WINEMAKING UPDATE
Organic Wine Edition
Number 3 – 2022

NATURAL BIOPROTECTION SOLUTIONS AN ALTERNATIVE TO SO_2 IN WINES

The current movement in the global industry towards low-/zero-SO_2-addition wines, or with less chemicals has initiated the use of bioprotection tools, and as the name implies are from biological origin, which can be used in organic winemaking.

The actions of bioprotection tools are two folds – one is to occupy the 'microbiological' space to reduce the development and impact of rogue microbes that would taint the wine, and two – to protect must or wine from oxidation phenomena. Both those issues are usually controlled using SO_2 and other chemicals. This Winemaking Update – Organic edition will focus on different approaches at various stages of the winemaking process (from must to wine).

White or rosé juice bioprotection

Grape juice/must is a very delicate medium that needs to be protected from oxidation and microbial spoilage. There are two categories of bioprotection tools for white and rosé grapes and juice: the first one with specific yeast derivatives (SYD) such as Glutastar™, and the second with positive microbial population of a unique strain of *Metschnikowia pulcherimma*, LEVEL² Initia™. This non-fermenting yeast used prior to inoculation with the fermenting yeast *Saccharomyces cerevisiae* is particularly suitable for white/rosé winemaking.

Oxidation protection

Some wine varieties are more sensitive to oxidation such as aromatic ones like Riesling, Albariño, Torrontes, and Verdejo, as well as rich in thiols precursors such as Sauvignon blanc. For rosé wines, it is important to preserve color and aromas. Glutastar™, a SYD with the highest guaranteed biological glutathione content provides innovative bioprotection from oxidation by improving the natural antioxidant capacity of a wine. Glutastar™ not only contains a high amount of reduced glutathione but also a large pool of antioxidant peptides. When the antioxidant activity is compared between SYDs with similar glutathione concentration, Glutastar™ has better activity. This can be attributed to the synergistic action of this unique pool of peptides which also helps to preserve glutathione and contributes to preserve the quality of the wine longer.

Used during pre-fermentation maceration, it helps protect white and rosé wines from oxidation, preserving color and aromas (Figure 1).

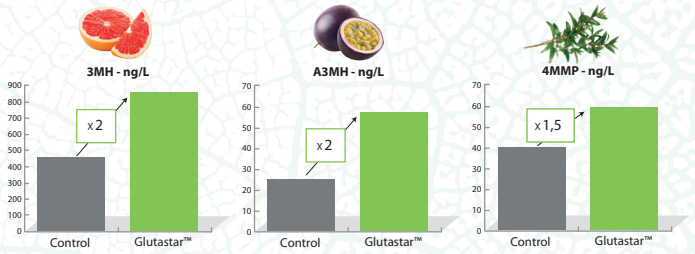

Figure 1. Thiols in Sauvignon Blanc (Val de Loire) with 30 g/hL of Glutastar™ added on added during cold juice stabulation (8 days at 4°C).

Microbial spoilage and oxidation protection

Another natural tool that can be used to protect whites and rosés from both oxidation and microbial spoilage (in a complementary effect with Glutastar™) is LEVEL² Initia™. It is a non-*Saccharomyces* yeast, non fermentative and able to grow at very low temperature. This strain of *M. pulcherimma* is unique in its mode of action. LEVEL² Initia™ has a high capacity to consume O_2 from juice which is needed to synthetise its own lipids (Figure 2). LEVEL² Initia™ also able to decrease juice copper content, an element used in organic viticulture (in the form of copper sulfate), also a powerful pro-oxidant heavy metal. By reducing both dissolved oxygen and copper content, LEVEL² Initia™ makes a dual contribution to limiting these oxidation phenomena.

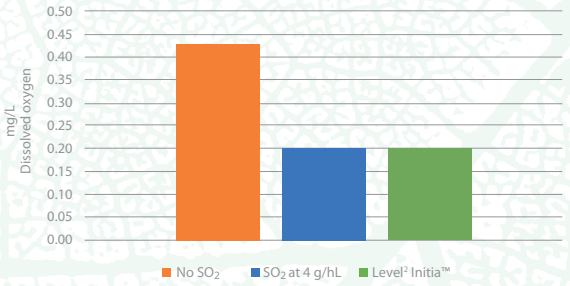

Figure 2. Dissolved oxygen in the press juice with SO_2 or LEVEL² Initia™ (Sauvignon blanc, Italy).

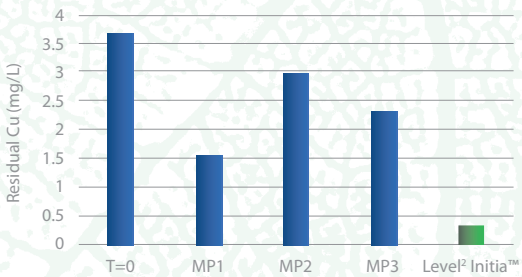

Figure 3. Residual copper in a Sauvignon Blanc juice with different strains of *Metschnikowia pulcherrima* including LEVEL² Initia™.

Inoculation with LEVEL² Initia™ was compared with another non-*Saccharomyces* yeast, also selected for bioprotection applications. Each yeast was added at a dose of 10 g/hL before stabulation for 5 days at 4°C. Analysis of thiols at bottling showed enhanced preservation of 3MH, A-3MH and 4MMP with LEVEL² Initia™ (Figure 4).

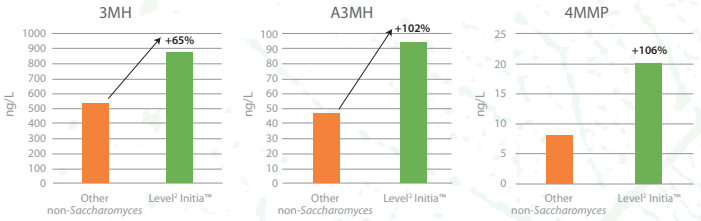

Figure 4. Yeast count after a 5 days cold soak at 10°C in a Pinot Noir (IFV Beaune, France, 2020).

The second advantage is protection from microbial spoilage, thus a reduction in the use of SO_2. LEVEL² Initia™ can protect the must from spoilage yeast and as shown in Figure 5.

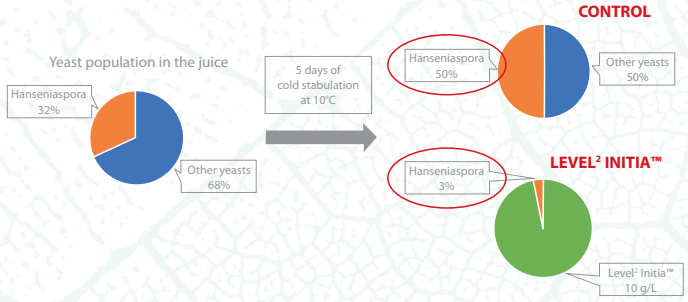

Figure 5. Microbiological bioprotection by LEVEL² Initia™ (Chardonnay no SO_2, Sicarex Beaujolais, France)

Co-inoculation for malolactic fermentation – a winning strategy on many levels

Co-inoculation for malolactic fermentation (MLF) is an efficient practice to control the development of *Brettanomyces* as well as the production of biogenic amines (BA), instead of SO_2 addition. As seen in Figure 5, when inoculated with wine bacteria, there is no growth of *Brettanomyces* (even with a high contamination) and moreover, the *Brettanomyces* levels decrease when the population of the selected bacteria increases.

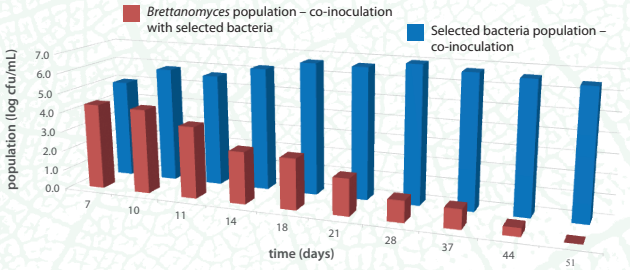

Figure 5. *Brettanomyces* growth during co-inoculation with our selected wine bacteria in Pinot Noir (Burgundy, France).

In general, biogenic amines levels are higher in wines with high pH due to the presence of various contaminating microflora. However, even at lower pH, spontaneous MLF can be associated with the production of biogenic amines (BA) as there is always a risk that MLF is conducted by indigenous bacteria having the capacity to produce biogenic amines. Different strategies can be used to reduce biogenic amines in the wine, such as using selected wine bacteria unable to produce BA, as shown Table 1. Moreover, the use of Bactiless™ (chitosan based natural product from *Aspergillus niger*) can help reduce the number of indigeneous LAB producing biogenic amines.

Analysis after MLF (mg/L)	Pinot noir		Pinot noir + histidine + tyrosine	
	Histamine	Tyramine	Histamine	Tyramine
Selected LAB	<1		<1	
Indigenous flora	13.8	2.7	50.3	8.3

Table 1. Biogenic amine production in Pinot noir with selected wine bacteria and during spontaneous malolactic fermentation.

Stabilisation, storage and transport

The final steps are key in maintaining the quality of the wine all the way to the consumer. Again, at this stage, other bioprotection tools are available to prevent the development of undesirable microorganisms, as well as protect the wines from oxidation.

If microbial instability is suspected or if extra precautions are needed to control spoilage microbes without the use of chemicals and SO_2, the use of No Brett Inside™ to control the development of *Brettanomyces* or Bactiless™ to control lactic acid bacteria is recommended. Both have proven their efficiency in finished wines and are approved for use in organic wine production.

To protect wines from oxidation during storage, cold stabilisation and bulk transport, the use of Pure-Lees™ Longevity is recommended, with the usual SO_2 dosage or with reduced concentration of SO_2. In a trial during the transport of wine in flexitanks from New Zealand to France, the addition of Pure-Lees™ Longevity (40 g/hL) during the loading of the flexitanks with the Sauvignon blanc wine made it possible to obtain on arrival a wine whose aromatic qualities are better preserved (thiols) as well as less disolved oxygen (Figure 6) and more stable free and total SO_2 compared to the control. With these results, the shelf life of the wines in pouches was extended by several weeks. We recommend consulting the Winemaking Update 1B, 2021 (Managing oxidative risk with biological tools Part II – Post-fermentation) on this topic for more details.

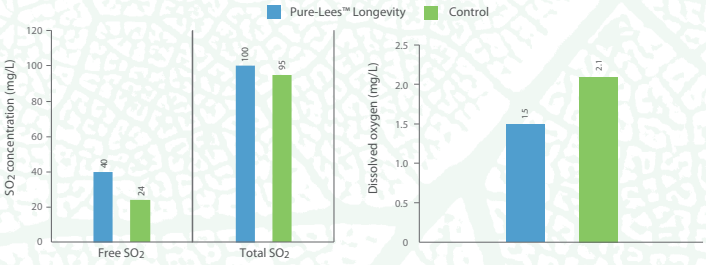

Figure 6. Free and total SO_2, and dissolved oxygen in Sauvignon blanc with Pure-Lees™ Longevity added prior to transport

In Summary

Many options are now available to winemakers who wish to reduce the the use of SO_2 to respond to consumers demands and have a more sustainable approach to winemaking. At Lallemand Oenology, we have efficient and unique tools that can help achieve this goal. Wine yeast and bacteria, and their derivatives offer alternatives to SO_2 that are efficient and respect not only the quality typicity of the wine, organic regulations, and the path for the future.