Don't get contaminated this vintage!

Introduction

Unfortunately, some taints and contaminations occur every vintage and cause winemakers around the world distress just when they least need it. The aftermath is typically a product that can't be sold, economic loss and possible brand damage if the taint or contamination goes undetected. The typical contaminations that occur during vintage are refrigerant 'brines' from leaking cooling systems and hydraulic oils from mechanical harvesters or grape bin tippers. The typical vintage taint is due to aromatic hydrocarbons that originate from particular paints, or paint thinners, used on grape bins and other transport vessels. There are actually a number of different taints and contaminations that can come from a number of different sources all year round. However, refrigerant 'brine' and hydraulic oil contaminations and 'paint taints' are the most frequently encountered ones during vintage.

Fortunately, there are preventative measures which can reduce the risk of winemakers experiencing these types of taints and contaminations. We outline the causes of the main vintage taints and contaminations in this article and also some possible preventative measures.

Refrigerant 'brine' contaminations

Temperature control is an essential requirement of winemaking in Australia and will no doubt become even more important as average temperatures rise into the future. Many of Australia's wineries use cooling systems that utilise low freezing point refrigerant 'brines'. A brine is a secondary coolant and is used as an intermediate fluid to transfer heat from the wine product to the primary refrigeration system. Air and water can be used as secondary coolants but alcohols and glycols are usually used because they have much lower freezing points (which make them more efficient). However, over the last three vintages, the AWRI performed analyses in relation to 59 cases of leakage of refrigerant brines into juices and wines.

Brine solutions can leak from internal dimpled cooling plates in tanks and contaminate the contents if the plates become compromised or damaged. External jacketed cooling is preferable as any leaks are less likely to end up in juice, must or wine. There have been cases of contamination caused by brine that has slowly leaked from joins or cracks in brine lines positioned directly above areas where fruit is exposed (e.g. grape receival or crusher areas). To eliminate this risk, brine lines should be designed and engineered so they don't lie directly above such areas. Similarly, brine lines throughout the winery should be positioned so they don't lie directly overhead any open tank fermenters, tank access points or any areas where fruit might be exposed. Smaller wineries may use cooling plates placed directly in contact with fruit or wine. These plates and hose connections should be checked before each use

to ensure their integrity and water should preferably be used as the secondary coolant in these cases.

Brine contaminations are sometimes the result of leakage from clamped hose ends and joins. This risk can be reduced by inspecting all brine hoses, particularly the hose ends, for wear and tear before vintage. Replace any damaged hoses and re-cut and clamp cracked hose ends. Importantly, all hose clamps should be checked and tightened if necessary.

Secondary cooling systems continuously recirculate brine from the primary cooling system through a network of hoses connected to tanks and heat exchangers. This means the volume of brine in the system should not change dramatically over the course of a vintage period. Regular monitoring of brine levels in the cooling system is therefore a simple and effective way to check for undetected leaks.

Unless there has been gross contamination, detecting possible contaminations of alcohol-based brines in juice and wine by measuring changes in ethanol and methanol concentration can be difficult, as wine itself naturally contains these alcohols. Fortunately, alcohol-based brines now usually contain marker compounds such as an array of rhodamine dyes (bright red/pink pigments) which make the detection of brine contaminations much simpler. Rhodamine is generally added to brine at a concentration of 10 mg/L. The AWRI's Commercial Service offers a service to measure rhodamine in juice and wine. Note that a sample of the offending brine must also be submitted to perform the analysis. This is because wineries often refill or 'top up' brine reservoirs year after year with different batches of refrigerant brine – this can affect the overall concentration of rhodamine in the brine. The AWRI method is capable of detecting a 0.001% brine contamination, which is the equivalent of 10 mL of brine in 1000 L of juice, must or wine (AWRI publication #987). The Commercial Service also offers analysis of wine for 1,2-propylene glycol, which is commonly used in glycol-base brines.

Hydraulic oil contaminations

Oils from vineyard and winery machinery can contaminate grapes, juice and wine from a number of sources. These include hydraulic oil from mechanical harvesters and bin tippers, various lubricating greases from machinery, gearbox oil from filter presses and a range of oils used on bottling lines. Note that even food-grade oils used on bottling lines are still classed as contaminants because they are not listed as legal additives in the Australian and New Zealand Food Standards Code. However, the main oil contaminations that occur during vintage time each year are those due to hydraulic oils. Occasionally oil leaks are obvious because they form a thin layer on the surface of the juice, must or wine in tank. Alternatively, there might be an obvious petroleum or hydrocarbon aroma.

Typically though, the scenario is that a hydraulic oil line breaks on a mechanical harvester and either sprays hydraulic oil over the grapes or the oil drips down onto the grapes. The problem is that minor spills or leaks of hydraulic oil from mechanical harvesters might go unnoticed, or they might not be noticed until the end of a work shift. Under these circumstances, it can be difficult to determine exactly which juice or batch of fruit has been contaminated, or if indeed a contamination has actually occurred.

A gas chromatography mass spectrometry method for detecting hydraulic oil contaminations in juice and wine has been developed at the AWRI (AWRI publication #766). However, the method is usually not sensitive enough to confirm minor hydraulic oil contaminations. This is because hydraulic oils contain a broad range of long chain aliphatic hydrocarbons which are similar to those naturally present in the waxy coating on grapes. The fact that they're not very volatile also makes them hard to detect. Currently, there is no marker compound in oils equivalent to the rhodamine added to brine, which would allow easy detection of contaminations.

Fortunately, contaminations and taints caused by other petroleum-derived products or materials (e.g. diesel) are easier to detect because they contain various volatile aromatic hydrocarbons that can be used as marker compounds for contamination.

The preventative measures that can be taken to reduce the chance of hydraulic and other oil contaminations occurring are similar to those taken for refrigerant brine. For example, hydraulic oil lines or moving parts requiring lubricating oil should be positioned or engineered so that any potential leak will not contaminate exposed fruit, juice or wine. Pre-vintage inspection and maintenance of all hoses and clamps supplying machinery oils is recommended – remember that hydraulic oil contaminations often occur through burst lines. Daily maintenance checks of mechanical harvesters are also recommended. In particular, the level of hydraulic oil in the harvester should be checked both at the start and end of each day of harvest to check if leaks have occurred, so that affected batches of fruit can be isolated.

'Paint taints'

Over the past 20 years, winemakers have occasionally submitted samples (grapes, juice and wine) to the AWRI during vintage in order to investigate 'paint taints'. These taints are variously described by the winemakers as plastic, PVC, styrene, solvent, chemical, or paint-like. Typically, the winemaker detects the taint in the harvested fruit. During the 2008 vintage, the AWRI's Winemaking and Extension Services team investigated five 'paint taint' cases such as this. Some of these cases arose because non-food-grade paint was used to coat grape bins. Other cases occurred because the paint was not sufficiently sealed or cured prior to use.

Grape or fruit picking bins vary in size and shape, age and material. Grape bins encountered today can be made from stainless steel or food-grade high density polyethylene which can be used without any pre-treatment. Bins made from non-food-grade material or from base steel need to be painted periodically with food-grade paint to make them suitable for use in the wine sector.

Historically, taints have arisen from the use of chlorinated rubber-based paints. These types of paints have been phased out over the last five to 10 years. Taints can also arise from paints containing phenols. If painted grape bins containing phenols are allowed to come into contact with chlorine-based cleaning agents, a class of compounds called chlorophenols are formed. These compounds can impart chlorine or plastic aromas to grapes, juice or wine put into these containers. These taints highlight why chlorine-based chemicals should never be used in the winery cellar or used to clean vineyard harvesting equipment. Heavy metals or petroleum derived aromatic hydrocarbons used in some non-food-grade paints can also contaminate grape, juice and wine products.

Paints supplied for winery and vineyard use today are generally a food grade, two pack epoxy coating. The paint should specifically:

- not contain any free phenols;
- not contain solvent;
- be suitable for potable water; and
- have been tested and approved by a water authority for storing potable water.

It should also be remembered that food grade paints are deemed to be food grade relative to their performance in storing potable water rather than acidic grape juice, and definitely not alcoholic wine or fermentations. Advice on appropriate paints can be obtained by contacting the Winemaking and Extension Services team.

Grape bins are often painted just before harvest but it is vital that the paints be properly cured before use. In general, these paints become touch dry at six hours, but should ideally be left seven to 12 days before use, depending on the product specifications, to ensure a properly cured and sealed surface. This curing time should be taken into consideration when the harvest is approaching. The product should be applied at the appropriate temperature as curing times might be longer with cooler application temperatures. It is advised that food grade paints be applied by professional painters and not by winery or vineyard personnel. Paint thinners should have similar properties to the paint, and should also be food grade and free of phenols. Paint suppliers should be able to provide these details. Bin surfaces may also require priming of metal before application. Food grade paints should not be applied over non-food grade paints, such as chlorinated rubber-based paints. These older paint layers should be removed first and the new paint applied.

Note that most paint suppliers have clauses in their technical notes for food-grade paints which state that if their paint does impart a taint to a food product coming in contact with the painted surface then they cannot be held liable in any way, regardless of the amount of testing that has been performed on their paint. For this reason it is advisable to test any paint before use for taint potential. The AWRI provides a taint screening method for paints on our website (www.awri.com.au).

A note on additives and processing aids

Wine taints and contaminations might occur through use of contaminated wine additives and processing aids during winemaking. This issue was recently discussed in a paper by Coulter et al. (AWRI publication #1039) with particular reference to chlorophenol taints. The AWRI recommends the assessment of all wine additives and processing aids for taint potential prior to use. Even more preferable is to obtain small samples of additives and processing aids from your suppliers for pre-screening prior to purchasing your vintage requirements. Such a step avoids bringing large amounts of potentially contaminated materials into the winery premise that could result in cross contamination of other products and additives. It also potentially allows the ordering of the entire vintage requirements from the batch already assessed and approved, thus minimising the amount of taint screening required. Given that an average winery might only use 10–15 additives and processing aids, this equates to a small amount of testing for a potential huge cost saving in preventing taints occurring through use of contaminated products.

Sensory screening tests for commonly used winemaking chemicals and processing aids can be found on the AWRI website. Note that sensory assessment for taints should be performed by more than one taster due to variation in people's sensitivity to a range of different taint compounds.

Summary

Vintage grape, juice and wine contaminations can in most cases be prevented by eliminating the chance that refrigerant brines, paints, oils and other non-allowed or contaminated substances can come into contact with your product. When there is evidence or even suspicion that an addition of a substance not listed as a legal additive in the relevant standard (such as the Australian and New Zealand Food Standards Code) has been made to grapes, juice or wine, it is suggested by the AWRI that the juice or wine made from the affected fruit, should be considered unsaleable. The AWRI's Commercial Service offer methods to detect common contaminations such as refrigerant brine. Providing this analytical evidence of contamination to your insurer allows you to write-off the wine and claim the loss through your wine insurance policy. For other types of contaminations and taints that might be encountered, Australian levy payers should contact the AWRI's Winemaking and Extension Services team for confidential assistance. This service is provided free of charge. Remember, prevention is better than a cure and some smart pre-vintage planning now might save you much post-vintage grief.

References

AWRI publication #766. Baldock, G.A., Hayasaka, Y. (2004) Screening method for petroleum-derived aromatic hydrocarbons in wine. Aust. J. Grape Wine Res. 10(1): 17–25.

AWRI publication #987. Baldock, G.A., Hayasaka, Y., Coulter, A.D., Godden, P., Herderich, M.J., Pretorius, I.S. (2007) Mass spectrometry in investigations of grape and wine contaminants: Protecting the quality and integrity of Australian wine. Aust. N.Z. Wine Ind. J. 22 (4): 21–26.

AWRI publication #1039. Coulter, A.D., Capone, D.L., Baldock, G.A., Cowey, G.D., Francis, I.L., Hayasaka, Y., Holdstock, M.G., Sefton, M.A., Simos, C.A., Travis, B. (2008) Taints and off-flavours in wine – case studies of recent industry problems. Blair, R.J.; Williams, P.J.; Pretorius, I.S. (eds). Proceedings of the thirteenth Australian wine industry technical conference, 29 July–2 August 2007, Adelaide, SA. Australian Wine Industry Technical Conference Inc.: Adelaide, SA.: 73–80.

The Australia and New Zealand Food Standards Code, Standard 4.5.1 [http://www.foodstandards.gov.au/foodstandardscode/].

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