)*

### **Ellagitan Extreme:**

Is an ellagic tannin extracted from toasted American oak staves. It is sweet with hints of licorice, cloves, pepper and chocolate, along with very high vanillin content. It is often used in red wines to hide vegetal characters and to open them up, helping to release a bouquet richer in cherries and red fruits in general. Both in red and white wines it adds a round and complex structure that is never bitter or astringent, even at high dosages. When used in complex and fruity red wines like Shiraz, Cabernet Sauvignon and Merlot, expect the fruit to be enhanced and integrated with sweet nuances of chocolate and licorice. When used in big whites like Chardonnay and Viognier, it gives a longer finish and keeps the wine fresh and fruity.

**Utilization:** rehydrate in warm water (35°C/95°F) or wine, for 1\2 hr before mixing. Then make a 1:10 slurry and add directly to circulating tank or barrel. Wait at least a week before filtering.

**Dosage:** 12-50 g/Hl (1-4 lbs/1000 gal)

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg packets

### **Ellagitan Refill:**

Un-toasted oak derived ellagic tannin that, along with oxygen, promotes ethanal production for phenolics polymerization. This is a crucial step in aging red wines and in building a smoother structure. In fact, un-toasted ellagic tannins catalyze the aging process, where tannins from seeds and skins lose roughness and become more elegant and “chewy”. At the same time, color is stabilized. Ellagitan Refill is an ellagic tannin in an aqueous solution, originally studied by AEB to reintegrate the ellagic fraction lost in used barrels, enabling them to be re-used for a longer time without losing their ability to promote optimal wine aging. The same tannin may be used as a way to increase structure or in tanks to optimize micro-oxygenation. Its hydrolysable nature also helps to cure the presence of reductive odors.



**Directions for use:** Dilute in ten parts of wine and add to mass by pumping over or mixer. Allow at least a week before filtering.

**Dosage:** consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. Average dosages range 120-720 ppm or 10-60 ml/Hl (380-2,280 ml/1,000 gallons or 1-6 lbs/1000 gal).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg bottles and 25 kg pales.

### **Taniblanc:**

Enhances fruit expression and oxidation resistance in white and rosé wines. It's a soft ellagic tannin derived from prized oak, and highly purified for usage in musts, red, white and rosé wines. Its antioxidant activity protects the wines during the entire period of bottle maturation and reduces the needs of chemical preservatives like sulfur and ascorbate. The use of Taniblanc, even from the early stages of white must processing, produces straw-yellow wines with youthful and intense varietal characterization. It balances wine structure, eliminating the coarseness caused by an excessive content of proanthocyanidinic tannins.

**Directions for use:** Re-hydrate in warm water (35°C/95°F) or wine, for 1/2 hr before mixing. Then make a slurry 1:10 in wine and add directly to circulating tank or barrel.

#### **Dosage:**

*red wines:* 12-50 g/Hl (1-4 lbs/1000 gal);

*rosé wines:* 12-25 g/Hl (1-2 lbs/1000 gal);

*white wines* 6-12 g/Hl (1/2-1 lbs/1000 gal).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg packets

### **Taniquerc:**

Derived from toasted French oak, is an ellagic tannin that promotes tannins polymerization during micro-oxygenation and that highlights the structure of red wines in general. The tannic infusion has been extracted by means of prolonged maceration in cold water. This technique promotes the precipitation of the bitter substances present in toasted woods. If used with micro-oxygenation, Taniquerc promotes the violet color, fragrance and taste, typical of barrel-matured wines. It also prolongs the aromatic persistency and the aftertaste of wines and increases the efficiency of used barrels.

**Utilization:** rehydrate in warm water (35°C/95°F) or wine, for 1/2 hr before mixing. Then make a slurry 1:10 in wine and add it directly to circulating tank or barrel

**Dosage:** 12-50 g/Hl (1-4 lbs/1000 gal).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg packets and 15 kg bags

### **Gallovin and Gallovin Liquid:**

A gallic tannin which could be used as a structuring additive but is mostly geared for protecting from all risks of oxidation, including botrytis infection. Gallovin is also very reactive with proteins. This favors protein stability in white and rosé wines. In reds it becomes a sacrificial tannin and minimizes the loss of phenolic compounds from the grapes; preserving the noble tannins that would normally precipitate with proteins. The main innovation that AEB brought with this product is the pure and neutral nature of the gallic tannin. Only the core of the gallnuts is used as raw material, making Gallovin a colorless and odorless product that will not affect wine flavors, but will reduce the needs for antioxidants such as SO<sub>2</sub> and ascorbic acid.



**Utilization:** Dilute in ten parts of wine and add directly on top of the grapes, must or to the wine by pumping over or mixer.

**Dosages for powder:** on rotten grapes about 150-200 grams per ton (or 1 pound every 2-3 tons of grapes).

During oxygen exposure of wine and musts (rackings, blendings, bottling) about 50 ppm.

**For Gallovin Liquid, consider this conversion factor to do additions:** 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. Average dosages range in musts is 120-360 ppm or 10-30 ml/Hl (380-2,280 ml/1,000 gallons or 1-6 lbs/1000 gal). Add about 200 ml per ton of grapes.

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging (powder):** 1 kg bags and 5 kg bags

**Packaging (liquid):** 1 kg bottles and 25 kg pales.

## The Ellagitan Barrique Line

### American and French Oak derived tannins in liquid and powdery forms for fermentation, aging and fine tuning

In general, when using oak extracts, oak derivatives or barrels, French products contribute with more vanilla and more structure, resulting in a balanced extraction. American oak products contribute with more volatile phenols, like eugenol and guaiacol (spices/smoky) or aldehydes like furfural (almonds). Interesting profile often not supported by a good structuring tannin extraction. All the tannins from the Ellagitan Barrique line are adjusted for a balanced content in structuring tannins.

The different Ellagitan Barrique liquid products vary their aromatic profile depending both on the source of wood but also on the toasting levels. Air seasoning initiates the polymer's breakdown into simple sugars in the raw material. As oak climbs through 300°F during toasting, more simple sugars are formed. Caramelized sugars and sweet-associated aromas then develop. Toasty characters develop as the oak temperature exceeds 420°F. Structural differences in American oak's hemicellulose and lignin result in more intense wood sugars, and "toastiness". More toasting in general decreases the Whiskey Lactons making the profile more rich in toffee and toasted-smoked aromas.

### Ellagitan Barrique Liquid:

The most "French" of the five; with the most vanilla. Opens up the fruit of the wine, enhancing the red and black berries. Also brings a peppercorn note to the spices in the bouquet. Great to hide defects in certain wines.

**Utilization:** dilute in 10 parts of wine and add to fermentation or at any other stage. It is better to avoid additions 2 weeks before micro-filtration.

**Dosage:** consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. According to our experience this tannin can be used on red wines up to 8.5 lbs/1,000 gallons (about 1,000 ppm). Average dosages range 120-720 ppm or 10-60 ml/Hl (380-2,280 ml/1,000 gallons or 1-6 lbs/1000 gal). Minimum dosage for light nuances in reds is 120 ppm (1lb/1,000 gallons). Higher dosage will increase the impact. In whites it may be dosed at 30-120 ppm (1/4-1 lb/1,000 gallons).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg bottles, 10 kg pales. A sediment will accumulate in the bottle, that's normal and it could be partially dissolved in wine or hot water.

## Ellagitan Barrique line analyses

µg/g	Ellagitan Barrique	EB XO	EB Fruit Reserve	EB Berry Mix	EB Goud-Ron
Furfurale	101	1	109	40	190
5-Metil furfurale	25	45	33	0	12
2(5H)-furanone	15	22	22	50	12
5-Idrossi metil furfurale	141	168	184	70	142
Coniferaldeide	0	1625	822	0	0
Guaiacolo	115	53	49	70	142
Siringaldeide	4706	5075	2598	3300	6760
Fenolo	11	5	7	43	13
Eugenolo	2	3	3	1	2
Isoeugenolo	2	5	6	nd	nd
4-Vinil guaiacolo	14	33	34	nd	nd
cis-Wisky lattone	2	0	0	5	13
trans-Wisky lattone	93	43	66	210	540
Vanillina	1541	1084	806	1700	2220
Acido vanillico	69	19	1	nd	nd
Acetovanillone	185	127	110	nd	nd
Acido omovanillico	217	265	266	130	120
2,Feniletanolo	nd	nd	5	400	61,0
Etilsuccinato	nd	3	15,0	82,6	12,1

■ Caramel, almonds, furfural  
 ■ Syrup  
 ■ Smoky, woody  
 ■ Spices, cloves  
 ■ Coconut  
 ■ Vanilla  
 ■ Berry

### ***EB Berry Mix:***

Released in 2019, this ellagic tannin is coming from a new technology of production that retains more of the original oak flavors. It helps stabilizing the color but also introduces a soft note that brings structure and smoothness. In the nose, it enhances the sweet notes of the fruit and brings along a pleasant bouquet of spices and toasted oak.

**Utilization:** dilute in 10 parts of wine and add to fermentation or at any other stage. It is better to avoid additions 2 weeks before micro-filtration.

**Dosage:** consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. Average dosages range 120-720 ppm or 10-60 ml/Hl (380-2,280 ml/1,000 gallons or 1-6 lbs/1000 gal). Minimum dosage for light nuances in reds is 120 ppm (1lb/1,000 gallons). Higher dosage will increase the impact. In whites it may be dosed at 30-120 ppm (1/4-1 lb/1,000 gallons).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg bottles, 10 kg pales. A sediment will accumulate in the bottle, that's normal and it could be partially dissolved in wine or ho

### ***EB Fruit Reserve:***

Has the least impact on the aromatics of the wine among the five liquid Ellagitan Barrique products, meaning that it marks less and should not be used to cover defects. It helps the wine to "take-off" with what the wine already has, enhancing the fruit and opening up the bouquet. It also bring notes of almonds and caramel.

**Utilization:** dilute in 10 parts of wine and add to fermentation or at any other stage. It is better to avoid additions 2 weeks before micro-filtration.



**Dosage:** consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. Average dosages range 120-720 ppm or 10-60 ml/Hl (380-2,280 ml/1,000 gallons or 1-6 lbs/1000 gal). Minimum dosage for light nuances in reds is 120 ppm (1lb/1,000 gallons). Higher dosage will increase the impact. In whites it may be dosed at 30-120 ppm (1/4-1 lb/1,000 gallons).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg bottles, 10 kg pales. A sediment will accumulate in the bottle, that's normal and it could be partially dissolved in wine or hot water.

### ***EB Goud-Ron:***

Released in 2019, this ellagic tannin is coming from a new technology of production that retains more of the original oak flavors. It helps stabilizing the color, but also introduces a soft note that brings along structure and smoothness. In the nose, it shows notes of "goudrone" (tar), a typical descriptor of old world wines, reminiscent of the ones found in the great reds from Rhône and Piedmont.

**Utilization:** dilute in 10 parts of wine and add to fermentation or at any other stage. It is better to avoid additions 2 weeks before micro-filtration.

**Dosage:** consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. Average dosages range 120-720 ppm or 10-60 ml/Hl (380-2,280 ml/1,000 gallons or 1-6 lbs/1000 gal). Minimum dosage for light nuances in reds is 120 ppm (1lb/1,000 gallons). Higher dosage will increase the impact. In whites it may be dosed at 30-120 ppm (1/4-1 lb/1,000 gallons).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg bottles, 10 kg pales. A sediment will accumulate in the bottle, that's normal and it could be partially dissolved in wine or hot water.

**EB XO:**

The most noticeable in the nose among the five liquid Ellagitan Barrique products. It gives a smoky/toasted note that works great for wines where we want to enhance the spices, chocolate, leather and earthy sensations. Not recommended in smoke tainted or Brett-affected wines.

**Utilization:** dilute in 10 parts of wine and add to fermentation or at any other stage. It is better to avoid additions 2 weeks before micro-filtration.

**Dosage:** consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. Average dosages range 120-720 ppm or 10-60 ml/Hl (380-2,280 ml/1,000 gallons or 1-6 lbs/1000 gal). Minimum dosage for light nuances in reds is 120 ppm (1lb/1,000 gallons). Higher dosage will increase the impact. In whites it may be dosed at 30-120 ppm (1/4-1 lb/1,000 gallons).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg bottles, 10 kg pales. A sediment will accumulate in the bottle, that's normal and it could be partially dissolved in wine or hot water.

**Ellagitan Barrique Rouge:**

This granulated tannin is extracted from highly toasted oak wood. The seasoning process exceeds two years, and is identical to the technique used when producing the most prized barrels. The innovative physical system used for extracting this ellagic tannins, hydrolyzes and then precipitates the other bitter substances. Added polysaccharidic micro-molecules encapsulate the aromatic properties of toasted oak, preventing their dissipation during spray drying. Ellagitan Barrique Rouge prolongs the aromatic persistency, improves the mellowness of wines and integrates their aromatic complexity with delicate nuances reminiscent of chocolate and vanilla. Ellagitan Barrique Rouge can also be used to extend the life of used barrels. It offers numerous advantages over other oak alternatives: it is immediately soluble, does not release undesirable substances, such as resins or bitter compounds, and inhibits bacteria or mold contamination reducing the need for SO<sub>2</sub>. Furthermore there is no color or wine loss due to wood absorption. Directions for use: Re-hydrate in warm water (35°C/95°F) or wine, for at least ½ hr before mixing. Then make a slurry 1:10 in wine and add directly to circulating tank or barrel. Allow at least a week before filtering.

**Dosage:** Minimum dosage for light nuances in reds is 100 ppm (0.8 lb/1,000 gallons). Higher dosage will increase the impact. In whites it may be dosed at 30-120 ppm (1/4-1 lb/1,000 gallons).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 500 grams and 10 kg bags.

**Ellagitan Barrique Blanc:**

Clear version of the powdery oak tannin described above. Extracted from French oak staves. Will have minor effects on the color. Ellagitan Barrique Blanc is used to highlight the varietal aromas of white and rosé wines. It is also used successfully on Craft Ciders. It has a soft velvety taste and also carries antioxidant properties, which preserve varietal aromas, and develop bouquet complexity by regulating the redox potential during the fermentation and post-fermentation stages. It inhibits bacteria or mold contamination reducing the need for SO<sub>2</sub>. It is recommended for those wines that have had a prolonged cold skin-contact maceration, which are often rich in polyphenols and tend to brown. Wines treated with Ellagitan Barrique Blanc are intense and complex to the nose, due to the synergy of the tannin with primary fermentation aromas. Wines will result fresher and lively to the palate, free of unpleasant bitterness and rich in body, like after oak barrel-aging.

**Directions for use:** re-hydrate in warm water (35°C/95°F) or wine, for at least ½ hr before mixing. Then make a slurry 1:10 in wine and add it directly to circulating tank or barrel. Allow at least a week before filtering.

Dosage in white wines: 6- 50 g/Hl – 1/2-4 lbs/1000 gal.

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 500 grams packets.

## Condensed tannins (Grape or Quebracho derived)

### **Protan Bois:**

proanthocyanidinic tannin extracted from Quebracho wood. Mostly utilized in red wines that need a stronger “structure-boost” on a budget. The nature of this flavanol is very different from the ones from grapes, and it needs a little more time to integrate (about 30-60 days depending on dosage). It strengthens and amplifies the tannin structure, stabilizes the color and reverses the oxidation process adsorbing aldehydes and port-like odors. In our trials it has shown its best effect on color stability, when added in the final part of the fermentation.

**Utilization:** mix 1:10 in warm water (35°C/95°F) or wine and add directly to circulating tank or barrel.

**Dosage:** 5-50 g/Hl (1/2 -4 lbs per 1000 gallons). Because of the powerful structure of this tannin it is recommended to allow 15 days of integration before judging the results. After the addition, wait at least one week before filtering the wine.

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1kg and 5kg packets.

### **Ptotan Malbec:**

Throughout history, the wines from Bordeaux have enjoyed the soft and important structure brought by the proanthocyanidins derived from Malbec grapes. It was only after the frost of 1956 that many French vintners abandoned Malbec as a favorite blending component. AEB is now able to provide wineries with the same component that has been the base of the Bordeaux blends for many years. Protan Malbec is a powdered proanthocyanidinic tannin extracted from Malbec seeds, that brings to red wines a sweet but strong backbone structure and color stability.

In white wines, a small addition goes a long way in protecting from oxygen, building volume and especially enhancing crispness. For this it is also recommended to fix “flat” and “doughnut” white and rosé wines.

**Utilization:** mix 1:10 in warm water (35°C/95°F) or wine and add directly to circulating tank or barrel. After the addition, wait at least one week before filtering the wine.

**Dosage:** Whites: 3 to 12 g/Hl (1/4-1 lb/1000Gallons). Reds: 12-40 g/Hl (1-3 lbs/1000 gallons in reds).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 500 grams packets

### **Protan Peel:**

Tannin obtained from unfermented and pressed grape skins, elaborated by a special extraction system for proanthocyanidins that does not alter them and keeps them reactive. This reactivity results in high astringency in the moment when the addition is performed, but also in a quick softening during the first 3-4 weeks of maturation. In a trial performed on a Pinot Noir, an addition at bottling of 2.5 lbs/1,000 of different tannins was compared to oak tannins. Protan Peel addition resulted in a longer shelf life of the wine. It kept expressing fresh fruit for a longer time compared to the untreated control and to wines treated with toasted-oak-extracts. Other experiments, outlined on page 61, have showed the good results that this tannin brings in terms of reactivity with color and the consequent color stability. For the most common scenarios like for Malbec, Zinfandel, Cabernet, Merlot and even for delicate varieties like Nebbiolo and Sangiovese and Pinot Noir, Protan Peel seemed to have an improving effect on color stability, more so when added in the first 6 hours of fermentation. For varieties where Malvidin is prevalent, like in Syrah and Touriga Nacional, the timing that gave the best results was the addition of Protan Peel after 72 hours of fermentation.

**Utilization:** Mix in warm water (35 °C/95 °F) or wine and add directly to circulating tank or barrel.

**Dosage:** consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. For whites 30 ppm are a good starting point for light varieties like Sauvignon Blanc, Chenin or even French Colombard. In Reds start with 10-50 g/Hl (1-5 lbs/1000 gallons). The higher dosages are recommended in fermentation.

**Shelf life and storage:** can be kept for two years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg bottle and 10 kg pales

### ***Protan Biopeel:***

The same tannin described above (Protan Peel), is available with organic certification upon request.

**Utilization:** Mix in warm water (35 °C/95 °F) or wine and add directly to circulating tank or barrel.

**Dosage:** consider this conversion factor to do additions: 10 ppm = 1g/hl = 0.083 lb/1,000 gallons = 0.85 ml/hl or 32 ml/1,000 gallons. For whites 30 ppm are a good starting point for light varieties like Sauvignon Blanc, Chenin or even French Colombard.

In Reds start with 10-50 g/Hl (1-5 lbs/1000 gallons). The higher dosages are recommended in fermentation.

**Shelf life and storage:** can be kept for two years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg bottle and 10 kg pales

### ***Protan Pepin Oxilink:***

Seed tannin obtained from over-ripe, “crunchy” and “nutty” seeds from the Burgundy area of France. It improves the structure and color stability of red wines. In white wines, a small addition goes a long way in protecting from oxygen, building volume and also enhancing crispness. Protan Pepin naturally integrates the polyphenolic structure of wines and reverses the oxidation process. Aldehydes and port-like odors are adsorbed to be used as ethanal bridges for the polymerization of the complex molecule, that ultimately leads to softer tannins and color stability.

**Utilization:** Mix in warm water (35 °C/95 °F) or wine and add directly to circulating tank or barrel.

**Dosage:** whites: 3 to 12 g/Hl (1/4-1 lb/1000Gallons). Reds: 10-50 g/Hl (1-5 lbs/1000 gallons).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 500 gram packets



### ***Protan Raisin:***

Granulated grape skin tannin from Burgundy. It brings its best when used to integrate the oak and the fruit of the wine, building a soft structure around it. In white wines, a small addition goes a long way in protecting from oxygen, building volume and to enhance crispness. Proanthocyanidin from grape skins, adds a velvety smooth structure and reverses the oxidation process, absorbing aldehydes and port-like odors. Protan Raisin is a pure proanthocyanin tannin extracted from grape skins. Like all proanthocyanin tannins, skin tannins are naturally present in grapes. Protan Raisin boosts the body and mid-palate of the wine simulating extended maceration, without the downside of bitter compounds. Proanthocyanidin are also the final receptor for color pigments and polymerizing tannins, ensuring the correct development of wine during the aging process. The presence of Protan Raisin stimulates polymerization making a wine mellow and harmonious. For the most prestigious Pinot Noirs and all organic wines, it can be used in fermentation to stabilize color and to protect from oxygen. This way minimizing the usage of other antioxidant chemicals.

**Utilization:** Mix in warm water (35 °C/95 °F) or wine and add directly to circulating tank or barrel. When adding Protan Raisin in a bench trial, wait for at least 3 days to evaluate. The strong flavor deriving from the dry tannin gives a note that is not completely pleasant until the tannin is fully integrated into the wine. Also, give the tannin a week to integrate before filtering the wine.

**Dosage- Whites:** 3 to 12 g/Hl (1/4-1 lb/1000Gallons).

**Dosage - Reds:** 10-50 g/Hl (1-5 lbs/1000 gallons).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 500 gram packets

### **Tanéthyl:**

Tannin extracted from grape seeds by means of a patented system, which locks an active ethanal bridge to the tannin. Ethanal bridges have been shown to be greatly responsible for color stabilization and tannin polymerization. Tanethyl is a great tool for achieving the big, soft structure provided by micro oxygenation, without using oxygen. It can be used both in reds and whites to increase volume and to balance a rough polyphenolic profile. It has been used successfully used to lock and stabilize the color during cold soak. In fact the color extracted during this process is hardly fixed on the tannins because the lack of alcohol makes ethanal bridges unavailable for the tannin-ethanal-color polymerization. Tanethyl can form that polymer without the need of alcohol. In wines with high pH's where micro-oxygenation is not recommended, Tanethyl can continue the polymerization process of polyphenols even in a reductive environment.

**Utilization:** Mix in a separate tub with warm water (35 °C/95 °F) and then add to the grapes or to the fermenting must during pump over. If used in a finished wine, after addition, wait at least one week before filtering the wine.

**Dosage- rosé wines:** 5 to 15 g/Hl (1/3 – 1 lb/1000 Gal),

**Dosage- red wines:** 12 to 36 g/Hl (1– 3 lbs/1000 Gal).

**Shelf life and storage:** can be kept for three years in the original sealed packaging away from light, and in a cool, dry, odor-free place.

**Packaging:** 1 kg packets

## **Bench Trials**

***To make a bench trial with one of these products, liquid or powder, you'll need:***

- Scale precise to the tenth of gram.
- 100 ml graduated cylinder.
- 10 ml graduated pipette.
- Containers for the product solutions (1 for each product trialed).

*To make each product solution, weigh 1 gram of product, add some wine, and bring the solution to 100 ml with wine. Now, note that in a bench trial every 1 ml of that product solution added to 100 ml of wine, will be equal to an addition of 10 g/hl or 100 ppm (or 0.83 lb/1,000 gallons). For example to make a 375ml sample with 10 g/hl or 100 ppm of product, just add 3.75 ml of the product solution to the bottle.*

## **Polysaccharides**

<b>Arabinol Arome</b>	Liquid gum Arabic based product to stabilize aromas and to soften the mid-palate
<b>Arabinol</b>	Liquid gum Arabic. it smooths out the mid-palate, helps with tartrate stability and preserves free SO2
<b>Arabinol HC</b>	
<b>Batonnage Plus Elevage</b>	Yeast derived mannoprotein, to add roundness and to protect from oxidation
<b>Batonnage Plus Texture</b>	
<b>Batonnage Plus Structure</b>	Yeast derived mannoproteins with ellagic tannins to add roundness and Structure
<b>Elevage Glu</b>	High glutathione, yeast-derived peptide. Provides volume & protection from oxygen
<b>Super-Mann</b>	Pure mannoprotein for tartaric stabilization and wine smoothening

### ***Polysaccharides: when & why***

•In red wines fermentation, aging and cold stabilization: it has been noticed that the addition of polysaccharides inhibits the combination of positively charged molecules (proteins), with the negatively charged ones (color).

•Between primary and malolactic fermentation or to extend shelf-life in general: these polysaccharides in general slow down chemical reactions, including oxidation. Therefore they become a perfect substitute for SO2 , when sulfur can't be added to facilitate malolactic bacteria. Also, all the yeast derived products contain a significant amount of glutathione, a strong natural antioxidant. Among all, Elevage Glu is the best additive for this purpose.

It is common, especially during the cold season (or during tartaric stabilization), that a lot of these combinations naturally occur in red wines. When anthocyanines polymerize with proteins, they precipitate down and their red color is permanently lost.

•Before bottling, to improve mouthfeel: polysaccharydes build a mid-palate which is very similar to the one given by residual sugars. Only, polysaccharides do not add real sweetness and don't introduce a source of possible instability. They do add viscosity (Arabinol) and also a complexity comparable to the one obtained with sur-lie (Batonnage line, Elevage Glu, Super-mann).



•To improve cold stability: gum Arabic and mannoproteins have been introduced into winemaking as stabilizing agent. Being colloid protectors they slow down tartrates formation improving (but often not guaranteeing) stability. The polysaccharide that really does achieve tartaric stability in wine is New-Cel (carboxymethylcellulose), described described at pag. 89.



### **Gum Arabic:**

Gum Arabic is a gummy exudation from the branches of the Acacia Seyal tree. During times of drought, the bark of these trees splits, exuding a sap that dries in small droplets or “tears”. One tree will yield about 200 grams to 2 kg of gum (about 0.5-4 pounds) per year. Even though the structure of Gum Arabic is not completely known, it is basically composed of a high molecular weight polysaccharide that contains residues of neutral sugars and acids. This mixture of polysaccharides and glycoproteins gives it the properties of a glue and binder that is edible by humans. Acacia gum has long been used in traditional medicine and in everyday applications. The Egyptians used the material as a glue and as a pain-reliever base. Arabic physicians treated a wide variety of ailments with the gum, resulting in its current name. It is even used as a lickable adhesive, for example on postage stamps, envelopes, and cigarette papers. Here, it really does help that Arabic Gum is not toxic!

Gum Arabic is not only edible but highly nutritious. During the time of the gum harvest, the denizens of the desert are said to live almost entirely on it, and it has been proved that 6 oz is sufficient to support an adult for 24 hours. It is an important ingredient in chocolates (M&Ms, etc.), and “hard” gummy candies such as gumdrops and marshmallows. It is also used as an emulsifier and a thickening agent in icing, fillings, chewing gum and other confectionery treats. More generally, it gives body and texture to pro-

cessed food products. It is also used in soft drink syrups. It binds the sugar to the drink and avoids it from crystallizing on the bottom. Because Gum Arabic also reduces the surface tension of liquids, it is usually responsible for increased foaming in carbonated beverages. This can be seen in a viral video called “Diet Coke and Mentos Eruption”, where a Mentos mint is thrown into a bottle of Diet Coke (or Pepsi) which causes the beverage to spray out of its container. All these technological characteristics of gum Arabic can be used in winemaking, where it has been introduced first as a crystal stabilizers and later became a tool to increase viscosity and ameliorate the perlage of sparkling wines.

### **Arabinol Arôme:**

The market is constantly looking for fresh and fruity wines, where the aromatic component is fundamental. To create wines high in aromatics winemakers use techniques such as cold macerations, fermentation at low temperatures, aromatic yeasts, treatment of the lees, etc. To protect these wine aromas, AEB has enhanced a technology used in the perfume industry: the utilization of gum Arabic as an aroma protecting substrate. Not all Arabic gums provide aroma protection because the property is lost when placed in a hydro alcoholic solution. Arabinol Arôme is formulated to retain these characteristics in wine and to preserve all the aromatics naturally present in the bouquet. Add to red, white and rosé wines stored in partially filled vessels.



**Utilization:** dilute 1:10 in wine to improve homogenization. Best timing for addition is after ML and before bottling. It is suitable for wines that undergo membrane filtration. Do not add Arabinol Arôme right before clarification because treating wines with polysaccharides before bentonite and fining agents additions can slow down their settling.

**Dosage:** 50-200mL/hL (0.5-3.6 gallons of product per 1,000 Gallons of wine), equal to 550-2200 ppm or 4.5-18 lb/1,000 gallons.

*\*US only: Under TTB 27 § 24.250 this product has a max dosage at 65 lbs/1,000 gallons or 760g/hl. However under TTB 27 CFR 24.246 the max dosage would be 8 lb/1,000 gallons or 96 g/hl. (1 ml = approximately 1.15 g).*

**Shelf life and storage:** once opened Arabinol Arôme should be used within 30 days. If a container is left open for a longer time, add 1000 ppm of SO<sub>2</sub> to extend life span.

**Packaging:** 10 and 25 kg pails

### ***Arabinol:***

Gum Arabic was introduced in the wine industry to help improve tartrate stability. The long polysaccharides contained in this product act as colloid protectors and prevent or slow down the reactivity of different molecules. When added to wines, Arabinol slows down aggregation of crystals of tartrates. It also diminishes the perception of astringent and bitter tannins. It can be used on whites and reds when there is a need to improve viscosity. Because Arabinol has one of the biggest polysaccharide molecules in the market, it is exceptionally viscous and “sweet”. It is very important to run bench trials against other products in order to calibrate dosage and flavor. When added to sparkling wines, Arabinol improves the finesse of the perlage. In young red wines and rosé it also improves color stability.

**Utilization:** Add to finished red and white wines that are stable and ready to be filtered. Addition should be done after diluting 1:20 in wine in order to improve homogenization of the product. It is suitable for wines that undergo membrane filtration. Do not add Arabinol right before clarification; addition of polysaccharides before bentonite and fining agent additions can slow down settling.

**Dosage:** 50-200mL/hL (0.5-3.6 gallons of product per 1,000 Gallons of wine), equal to 550-2200 ppm or 4.5-18 lbs/1,000 gallons.US only: Under TTB 27 § 24.250 this product has a max dosage at 65 lbs/1,000 gallons or 760g/hl. However under TTB 27 CFR 24.246 the max dosage would be 8 lbs/1,000 gallons or 96 g/hl. (1 ml = approx. 1.15 g)

**Shelf life and storage:** once opened Arabinol should be used within 30 days. If a container is left open for a longer time, add 1000 ppm of SO<sub>2</sub> to extend life span.

**Packaging:** 10 or 25 kg pails and 230 kg drums.

### ***Arabinol HC:***

Is a solution of about 33.5% gum Arabic, mostly composed of polysaccharides with high molecular weight. After their hydrolysis they release non-fermentable sugars, contributing to the softness and sweetness of the mid-palate in the wines treated. From a chemical point of view, Arabinol HC, is a chain of D-galactose, a non-fermentable monosaccharide sugar that is about as sweet as glucose, and about 30% as sweet as sucrose. These D-galactose units are ramified with D-glucuronic acid (monosaccharide), with l-rhamnose (pentose)

or l-arabinose (pentose) final units. The characteristics of this premium gum Arabic are derived from the unique composition of the soil where the Acacia grows. In fact Arabinol HC is derived from trees that grow in presence of Rhizobium Leguminosarum on their roots, able to fix the atmospheric N. The combination of these characteristics, with the application of other farming techniques, results in an increase of N and Mg. The presence of such compounds modifies the soil pH, increasing the concentration and solubility of salts near the plant and consequently the pH of its lymph. This will ultimately yield a gum with higher softening and stabilizing power.

**Utilization:** Add to finished red and white wines that are stable and ready to be filtered. Addition should be done after diluting 1:20 in wine in order to improve homogenization of the product. At lower dosages (200-300 ppm) it is suitable for wines that undergo membrane filtration. Do not add Arabinol HC right before crossflow filtration or clarification: addition of polysaccharides before bentonite and fining agent additions can slow down settling.

**Dosage:** 30-150 mL/hL (0.3-2.7 gallons of product per 1,000 Gallons of wine), equal to 350-1700 ppm or 3-14 lbs/1,000 gallons.

*\*US only: Under TTB § 24.250 this product has a max dosage at 48 lbs/1,000 gallons or 576 g/hl. However under TTB 27 CFR 24.246 the max dosage would be 6 lbs/1,000 gallons or 72 g/hl. (1 ml = approx. 1.17 g).*

**Shelf life and storage:** once opened Arabinol HC should be used within 30 days. If a container is left open for a longer time, add 1000 ppm of SO<sub>2</sub> to extend life span.

**Packaging:** 1 kg bottles and 25 kg pails.

## ***Peptides and yeast derived mannoproteins***

The importance of glutathione in winemaking has been recently certified by a monograph released by OIV in 2017. In the monograph reduced glutathione (GSH) is described as: “a biologically active tripeptide consisting of L-glutamate, L-cysteine and glycine. Its antioxidant properties can protect from oxidation phenomena in musts and wines and preserve aromatic compounds. GSH is principally produced by microbial fermentation. The more onerous methods of production, chemically or by enzymatic reaction, are not used on an industrial scale. Production by microbial fermentation frequently uses *Saccharomyces cerevisiae*”.

The monograph then goes on describing methods of labeling, analyses and other informations on the full strength GSH product, similar to the one that we can also buy in the health stores as antioxidant for human consumption.

The glutathione normally used in winemaking nowadays, is an indirect effect of the addition of yeast derived products. GSH is slowly released into the wines and brings its antioxidant effect in a matter of hours.

The following AEB products all bring GSH into the wine, providing protection against oxygen since the early stages of winemaking, and also extending the shelf-life of the finished wines. In many cases they can be used in lieu of SO<sub>2</sub>

### ***Elevage Glu:***

A yeast derivative with a high percentage of the antioxidant tripeptide glutathione. It can be used to improve mid-palate but this product is especially geared for protecting from oxidation and to reduce the need for SO<sub>2</sub>. This technology is based on yeast extracts from a specific yeast strain from our collection (Glutaferm1), rich in smooth polysaccharides and active antioxidant proprieties. In fact, the molecules extracted are extremely rich in reduced glutathione. Glutathione has been introduced in winemaking by OIV in 2015 and as confirmed in the literature, it protects red rosé and white wines from oxidation; extending the life of aromas and color alike. In Principles and Practices of Winemaking it is observed how “the extent to which oxygen uptake results in browning depends on the formation of a colorless reaction between oxidized caftaric acid and the peptide glutathione. Glutathione couples with oxidized caftaric acid and regenerates hydroquinones, which are uncolored, preventing browning (Singleton et al., 1984)”. Other research from Denis Dubourdieu, professor of oenology at the university in Bordeaux, already claimed that: “higher levels of glutathione in Sauvignon Blanc wine at bottling prevent the color from yellowing, dissipation of the varietal aroma, and the wine tendency towards developing aging defects”.



**Utilization:** Re-hydrate in warm water (35°C/95°F) or wine, for 1/2 hr before mixing. Then dilute 1:10 in wine and add directly to the tank or barrel. Once homogenized it doesn't need further stirring. Some particles derived from the yeast cells are not completely soluble so a good racking or filtration are needed before bottling. Wait at least two weeks before sterile filtration. For best results, to give time to the GSH to be in dissolved, add Elevage Glu 24 hours before the antioxidant effect is desired.

**Dosage:** 12-30 g/HI; 1-2.5 lbs/1000 Gal.

Shelf life and storage: Elevage Glu can be stored at room temperature and low humidity for two years.

**Packaging:** 500 grams packets and 5Kg bags.

### ***Batonnage Plus Elevage:***

A yeast derivative rich in polysaccharides, used to boost wine texture and to improve red-ox stability. For a rounder body and longer shelf life. Technically it's a yeast autolysate product and as such, intensifies and brings forward the positive effects of aging on fine lees, without the risk of reductive odors involved with sur-lie treatment. Batonnage Plus Elevage is immediately soluble and therefore eliminates the time, labor and barrels needed in traditional aging on lees. It can be used in conjunction with oak derivatives to better integrate and retain the aromas released by the wood.

**Utilization:** Re-hydrate in warm water (35°C/95°F) or wine, for 1/2 hr before mixing. Then dilute 1:10 in wine and add directly to the tank or barrel. Once homogenized, the wine doesn't need further stirring. Some particles derived from the yeast cells are not completely soluble so a good racking or filtration is needed before bottling. Wait at least two weeks before sterile filtration.

**Dosage:** 12-30 g/HI (1-2.5 lbs/1000 Gal).

**Shelf life and storage:** Batonnage Plus Elevage can be stored at room temperature, low humidity for two years.

**Packaging:** 5 Kg bags

### ***Batonnage Plus Structure:***

It's a yeast autolysate blended with “mocha” ellagic tannins. After years of experience we can claim that this product fixes most aromatic faults in red wines and especially the green notes attributed to methoxypyrazines. It is a yeast preparation combined with highly toasted ellagic tannins that mask the vegetal notes and promotes fruity and chocolate-like aromas.

**Utilization:** Re-hydrate in warm water (35°C/95°F) or wine, for 1/2 hr before mixing. Then dilute 1:10 in wine and add directly to the tank or barrel. Once homogenized it doesn't need further stirring. Some particles derived from the yeast cells are not completely soluble so a good racking or filtration are needed before bottling. Wait at least two weeks before sterile filtration.

**Dosage:** 10-30 g/HI 1-2.5 lbs/1000 Gal.

**Shelf life and storage:** Batonnage Plus Structure can be stored at room temperature, low humidity for two years.

**Packaging:** 5 Kg bags



## Stabilizers & fining agents

### **Batonnage Plus Texture:**

Polysaccharide based, autolyzed yeast product, rich in mannoproteins. It gives a sweet and viscous texture to red, white and rose' wines. It brings a sweet texture due to the large size of the molecules that it releases, that exceed 100 Kilo Dalton. When added to fermenting musts it improves the structure and in red wines helps color stabilization. It also has strong antioxidant proprieties.

**Utilization:** Re-hydrate in warm water (35 °C/95°F) or wine, for 1/2 hr before mixing. Then dilute 1:10 in wine or must and add directly to the tank or barrel. Once homogenized it doesn't need further stirring. Some particles derived from the yeast cells are not completely soluble so a good racking or filtration is needed before bottling. Wait at least two weeks before sterile filtration.

**Dosage:** 10-40 g/HI (1-3 lbs/1000 Gal.)

**Shelf life and storage:** Batonnage Plus Texture can be stored at room temperature and low humidity for two years.

**Packaging:** 20 Kg bags

### **Super-mann:**

A pure mannoprotein that, thanks to its high colloidal power, improves tartaric stabilization. Thanks to its specific tactile sensation, Super-mann also very much contributes to softening the wine, smoothing the roughness deriving from an excess of acidity or tannins. In red wines, thanks to the high colloidal power, it interacts with polyphenols making the color more stable.

**Usage:** Re-hydrate in warm water (35°C/95°F) or wine, for 1/2 hr before mixing. Then add directly to the tank or barrel. Once homogenized it doesn't need further stirring. Some particles derived from the yeast cells are not completely soluble so a good racking or filtration are needed before bottling. Wait at least two weeks before sterile filtration.

**Dosage:**

**White wines:** 10 - 25 g/hL. 1-2lbs/1,000 Gallons

**Red wines:** 10 - 40 g/hL. 1-3lbs/1000 Gallons. TTB allows 400 ppm max to be used pre bottling

**Shelf life and storage:** Super-mann can be stored at room temperature and low humidity for two years

**Packaging:** 1kg

Fining/Stabilizing Action	Mean	Active Ingredient	Commercial Name
<b>Bitterness and color fining</b>	By removing catechins and oxidized phenolics	Potassium caseinate bentonite and redox-buffer	<b>Catalasi</b>
		PVPP Bentonite Gelatin Silica	<b>Catalasi AF Plus</b>
		PVPP Bentonite cellulose	<b>Microcel AF</b>
		Potassium Caseinate Bentonite Cellulose	<b>Microcel</b>
	By removing color	Carbon in pellets	<b>Decoran Gran</b>
		Liquid Carbon and Silica	<b>Carbosil</b>
<b>Phenolic removal and must fining</b>	by binding phenolics and removing solids	Liquid Pork Gelatin	<b>Gelsol</b>
	by binding phenolics and removing solids	Pea gelatin	<b>Ve-gel</b>
<b>Cold Stability (stabilization of tartrates)</b>	by avoiding growth of the crystals using a polysaccharide that can coat them	Metatartaric acid	<b>Cremor stop extra</b>
		Carboxymethyl Cellulose	<b>New-Cel</b>
	By accelerating formation and precipitation of tartrates in tank	Cream of tartar in a proprietary blend	<b>Crystalflash</b>
	By removing potassium to avoid formation of potassium tartrates	Ion Exchange	<b>Stabymatic</b>

## Stabilizers & fining agents

Fining/Stabilizing Action	Mean	Active Ingredient	Commercial Name
<b>Heat Stability (stabilization of proteins)</b>	By removing unstable proteins in finished wines	Bentonite	<b>Bentogran</b>
	By removing unstable proteins and catechins during fermentation	Micronized bentonite and Potassium caseinate	<b>Microcel</b>
	By removing unstable proteins and catechins during fermentation	Micronized bentonite and PVPP	<b>Microcel AF</b>
<b>VA &amp; re-fermentation control</b>	By killing gram positive lactic bacteria	Lisozyme	<b>Lysocid</b>
	By killing aerobic microorganisms forming film on top of partial vessels	Allyl isothiocyanate	<b>Steryl</b>
	By killing yeast and inhibiting bacteria	Sorbate & KMS	<b>Microcid</b>
	By inhibiting yeast and bacteria in barrels	KMS in pellets dosed for barrels	<b>Sulfigrain</b>
	By inhibiting yeast and bacteria on grapes	KMS and Ascorbic mixed with dispersion agent (perlite)	<b>Aromax B4</b>
<b>To clean the wine from reductive aromas</b>	By catalyzing oxygen activity	liquid copper sulphate	<b>Desulfin</b>
<b>To drop acidity</b>	By dropping tartaric acid	Potassium bicarbonate in proprietary blend	<b>Deacid</b>

## Stabilizers & fining agents

Fining/Stabilizing Action	Mean	Active Ingredient	Commercial Name
<b>Brett and Smoke Taint Control</b>	By adsorbing volatile phenols like 4-ethylphenol/guaiacol, guaiacol and 4-methylguaiacol	Adsorbing media derived from saccharomyces cerevisiae	<b>Antibrett</b>
	By killing Brettanomyces and adsorbing odors	Chitosan and adsorbing media derived from saccharomyces cerevisiae	<b>Chitocel</b>
<b>Lees compaction</b>	By binding proteins like gelatin, albumin and casein	Silica	<b>Spindasol</b>

### Must protection

#### **Aromax B4:**

Ascorbic acid and potassium metabisulfite immobilized on an inert substrate for easy dispersion on grapes and juice and protection during machine harvesting or grapes transportation. It optimizes anti-oxidation and antiseptic protection. The perlite used to immobilize the ascorbic acid and the potassium metabisulfite floats, only releasing the components when they are wetted by the juice. In this way it forms a protective layer on the wetted surface of broken berries, juice in the gondolas, or holding tanks.

**Utilization:** Disperse the powder on the bins, boxes, trucks, and conveyers or at any stage that needs antioxidant protection for the juice. Use at 0.5-1 kg/Ton. (1 Kg/Ton will release 54 ppm of SO<sub>2</sub> and 60-70 ppm ascorbic).

**Shelf life and storage:** 2 years stored at room temperature in a non-humid environment.

**Packaging:** 5kg bags

## Tartrates Stabilization

### **Cremor Stop Extra 40\*:**

It's an "old school" tartrate stabilizer, not even included in the TTB list of approved materials for winemaking usage in USA. Cremor Stop Extra 40 is an extremely pure metatartaric acid with a very high esterification index. The efficiency of metatartaric acid depends on the amount of active hemipoly lactide it contains and the degree of condensation. Control of the quality of metatartaric acid preparation is based on measuring their esterification index or percentage of esterified functions. The most active products, like Cremor Stop Extra 40, have an esterification index of 38-40%. It requires twice as much of the lesser quality product (esterification index at 30%), to obtain the same protection.

It is recommended to add Cremor Stop Extra 40 always after the addition of organic and inorganic clarifiers, de-acidifying products, decolorizing or deodorizing carbons. A filtration carried out 12-24 hours after the addition of Cremor Stop Extra 40 eliminates the possible occurrence of opalescence, caused by the high esterification index and by the presence of proteic substances in the wine.

**Utilization:** dissolve the product in cold water at about 1:5. Avoid using hot water and always make a fresh solution every time.

Add to the wine by pumping over or through a Venturi pipe. Do not use in wines rich in calcium or stored in concrete tanks. An addition of 55 ml/Hl (5 lb/1000 Gal) of Arabinol makes Cremor Stop 40 even more stable in time.

**Dosage:** 10 -15 g/Hl (1lb/1000 Gal)

**Shelf life and storage:** Sealed containers will last for 2 years stored at room temperature in a non-humid environment.

Temperature should not fall under 5°C/41°F

**Packaging:** 1kg packets & 25 kg bags

**\*Not legal for U.S. commercial wineries.**

### **Crystalflash:**

Potassium bicarbonate, tartaric acid and neutral potassium tartrate, plus bentonite, for optimized tartrates seeding and settling. It accelerates the crystallization of tartaric acid salts, in particular potassium bitartrate and neutral calcium tartrate, in wines during refrigeration. Is able to induce in the cold wine (around freezing temperature), the instantaneous formation of a very thick cloud of rising micro-crystals, facilitating the first and more delicate stage of the nucleation process. Thanks to its balanced and exclusive formulation, Crystalflash eliminates the occurrence of oxidative phenomena in the wines going through cold stabilization. Also, Crystalflash shortens the cold holding time in a tank to a very short period of time, usually between 3 and 5 days.

**Dosage:** 20 and 40 g/Hl (1,5 – 2,5 lbs/1,000 Gallons).

**Shelf-life and storage:** 4 years stored at room temperature in a non-humid environment.

**Packaging:** 1 kg packets.

<i>Crystalflash</i>		
<i>Ingredient</i>	<i>%</i>	<i>Purpose</i>
Potassium Bicarbonate	40%	Helps to disperse the product, also crystallizes tartrates helping precipitation
Cream of tartar	30%	Helps Nucleation
Potassium tartrate (tartaric Acid)	10%	Works in Synergy with Cream of Tartar to speed up nucleation and balances acidity
Cellulose	5%	Helps dispersion

### **New-Cel:**

CMC based New-Cel is a colloidal protector that wraps the tartrates crystal structure with a protective film and deforms them making their growth impossible. Studies (Malherbe & O'Kennedy, 2008) have demonstrated the savings when using this technology instead of the traditional cold stabilization, with CMC treatment costing 8-10 cents/gallon, while traditional "chilling" was about four times the cost in energy. New-Cell has been developed by AEB considering that the most effective wine stabilization occurs when

the CMC polymer contains a ratio between the number of carboxylated groups and glucose units equal to 1. This allows the ultimate efficacy in forming a chemical barrier between the crystals of potassium bi-tartrate preventing their enlargement. CMC is negatively charged so it will bind molecules like proteins (but also unstable color in reds). If the wine is perfectly protein/color stable there will be no problem, but if it is borderline, CMC will cause haze that needs to be filtered. We recommend checking protein stability after CMC addition on a sample and make sure protein haze doesn't develop. It can be used in sparkling wines by adding it a few days before the riddling agents or in the liqueur d'expédition at the dégorgement. CMC is approved in the US under 27 CFR 24.250.

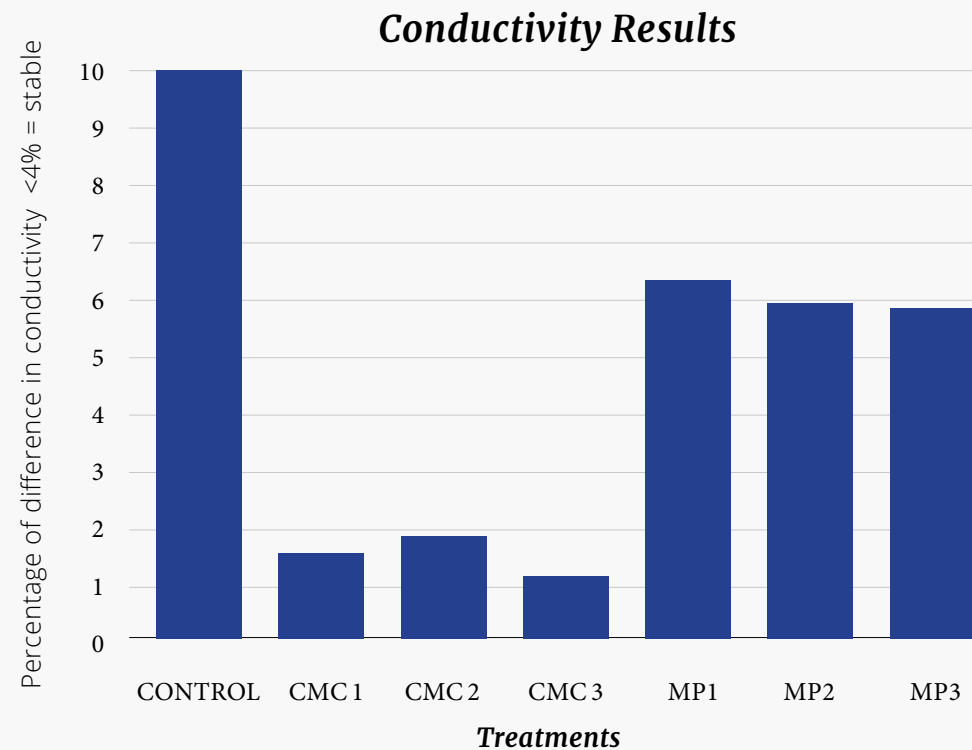
**Utilization:** Directly dissolve the solution into the wine 48 hours before bottling or before any filtration stage. Wines must be brought at 16°C-64°F for 8 hours for CMC to dissolve. Wines must be protein stable and with turbidity <1NTU. In reds CMC may interact with unstable color making it precipitate. Stabilize the color with tannins, MOX, Arabinol, or chill the wine and filter it prior to CMC addition.

**Dosage:** 100-150g/hL or 8/12 lbs/1,000 Gallons. TB limit= The amount used must not exceed 0.8% of the wine.

**Shelf life and storage:** 1 year at room temperature in a non-humid environment.

**Packaging:** 1 kg bottles and 25 kg pales.

*A comparative trial on available techniques to achieve cold stability was performed by AEB in collaboration with Cal Poly Wine & Viticulture institute, on a Chardonnay from Santa Lucia Highlands. According to the conductivity tests, the control measured a 10.9% difference in conductivity, 6.9% above the threshold for cold stability. The results for the CMCs showed successful stabilization of all wine samples with the lowest percentage difference of 1.4% and an average of 1.8% difference. The results for the mannoprotein products used as tartrate stabilizers, showed that the wines were not fully cold stable as the lowest percentage difference was 5.8% and an average of 6% difference between all three repetitions made with mannoproteins. According to those trials, the best technique available to winemakers to insure cold stability was ion exchange.*



## Redox Adjustment

### **Desulfin:**

Stabilized liquid copper sulfate to remove H<sub>2</sub>S and reductive odors. If wines show a bouquet that seems to be too “closed” or affected by reductive odors, try adding a drop of Desulfin in the glass. If the wine changes positively, the wine is most likely reduced by H<sub>2</sub>S or mercaptans, and can be treated with an adequate addition of Desulfin. If the problem is mercaptans, do not aerate. mercaptans can be removed to some extent with appropriate copper sulfate additions (about twice the one needed for H<sub>2</sub>S removal). The reaction forms an insoluble Cu-mercaptide salt that can be filtered out of the wine. If the problem is DMDS or DEDS, we need to convert them back to mercaptans with 500 ppm of ascorbic. This can take up to 60 days. After that we can use Desulfin.

**Utilization:** preliminary H<sub>2</sub>S tests should be conducted. Add Desulfin directly to the affected product and circulate in an open environment.

**Dosage:** 10 ml/Hl or 0.38 ml/Gal= 0.25 ppm copper

**Shelf life and storage:** Sealed containers will last for 2 years stored at room temperature in a non-humid environment. Temperature should not fall under 5°C/41°F.

**Packaging:** 1 kg bottles

Sulfur Compound		Odor
	H <sub>2</sub> S	Rotten Eggs
Mercaptans	Methyl Mercaptan	Rotten Cabbage
Cream of tartar	Ethyl Mercaptan	Burnt Match
Disulfides	DMDS	Cooked cabbage, onion
	DEDS	Burnt rubber, garlic

***Riduxhigh:***

Anti-oxidant stabilizer to be used at bottling, it improves shelf life of white, reds and rosé wines. The vigorous anti oxidizing action of Riduxhigh, drastically lowers the redox potential in just 24 hours and keeps it constant through time. The results are thus, improved wine color and bouquet stability along with enhancement of its organoleptic characteristics. It interrupts the chain reaction responsible for the formation of oxidized radicals and instantly re-establishes a stable oxygen-free environment, maintaining constant levels of SO<sub>2</sub>. It also prevents the occurrence of ferric casse by keeping iron in a stable and soluble form. It contains 15% ascorbic acid, a strong antioxidant that can quickly reduce oxygen. This reaction is known to produce a strong oxidant, H<sub>2</sub>O<sub>2</sub>, and because of that, winemakers are afraid to use it. However, the oxidative species produced by the reaction between oxygen and ascorbic acid will react quickly with SO<sub>2</sub>. For this reason, the SO<sub>2</sub> present in Riduxhigh, other than controlling the microbial environment, will optimize the efficiency of this product as an antioxidant.

**Composition:** Citric acid, potassium metabisulfite, ascorbic acid, metatartaric acid. 10g/hL (0.8 lb./1000 Gallons) of Riduxhigh, increase the SO<sub>2</sub> by 17 ppm.

**Dosage:** white and rosé wines: from 100 to 250 ppm. Red wines: from 100 to 200 ppm.

Dissolve in 10 parts of wine and add before micro filtering or bottling.

**Shelf life and storage:** 3 years if stored in a cool dry place, away from direct sunlight and heat.

**Packaging:** 1 kg packets.

## ***Protection from wild yeast and bacteria***

***Lysocid W:***

lysozyme enzyme naturally obtained from selected egg albumin, which has the capacity to breakdown lactic cellular walls. It helps to degrade the cell walls of gram positive bacteria such as Oenococcus, Pediococcus and Lactobacillus. It is not effective against gram-negative bacteria like Acetobacter and has no effect on yeast.

**Utilization:** Dissolve Lysocid W 1:10 ration in water, juice or wine and add uniformly to musts or wines. Do not treat with bentonite or other fining agents for 24 hours after addition to avoid inactivation of the enzyme.

**Dosage:** to prevent Lactobacillus in grapes: 10-25g/Hl (1-2 lbs/1000 Gal). To stabilize Lactobacillus during slow or stuck fermentation: 25-40 g/Hl (2-3 lbs/1000 Gal).

**Shelf life and storage:** 2 years stored in cold temperature in a non-humid environment.

**Packaging:** 1kg packs

***Microcid:***

Due to its potassium sorbate content, it helps prevent re-fermentation of wines containing residual sugars. Microcid inhibits bacterial alterations, by stabilizing free SO<sub>2</sub>, thereby inhibiting the activity of lactic bacteria that metabolize sorbic acid. As a result, it prevents the formation of an anomalous odor, reminiscent of geraniums that can be derived from the usage of straight sorbate. Due to its reducing components (KMS and citric acid), it helps prevent oxidation and hinders increased volatile acidity.

**Utilization:** dissolve in about 10 parts of warm water and add uniformly to the clarified and filtered mass. 50g /Hl – 4 lbs/1,000 Gallons of Microcid increases total SO<sub>2</sub> by 30 ppm and 270 ppm of sorbate.

**Dosage:** 25 – 50 g/Hl (2-4 lbs/1000 Gal).

**Shelf life and storage:** 2 years stored at room temperature in a non-humid environment.

**Packaging:** 1 kg packets

***Steryl\*:***

Anti-flor tablets consisting of an inert pure-paraffin support in which allyl-isosulphocyanate, a natural form of mustard oil, has been dissolved. Mustard oil is a volatile substance with high antiseptic properties especially with regard to aerobic microorganisms. Steryl anti-flor tablets are made with the most up to date techniques using fully automated systems, which guarantee consistent quality. The microorganisms responsible for the formation of white film on the surface of wines stored in partially full containers, belong to the specie Pichia, Hansenula and Candida, they are yeasts with a prevalently oxidative metabolism and almost free from fermenta-



tive activity. In addition to the white film and oxidation, a loss of alcoholic content takes place as well as the formation of acetaldehyde, which gives a vinegary smell to the contaminated wines. By floating on the surface of the liquid, Steryl tablets slowly release the allyl isosulphocyanate, which sterilizes the air above it. As a result, the development of the film is inhibited together with other oxidation related bacterial and enzymatic surface alterations. ML bacteria as well as wine flavor in general are not affected.

**Dosing:** use one or two tablets of the adequate size, and replace it every 15 days.

**Shelf life and storage:** Packing in blister packs of aluminum and plastic laminate ensures unlimited preservation and maintains the efficiency of the product.

**Packaging:** Steryl tablets are contained inside practical packs and commercialized in three different packaging sizes, for casks, barrels and tanks of variable dimensions. Steryl Vasche (for tanks) N. 50 tablets in 50 x 1 tablet sachets, Steryl Fusti (for barrels) N. 80 tablets in 40 x 2 tablet sachets, Steryl Demijohns (for small containers) 600 tablets in 50 x 12 tablet sachets

*\*Not legal for US commercial wineries.*

### **Sulfigrain:**

Potassium metabisulfite (K<sub>2</sub>S<sub>2</sub>O<sub>5</sub>) in pellets, easy to dissolve. It allows a must or a wine to be sulfited quickly and precisely, without having to manually mix in the product barrel by barrel. It is the perfect SO<sub>2</sub> dose to add to a 55 gallons barrel. Due to its formulation, the use of Sulfigrain limits the amount of SO<sub>2</sub> lost to the atmosphere.

**Composition and Features:** potassium metabisulphite 75%, potassium bi-carbonate 25%. When in contact with must or wine, the effervescence of the particles of Sulfigrain makes it possible to ensure a natural and complete diffusion of the SO<sub>2</sub> in the tank or Barrel. Sulfigrain does not undergo ionized treatment and is a non-GMO product. Sulfigrain is in conformity with the standards of the International Oenological Codex .

**Utilization:** disperse the pellets of Sulfigrain on the surface of must or the wine to be treated.

**Dosage:** 1 dose contains 5 grams of pure SO<sub>2</sub> which are equal to: 1.32 ppm in 1000 Gallons 20 ppm in 55 gallons (barrel) 50 ppm/Hl.

**Shelf life and storage:** Preserve only in its original sealed packing of origin, safe from light sources, in a clean place, dry and free from odors.

**Packaging:** Box of 20 doses.

## **Smoke and Brett taint treatment**

### **Chitocel:**

A product based on Chitosan, a natural polysaccharide of fungal origin (derived from *Aspergillus niger*), biodegradable and non-allergenic, that allows to reduce and in some cases to eliminate, the unwanted microbial population in wine. Chitocel is active against acetic and lactic bacteria, yeasts in general and specifically on *Brettanomyces bruxellensis*. It's action is mostly "physical" as there seems to be an electrostatic interaction between the membranes of the microorganisms and chitocel, that would induce a strong disturbance in the permeability of the membrane of the *Brettanomyces*. This ultimately ends up forming a large flocula and can be eliminated by racking or filtration. It's still possible to detect live cells of *Brettanomyces* after the treatment with Chitocel, but these cells are for the most part critically damaged and incapable of reproducing or to form volatile phenols (false positives).

Thanks to the synergy with yeast hulls (deodorizing media), Chitocel reduces the content of 4-ethylguaiacol, 4-ethylphenol and contaminants such as ochratoxin A. Also, the use of Chitocel allows to reduce the content of heavy metals such as iron, lead, cadmium, copper, thus preventing the ferric casse and the copper casse.

*Approved as acceptable in good commercial practice in the US under TTB § 24.250*

**Utilization:** dilute 1:10 in must or wine and add to mass making sure to homogenize well. Leave it in the media for at least 10 days before filtering or racking.

**Dosage:** 120-180 ppm (1-1.5 lbs/1,000 gallons). TTB limit for this product is 200 ppm.

**Packaging:** 250 grams

### **Antibrett:**

Cures smoke taint and *Brettanomyces* taint. These are two defects that are very hard to fine without using special equipment.

The major indicator compounds associated with both these types of taint belong to the group called volatile phenols. In the case of *Brettanomyces*, the responsible compounds are 4-ethylphenol and 4-ethylguaiacol; and in the case of smoke taint, guaiacol and 4-methylguaiacol. These molecules are fairly similar. AEB has found a natural fining agent that can diminish (and in certain cases eliminate) the problems caused by these compounds.

Antibrett may be used as a preventive tool in contaminated barrels. It guarantees the inhibition of vinyl-reductase which is responsible for the transformation of naturally occurring cinnamic acids into the corresponding ethyl derivatives. Although it can be used to cure wines that already show taint problems, results may vary. Bench trials are always recommended before treating a full batch.

**Utilization:** Dissolve 40g/hl or 3 lbs/1,000 Gallons in 10 parts of wine or demineralized water, and add to the mass making sure it is well homogenized. Wait at least two weeks before assessing results. Filter before going to bottle but at least 2 weeks after addition.

**Shelf life and storage:** Antibrett is stable at room temperature for at least two years.

**Packaging:** 500g can

## Traditional fining of musts and wines:

### **Bentogran:**

A pharmaceutical grade Na-bentonite for protein removal with low impact on the wine aromatics.

Protein content in musts or wines, especially in whites, is usually around 50-200 mg/L, with peaks that can range from 10 to 300 mg/L. Protein-related instabilities in wines are caused by thermo-labile proteins. Haze may arise when there are extreme conditions of storage/shipping, where the temperature is not very well controlled. At wine pH, proteins precipitate with tannins and this is what creates haziness in wines. Research and expertise have brought AEB to find a very active grain of montmorillonite, with extremely high adsorbing properties that optimize protein stabilization with minimal impact on the wine treated. Bentogran is used at rates of addition that are up to 50% less than regular Na-bentonites, with very compact sediment thus minimizing the lees. Compact sediment and lower dosage rates will result in decreased wine loss.

**Utilization:** rehydrate Bentogran for 20 minutes in 15-20 parts of cold or warm water (warm being more effective and faster than cold) before usage. Because of its high swelling power, Bentogran will increase its size 20 folds. To match this potential, it needs to be re-hydrated in a larger volume of water compared to other bentonites. When re-hydrating Bentogran, try not to use wine or

hard water. The active surface of Bentogran will be 3-4 times larger if compared to a regular bentonite. This characteristic will yield larger sized floccules with a higher clarifying power. Ultimately, by using less Bentonite-slurry in the fining process, less water will be added to the wine. Bentogran is granulated and doesn't contain fine powder which are hazardous to the respiratory system. Bentogran is soluble-calcium free, soluble-sodium free, soluble-phosphates free, soluble-metals free, and arsenate-free. Free from dust, sand, and organic matters.

**Dosage:** 12-50 g/Hl (1-4 lbs/1000 Gal).

**Shelf life and storage:** 4 years stored at room temperature in a non-humid environment.

**Packaging:** 1kg packs & 25 kg bags

### **Carbosil:**

A liquid clarifier based on silica and decolorizing carbon. It allows a quick and efficient color removal in both musts and wines. Carbon is hydrated and in liquid form, so the product is safe and practical to use. It is highly recommended on musts of Pinot Grigio or those obtained from over-ripe grapes. It will yield a clear must/wine, with no trace of carbon and with a compact sediment.

**Utilization:** It may be used in cold settling along with Gelsol for must clarification, or added during fermentation to reduce color. Mix Carbosil in must/wine using a Venturi or by pumping over. Dose the product either diluted 1:1 with water or full strength. For solids and color fining: in musts, add Carbosil before adding gelatin. In wines, do the opposite; wait at least 1/2 hour after the clarifier (albumin, gelatin,



casein) is fully homogenized, and then add Carbosil and mix.

**Dosage:** It always depends on the wine or must to be treated, and trials are recommended. As a general rule of thumb, if used in combination with gelatin, Carbosil needs to be added at 5 to 10 times the amount of Gelsol used. When used as color remover during fermentation, rates of addition are between 250-600 ppm equal to 25-60 grams/hl or 2-5 lb/1,000 gallons. In liquid unit of measures it would be 790-1,900 ml of Carbosil per 1,000 gallons.

**Shelf life and storage:** Sealed containers will last for 2 years stored at room temperature in a non-humid environment. Do not store below 5 degrees Celsius.

**Packaging:** 25 kg pails

### ***Deacid:***

A formulation of potassium bicarbonate and neutral potassium tartrate salts, both highly soluble, able to induce a decrease in the total acidity with neutralization reactions and a subsequent complete and quick precipitation of the salts. The wine acid profile is thus modulated and the aromatic structure is not damaged.

The total acidity diminishes and the pH will rise proportionally to the quantity of product applied. Deacid contributes to equilibrate the full body expression in all wines, eliminating green and aggressive notes, keeping the right freshness in whites and rounding excessively acid notes in red wines.

**Utilization:** add directly to the must or wine, little by little, by pumping over in order to avoid an excessive localized (but temporary) deacidification of a small amount of product. If used in solution, dissolve it in water. Pay attention to the development of CO<sub>2</sub> and the consequent increase in wine volume.

**Dosage:** 130 g/hL are required to lower the total acidity of 1 g/L (i.e. 1‰ in tartaric acid and 0,72‰ in sulfuric acid). Note: for higher additions, we recommend a preliminary laboratory trial.

**Shelf life and storage:** 2 years stored at room temperature in a non-humid environment.

**Packaging:** 5 and 10 kg bags

### ***Catalasi:***

To cure oxidized wines or to add “freshness” to fermenting musts. Used in fermentation it also helps preventing “pinking”. It contains a balanced amount of Bentonite, caseinate, gelatin, L-ascorbic acid and potassium metabisulfite.

It partially cures or prevents darkening of white wines, the occurrence of “brick” hues in rosé, and yellow hues in red wines. The potassium caseinate present in Catalasi highlights the original aromas and color, reducing the level of polyphenols and oxidized polymerized components. It also contains a strong antioxidant (vitamin C) and a calibrated dose of SO<sub>2</sub> important to neutralize eventual peroxides produced by the oxidation of vitamin C.

**Utilization:** Dissolve the dose of Catalasi in about 5 parts of cold water. Wait 15 minutes before use. Add quickly to mass with maximum turbulence in order to disperse before flocculation of the bentonite with the caseinate occurs.

**Dosage:** 200/500 ppm (20-50g/Hl or 1.5-4 lbs/1000 Gal). 100 ppm or 0.8 lb/1,000 gallons of Catalasi, yield 5ppm of SO<sub>2</sub>

**Shelf life and storage:** 2 years stored at room temperature in a non-humid environment.

**Packaging:** 1kg pack and 20 kg bags

### ***Catalasi AF Plus:***

A mix of clarifiers (Bentonite, isinglass, pork/fish gelatine, PVPP and silica gel) that selectively remove green and bitter catechins from red rosé and white wines and cures light off flavors. The variety of agents that formulates Biocatalasi AF, will give a balanced fining process, without the classic albumine and caseinate allergenic agents. It can be used in reds and whites for removal of bitterness and odd flavors deriving from reductive phenolics. Ideal also to ferment on for Pinot Grigio or in general for white and rosé wines with high phenolics.

**Utilization:** Dissolve Biocatalasi AF in about 5 parts of cold water. Wait 10 minutes, mix and quickly add suspension to mass with turbulence (Venturi or pump).

**Dosage:** 200/500 ppm (20-50g/Hl or 1.5-4 lbs/1000 Gal).

**Shelf life and Storage:** 2 years stored at room temperature in a non-humid environment.

**Packaging:** 1kg packet and 20 kg bags

### **Quickgel AF:**

Allergenic free clarifier for red musts and wines, with no significant impact on color. Extremely effective and quick, it's the best choice when winemakers need to clarify cloudy juices or wines in a very short time. It enables to obtain bright and softer wines with extremely compact lees. Thanks to the presence of specific quantities of bentonite, pork and fish gelatine, Quickgel AF helps to make sure that wines and juices are fined even with a high level of turbidity and polysaccharides.

Quickgel AF forms a very compact "net" of flocculants, which gives the wines brightness, and makes it easier to filter them. The sediment left at the bottom of the tank will be very compact making it for an easy and clean raking. Filtration can be carried out 48 hours after addition without any problems in filtration flow rates.

**Utilization:** Dissolve Quickgel AF in ten parts of cold water and let it rehydrate for 20-30 minutes. Add the slurry to the tank, homogenizing with a pump over. Wait 48 hours before racking and filtering.

**Dosage:** 300-900 ppm (30-90 g/hl or 2.5-6 pounds/1000 gallons).

**Shelf life and Storage:** 2 years stored at room temperature in a non-humid environment.

**Packaging:** 500 grams and 10 kg packets.

### **Decoran Gran:**

Activated decolorizing and deodorizing carbon, obtained by carbonization of non-resinous wood, and commercialized in mini-pellets. It is produced utilizing a process of carbonization in a controlled atmosphere. The activation process helps to subsequently produce a product that is micro pelletized and carries minimal dust. It is ideal to remove excess color, undesired odors and to reduce the level of catechins. This specifically activated decolorizing carbon can be utilized on both musts and wines, giving excellent results. Thanks to its particular form, Decoran Gran eliminates the problem of powder dispersion in the environment, helps to avoid waste and eliminates discomfort for operators. These characteristics make it extremely easy to handle and to use, making cellar operations far more efficient. Thanks to a specific surface area of more than 1000 m<sup>2</sup>/g and a particle diameter from 10 to 100 Ångström, it ensures high decolorizing activity in musts, especially when treating higher molecular weight molecules such as polyphenols. It is chemically inert and has low transferable heavy metals.

**Utilization:** dissolve Decoran Gran in must, wine or water at a ratio 1:10 and add to the mass by pumping over. At the end of the absorption of the coloring matter, proceed with the removal by filtration or sedimentation-clarification.

**Dosage:** 50-1000 ppm (5 to 100 g/hL or 0.5-8 lb/1,000 gallons) depending on the decolorization to be obtained.

**Shelf life and storage:** 4 years stored at room temperature in a non-humid environment.

**Packaging:** 20 kg bags

### **Gelsol:**

A liquid gelatin produced by a process of irreversible hydrolyzation, that helps to maintain a constantly stable liquid product. The clarifying effect achieved through instantaneous flocculation results in the formation of large, heavy macro-coagula. Sediments are compact and easily filtered out. It is used alone or in conjunction with Spindasol in order to clarify white musts both in cold settling or flotation. In reds, it helps the wines to be softer and less susceptible to oxidation, Gelsol in fact removes small condensed tannins, which give most of the bitter-astringency to wines. Gelsol has little affinity with anthocyanins; therefore it is ideal for red wines because it does not cause any loss of color intensity.

This liquid gelatin, is prepared enzymatically, without the use of heat. This difference makes Gelsol more active if compared with dry products where the use of high temperatures, to hydrolyze the gelatin and especially to put it in a dry solid form, denatures proteins making them less efficient. Gelsol never sees the solid phase, and not only does this make it more efficient, but it also prevents re-condensation and the formation of "footballs" or "pyramids" inside the tank.

**Utilization:** Dilute in 1 to 3 parts of water before adding it to the wine, must or flotation equipment. In musts, add Spindasol or Carbosil before adding Gelsol. In wines, wait at least ½ hour after Gelsol is fully homogenized, and then add Carbosil or Spindasol and mix.

**Dosage:** It always depends on the wine or must to be



treated, and trials are recommended. Consider a specific weight of 1.2. For must clarification in combination with Spindasol, do trials starting from 60 ppm or 6 g/hl (1/2 pound/1,000 Gal) of Gelsol and compact with 5 to 10 times the weight of Spindasol or Car-bosil (specific weight of 1.15). For both rosè and red wines fining trials, start from 30 ppm of Gelsol (10 ppm of Gelsol is equal to 7.7 ml/hl or about 0.1 gallon or 1 lb for 1,000 gallons). Dosages of Spindasol for settling are only 3-4 times the amount of Gelsol used.

*Must clarification (with Spindasol): begin trials at 5 ml/hL of Gelsol and settle with Spindasol at 5-10 X the weight of Gelsol.*

**Shelf life and storage:** sealed containers will last for 2 years stored at room temperature in a non-humid environment. Do not store below 5 degrees Celsius.

**Packaging:** 25 kg pail 250 kg drum

## **More about Gelsol & flotation:**

Gelatins are proteinaceous products with specific characteristics that can determine the success of their application in winemaking. Above all, gelatins share similar physical and chemical properties with colloids, including their electrostatic properties. In general: at must pH proteins carry a positive charge; the bigger the molecular weight of the gelatin molecule, the higher is its charge; the hydrolysis of the gelatin affects the molecular weight and therefore their charge. Finally, all proteins are characterized by a factor known as “Z Potential” that determines their electro-chemical properties and the efficiency of a gelatin in the different stages of the winemaking process. The Zeta Potential measures the surface charge of colloids in solution. Nanoparticles of Gelsol have a surface charge that attracts a thin layer of ions of opposite charge to the nanoparticle surface. This double layer of ions travels with the nanoparticle as it diffuses throughout the solution. The electric potential at the boundary of the double layer is the Zeta potential of the particles and has values that typically range from +100 mV to -100 mV. The magnitude of the zeta potential is predictive of the colloidal stability. Nanoparticles with Zeta Potential values greater than +25 mV or less than -25 mV typically have high degrees of stability. Dispersions with a zeta potential value close to 0 will eventually aggregate due to Van Der Waals inter-particle attractions. An higher Z-Potential guarantees better stability because it originates electrostatic repulsion that inhibits the aggregation

of dispersed particles. Z-Potential close to zero, like in Gelsol, causes the attraction forces to prevail on the repulsive allowing for better coagulation and flocculation. This situation facilitates must fining. These numbers are important to evaluate the best gelatin for the application. In flotation Gelsol acts as a bridge between the bubble of gas and the solids to be removed. The flocula needs to be of medium size. A large flocula will slow down the process because too heavy to travel against gravity.

***Some characteristics are crucial in this phase:***

- *Gelatin needs to have a medium size molecular weight.*
- *Z-Potential needs to be close to zero.*
- *The molecule must be hydrolyzed.*

*Gelsol guarantees all of these characteristics.*

### ***Microcel:***

To be added to white musts when they start fermenting, it diminishes the concentration of phenolics and proteins in the finished wines. It is also ideal to minimize the damage in wines derived from botrytized or moldy grape musts. The main philosophy of the Microcel product is that modern winemaking usually prefers a preventive approach instead of a curative one. Using Microcel in fermentation of wine and rosé wines, winemakers stop oxidation at its onset. Also, a significative amount of proteins is taken out early on, before the risk of affecting the “finished” bouquet with heavy bentonite treatments.

Microcel is composed of potassium caseinate, active cellulose fibers, and micronized pharmaceutical bentonite. During fermentation, Microcel absorbs the proanthocyanidins and monomeric catechins, which cause oxidation in wines. The color of treated wines becomes more appealing with greenish hues in white wines or more defined pink hues in the case of rosé wines. Musts treated with Microcel produce more complex wines, which retain their individual characteristics longer.

**Utilization:** Dissolve the dose of Microcel in about 5-10 parts of cold water, wait approximately 15 minutes, add to mass quickly and with turbulence.

**Dosage:** 200/500 ppm (20-50g/Hl or 1.5-4 lbs/1000 Gal).

**Shelf life and storage:** 3 years stored at room temperature in a non-humid environment.

**Packaging:** 10 and 25 kg bags.

***Effects of different Microcel components:***

**1.** Potassium Caseinate: using potassium caseinate during fermentation results in a lower level of catechins and therefore a finished wine that is going to be more resistant to browning and reduction. Potassium caseinate also fines for copper as well as iron (up to 50% of the initial content).

**2.** Bentonite: the bentonite used in Microcel is an extremely fine product selected to be very high in Na<sup>+</sup>. Having bentonite in the fermenting must is going to result in several advantages: reduces the amount of bentonite required for protein stabilization; adsorbs laccase and triosynase which oxidize polyphenols in botrytized grapes; adsorbs fungicides making it easier for the yeast to thrive.

**3.** Activated celluloses: to improve fermentation kinetics by adsorbing toxins and long chain fatty acids that inhibit the yeast during fermentation. Also, the cellulose is going to work as a nucleation media: a “boat” for the yeast cells so they can stay well suspended in the fermenting must. This is crucial especially in cold fermentation, when the activity is quite slow and there is little CO<sub>2</sub>. In these conditions certain yeast can flocculate and bacteria take over in the upper part of the tank, causing VA production and sluggish fermentation.



### **Microcel AF:**

The allergenic free version of the Microcel described above. The potassium is replaced by pure PVPP. The mix also includes bentonite and activated celluloses with a high adsorbing power. Thanks to the activity of PVPP, Microcel AF adsorbs catechins, preserving the product from oxidation risks and thus eliminating those yellow or orange and reductive smells.

**Utilization:** dissolve the dose of Microcel AF in about 5-10 parts of cold water, wait approximately 15 minutes, add to mass quickly and with turbulence.

**Dosage:** 200/500 ppm (20-50g/Hl or 1.5-4 lbs/1000 Gal).

**Shelf life and storage:** 3 years stored at room temperature in a non-humid environment.

**Packaging:** 10 kg bags

### **Spindasol W:**

Liquid silica for extra compaction of settling agents or carbon fining. When used in must, lees are heavier than when using just bentonite and the settling is much faster and compact. Also, silica is a mineral and does not adsorb aromatic molecules nor color. Because of its negative charge, it can be used in conjunction with gelatin, casein and albumin in order to achieve a more compact sediment, minimizing the lees. Using Spindasol to help settle the fining agents always improves the yield and reduces work.



**Utilization:** Mix Spindasol in must/wine using a Venturi or by pumping over. Dose the product either diluted 1:1 with water or at full strength. In musts, add Spindasol before adding Gelsol. This way gelatin will be neutralized on the silica and will interfere much less with the phenolics. To smooth out phenolics in finished wines, wait at least ½ hour after the proteic clarifier (albumin, gelatin, casein) has reacted in the media, and then add Spindasol to settle.

**Dosage:** it always depends on the wine or must to be treated, and trials are recommended. As a general rule of thumb, Spindasol needs to be added at 5 to 10 times the amount of the protein based clarifier used. As a generic settling agent use 500 to 1000 ppm (1 liter is about 1.15 kg).

**Shelf life and storage:** Sealed containers will last for 2 years stored at room temperature in a non-humid environment. Do not store below 5 degrees Celsius.

**Packaging:** 25 kg pail, 240 kg barrel.

*In a trial in a Chilean Pisquera, we trialed Spindasol to settle the gelatin used to fine the must of Muscat, later used to make Pisco.*

*We used 800 ppm of Spindasol to settle 60 ppm of Gelsol in a 50,000 liters tank (about 13,000 gallons). The percentage of lees in the tank treated with Gelsol only was 24% of the total mass.*

*With Gelsol and Spindasol just 18%. About 6% or 3,000 liter (800 gallons) of wine recovered.*

*A simple treatment paid itself just in wine recovery, time and material to filter lees.*

### **Ve-Gel:**

Clarification product based on vegetable proteins. Its high reactivity towards bentonite and silica enables to obtain a quick clarification with compact deposits. In must cold settling, Ve-gel enables to obtain not only a better technological result, but also more favorable parameters. The clarification achieved has lower NTU's than the ones obtained with common vegetable proteins, the deposit is more compact and the clarification is carried out significantly faster. Thanks to its reactivity, Ve-Gel can be successfully utilized during flotation, alone or in association with bentonite. Ve-Gel has a low reactivity towards the coloring matter and can be used in red wines with virtually no color loss.

**Usage:** dissolve Ve-Gel in water at a ratio 1:15 and add it on line.

**Dosage:** 100-500 ppm (10 to 50 g/hL or 0.8-4 lb/1,000 gallons)

**Shelf life and storage:** store in a cool dry place, away from direct sunlight and heat.

**Packaging:** 1 kg packs and 20 kg bags.

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