Inspiring innovation.

GLASS ALTERNATIVES: PART 1 – THE BAG-IN-BOX

The search for new marketing strategies and the need to adopt more sustainable solutions for the environment are pushing wineries to choose alternative containers to the glass bottle. The use of cans and Bag-in-Box mean winemakers face new challenges that they need to be aware of in order to continue offering the consumer a wine of exceptional quality.

The Bag-in-Box

Bag-in-Box (BiB) has been used for a long time in the wine sector, mainly for wines of quick consumption. The shortage of glass due to the contingent market situation, the increase of home consumption of wine imposed by Covid and the desire to explore new forms of sales have pushed many wineries to adopt the use of BiB even for their premium wine range. This new application has highlighted a well-known problem connected to the use of BiB: wine, being premature oxidation. Oxidation in BiB occurs much quicker than with glass, showing all the characteristics: appearance of a decreased aroma, color alteration with accentuation of yellow/brownish tint, and a significant decrease of free sulfur dioxide.

Causes of oxidation in BiB wines

Why are BiB wines more susceptible to oxidation than the ones bottled in glass?
Besides oxygen dissolved at bottling or in the phases immediately preceding it, which is always dangerous regardless of the type of container used, the oxygen present in the headspace and the permeation through the bag represent an additional threat for the quality and shelf life of wine stored in BiB.

The Headspace

For filling, the BiB bag is laid out on a flat surface with the gland facing up. The formation of an air bubble inside the bag is unavoidable since the tap must be attached without any leakage of liquid. To ensure a better resistance to oxidation, it is necessary to reduce the volume of the bubble. Headspace represents a critical factor especially in small size BiBs. Often its volume remains the same regardless of the volume of the BiB. Therefore, in smaller BiBs the quantity of oxygen contained per liter of wine is higher than in larger BiBs.
Another problem encountered is the high variability of bubble size (Figure 1). By sampling during the same bottling, it is found that the headspace varies significantly from one BiB to another. This leads to a high variability in quality and duration of the wine within the same batch.

Bag permeability

BiB bags have a different oxygen permeability depending on the thickness and the materials (PE, PET, EVOH, aluminum etc.) composing the film. Obviously, the presence of barrier materials such as aluminum and EVOH reduces the diffusion of oxygen into the wine.
Seals and contact points between the gland and the film and between the gland and the tap can be other areas where oxygen enters.
Measuring the amount of oxygen entering the BiB is impossible since wine has an oxygen consumption rate greater than the oxygen inflow rate; therefore, information regarding bag permeability should be obtained from the supplier.

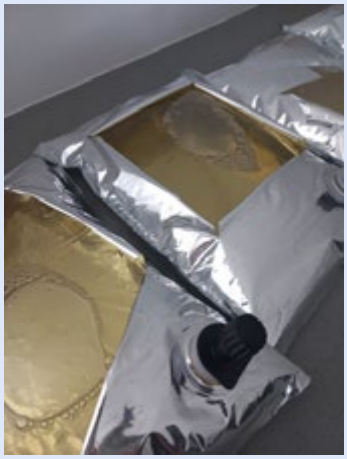

Figure 1: Headspace varies significantly from one BiB to another. This leads to a high variability in quality and shelf life of the wine within the same batch.

How to extend the shelf-life of wines in BiB?

Reducing Dissolved O_2

If reducing dissolved oxygen is fundamental for every wine, in the case of BiB wines it is even more important. The adoption of an adequate sampling and analytical control plan for the total packed oxygen - dissolved and present in the headspace - helps to identify the critical points and to implement the necessary corrective measures. The use of tannins and ascorbic acid-based products can help extend the shelf-life of wine in BiB.

Managing O_2

One of the effects of oxidation caused by the total packed oxygen is a rapid decrease of free sulfur dioxide (Figure 2). A drop in the first two months after bottling is considered physiological even in glass bottled wines but then it settles at relatively stable levels. In BiB, however, because of the continuous inflow of oxygen through the bag, the loss of free sulfur dioxide persists and after few months it reaches values insufficient to ensure the necessary antioxidant and antimicrobial protection. For a longer shelf life, it is necessary to increase the initial content of sulfur dioxide. It is also

important to add SO_2 a few days before bottling and make sure its content is stable to avoid putting a wine with a lower content of sulfur dioxide than the one considered as correct in BiB.

Controlling Storage Temperature

Highlighting that high temperatures are not good for wine quality is trivial but the effects on wine in BiB are dramatic: increasing the storage temperature from 20°C to 30°C reduces the shelf-life of wine from 8 to 4 months!
Controlling storage temperature and planning the production to shorten the storage time helps to have a higher quality wine in the market. (Table 1)

Merlot in 2 liters BiB: variation of free SO_2 content during storage

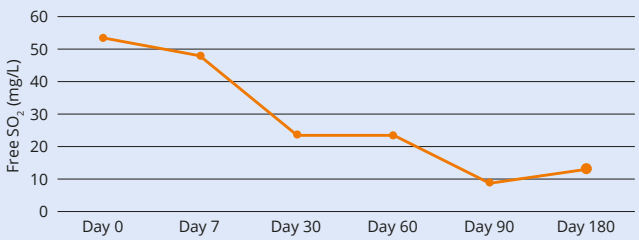

Figure 2: Variation of free SO_2 content during storage. Dissolved oxygen at the time of bottling: 1,9 mg/L; range of headspace volume: 14-57 mL.

For more information on the use of the Bag-in-box, we invite you to watch the presentation made by Dr. Carien Coetzee of Basic Wine (www.basicwine.com) at the Enartis Stabilisation School 2021 and is available at the following address https://youtu.be/VvHmdnGDPko

PARAMETERS TO MONITOR IN BAG-IN-BOX WINE

RIGHT AFTER BOTTLING	DURING WINE STORAGE
Dissolved oxygen	Free SO_2
Headspace volume	Colour
Oxygen present in the headspace	Sensory quality
Right after bottling monitoring the suggested parameters is needed to understand if there is oxygen solubilization and to correctly set up the filling machine to minimize the headspace volume. During wine storage monitoring free SO_2, colour and sensory quality are required to check wine evolution and shelf-life.	

Table 1. Parameters to monitor in BAG-IN-BOX wine.

Products recommended in reducing dissolved oxygen:

- **Citrostab rH** is a pre-bottling coadjunct that can be used to "consume" the dissolved oxygen preventing wine compound oxidation. Note, a dosage of 6 g/hL of Citrostab rH will scavenge approximately 1 ppm of dissolved oxygen, thus being beneficial in controlling SO_2 additions. More details on dosages and effects can be found at on our website
- **Hideki** is a tannin made of molecular fractions obtained through the selection and purification of gallic, ellagic and condensed tannins that are the most effective in protecting wine from oxidation and the development of undesirable microorganisms. The application of Hideki in BiB improves wine resistance to oxidation preserving a fresher colour and aroma for longer time as well as a higher free SO_2 content. A higher free SO_2 content together with Hideki's inherent antimicrobial activity prevent microbial alteration of the wine.

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