3.11 How can I protect my grapes and juice from spoilage during transport to the winery?

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Sulfur dioxide (SO_2) can be added to harvesting bins if there is a risk of spoilage due to high temperatures, high pH, diseased or damaged fruit, long wait times until the fruit can be minified or long transport distances to the winery. High temperatures and pH increase proliferation of microbes after infection and increase the rate of oxidation. Machine harvested or diseased and damaged berries often have ruptured skins, releasing juice which drains to the bottom of the container. Accumulation of juice in the base of the bin increases the risk of infection with microbes, as the juice is more easily accessible. The longer the journey to the winery, the greater the opportunity for spoilage.

Sulfur dioxide's main role is to prevent microbial infection of the juice and thereby prevent unwanted or spontaneous fermentations by yeasts other than that planned by the winemaker and infections by undesirable bacteria (e.g., ***acetobacter, lactobacillus).*** Molecular sulfur dioxide (SO2 or H2S03) is the form that inhibits microbes. The sulfite ion ($S0_3^{2-}$) is mainly responsible for preventing oxidation but there is not much present at the pH range of most juices and wines (Boulton ***et al.*** 1996). Sulfur dioxide can react with compounds other than oxygen that may be found in musts (e.g., anthocyanins, acetaldehyde, glucose) to form 'bound' SO_2, which is unable to prevent microbial spoilage or oxidation. Consequently, when we add sulfur dioxide to a juice or wine, not ***all*** **will be** available to protect the wine (depending on its distribution between the different forms), which complicates deciding how much to add. In practice, we have to make an estimate of how much will be in the bound form to ensure that there is sufficient molecular SO_2. At this stage of the winemaking process, we may assume that 25-30% may be in the bound form once it dissolves in juice. A further complication is that different amounts of molecular SO_2 are required to inhibit different microbes.

The simplest way to add SO_2 to harvesting bins is as the solid, potassium meta-bisulfate (KMBS). Fifty seven percent of potassium meta-bisulfite is SO2 (some winemakers approximate this to 50%). The great advantage of KMBS is that the SO2 is not released until it comes in contact with juice in the harvesting bin (i.e., when spoilage could begin to occur). The amount to add will vary according to the extent of the risks mentioned above. If there were more than one risk evident, then the amount would need to be increased. Table 1 illustrates how the amount added might vary according to the level of two different risks and assumes that approximately 25% may be in the bound form. If a third factor Was present, the additions may increase to 60-70 mg/L. If it is hot, then some of the KMBS could volatilize as SO2 which may kill micro-organisms on the surfaces of whole berries. However, this is a secondary mechanism of protection and the extent to which it might occur has not been investigated.

Table 1 Possible examples of the variation in SO_2 additions (mg/L) with temperature (°C) and disease level

Disease level	SO_2 additions (mg/L) at different temperatures		
	<15°C	15–25°C	>25 °C
Low	30	35	40
Medium	35	40	45
High	40	45	50

Calculating the weight of KMBS 10 add to achieve a specific concentration of SO_2 in the juice

Grams of KMBS to add = tons of grapes x press yield x mg/L SO_2 required x 0.00175

For example, the amount of KMBS required to add 40 mg/L of SO_2 to a picking bin holding 0.5 ton of grapes (that one would expect a press yield of 650 L/ton) would be:

Grams KMBS = 0.5 x 650 x 40 x 0.00175 = 22.75 g

The KMBS can then be weighed into small, resealable plastic bag, one for each harvesting bin. In the vineyard, the solid can then be sprinkled over the base of the harvesting bin just before it is filled. Juice from machine-harvested fruit (or damaged grapes) will drain to the bottom of the bin where it dissolves the KMBS and becomes protected from spoilage. If there is more time and the bin is not being filled too quickly, the KMBS could be dissolved in a small amount of water and added in portions as the bin was filling. These small amounts of KMBS should not present a problem of pickers breathing SO_2 fumes particularly since they do not stay by the bins for long periods of time. If a sorter was being employed to sort through the bin while it was being loaded, then a gas mask should be provided for protection as a precaution.

Reference

Boulton, R.B., Singleton, V.L., Bisson, L.F. and Kunkee, R. E. 1996. Principles and Practices of Winemaking, New York, Chapman & Hall.

1. In order to carry out the calculation, we need to make an assumption about the amount of juice per ton (commonly referred to as the press yield, L/ton). The volume of juice is calculated from the tons of grapes multiplied the expected yield (L per ton) from the press, e.g. if the yield for the press is 650 L/ton and 3 tons are going to be crushed, the volume would be 650 x 3 = 1950 L.