ENVIRONMENTAL TAINTS

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***Learning Outcomes:* Environmental taint is a relatively new term for the wine industry and reflects the fact that wine because of its alcohol content is an excellent solvent. We have experienced this problem in the mid-Atlantic region. Certain components in the atmosphere present in parts per billion can taint wines. The following provides an overview of the sources and types of environmental taint.**

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Introduction

Several odor/flavor-active metabolites are associated with the manufacture, shipping and/or storage of packaging materials such as cork, cardboard, and paper wrappings. Likewise, winery additives, such as fining agents, when stored in an environment enriched with chloroanisoles, are known reservoirs for general contamination of wines with which they come into contact (Tanner and Zanier,

1981).

Compared with defects such as volatile acidity and reductive tone arising from the wine, “taint” describes spoilage from external sources. While chlorophenols and anisoles are generally the first that come to mind, “taint” is not uniquely defined by these, and may include contributions from several other potent microbial metabolites.

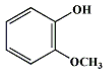
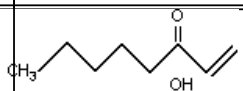
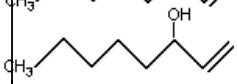
Non-halogen taints

Non-halogen taints include the following:

- guaiacol,
- geosmin
- 2-methyl-isoborneol (MIB)
- octen-3-ol
- octen-3-one

As seen in Table 1, all have very low (ng/L to µg/L) detection and identification thresholds. Sensory descriptors range from musty to mushroom and, in cases of near-threshold levels of contamination, flavor/aroma “scalping” is often observed. Here, the contaminating compound acts to mask or mute varietal characteristics and intensity, rather than overtly manifest itself.

Table 1. Non-Halogen Taints Found in Wines ([1]Duerr, 1985; [2-3]Amon et al., 1989; [4]Simpson et al., 1986; [5-6]Amon, et al., 1989)

Compound	Structure	Aroma	Threshold Value
2,4,6-TCA		Musty/Moldy	[1]1.5- 3.0 ng/L 4.6 ng/L in Sauvignon Blanc (trained judges)
Geosmin		Earthy/Muddy	[2]25 ng/L in wine
2-methylisoborneol		Earthy/Muddy. At high concentrate camphoraceous	[3]30 ng/L in wine
Guaiacol		Smoky/Medicinal	[4]20 µg/L in wine
1-Octen-3-ol		Mushroom/Metallic	[5]20 ng/L in wine
1-Octen-3-one		Mushroom/Metallic	[6]20 µg/L in wine

Halogen Taints

Until fairly recently, compounds such as TCA (2,4,6-trichloroanisole) and, to a lesser extent, TeCA (2,3,4,6-tetrachloroanisole), were held mainly responsible for taint in wines. It was assumed that the ultimate problem stemmed from natural cork. This is why musty or wet cardboard-smelling wine is so frequently mistaken for cork taint.

It has been understood for some time that not all wine taints are cork-derived. Today, we know that there are a host of compounds, TCA included, which can cause taint and do not necessarily come from cork. What is relatively new is the understanding that taints can come from the environment in which wine is stored. As such, this is an important winery establishment and design issue. TBA (2,4,6-tribromoanisole) is a molecule which behaves like TCA and produces a similar effect, but is one of several source compounds responsible for environmental taint.

The precursor of TBA is TBP (tribromophenol), which is widely used to treat wood and wood products. It is both a flame retardant and fungicide. Additionally, TBP can be produced by some algae, and it is also found in detergents containing bromine. This extremely volatile compound has been found not only in wines, but on winery surfaces, including barrels, plastics (including synthetic closures), natural corks, and wood structures, including walls, floors, and ceilings.

TBA released from treated wood circulates in the air and can cling to any surface. Given its volatile nature, it can return to the air and taint wine. Such taints result in either a direct perception of a taint, or more likely the simple loss of fruit and wine aroma intensity. The perception threshold for TBA is as low as 4 ng/L, about the same as for TCA. This concentration is roughly equivalent to one sugar cube dissolved in the water contained in 100 Olympic-sized swimming pools. Wood treatments have become a serious environmental pollutant.

Environmental taint is derived from the interaction of molds, halogens (chlorine and bromine), and phenols (such as wood products). The problem is frequently associated with chemically-treated wood.

The extent of TBA and other-source environmental taint is often unknown. However, several prestigious French and US wineries have undergone the significant expense of attempting to rid their cellars of this problem. Sources of possible environmental taint include barrels, wooden barrel racks, interior walls and ceilings, wooden catwalks, ladders, cardboard, wooden pallets, tap water, hoses, filter pads, fining agents, and polymeric tank liners. Environmental taint is a greater problem in new wineries, in humid cellars, and in air-conditioned cellars.

- Formed by interaction of mold, halogens, phenols
- Halogen taints are frequently associated with chemically treated wood
- Results in loss of fruit intensity
- Most common halogen taints
  - tetrachloroanisole
  - pentachloroanisole
- Greater problem in new wineries
- Greater problem in humid cellars
- Greater problem in air-conditioned cellars

Environmental HACCP-Like Plan Critical Control Points

- Test
  - atmosphere of all confined spaces
  - water supply (UV filter)
  - drain water
  - rubber hoses/gaskets
  - silicon bungs
- Avoid
  - cardboard in confined spaces
  - wood in confined spaces

Sources of Environmental Taint

Environmental taints are associated with chlorine, polychlorophenols, pentachlorophenols, and the following:

- barrels
- wooden barrel racks
- interior walls/interior roofs
- catwalks, ladders
- cardboard
- wooden pallets
- tap water
- hoses
- filter pads
- fining agents
- polymeric tank liners
- synthetic closures

Types of Chlorophenols, Chloroanisoles, and Bromoanisoles Found in Wines

The following are chlorophenols, chloroanisoles, and bromoanisoles found in wines (Ribéreau-Gayon et al., 2000):

- TCA: 2,4,6-trichloroanisole
- TCP: 2,4,6-trichlorophenol
- TeCP: 2,3,4,6-tetrachlorophenol
- TeCA: 2,3,4,6-tetrachloroanisole
- PCP: 2,3,4,5,6-pentachlorophenol
- PCA: 2,3,4,5,6-pentachloroanisole
- TBA: 2,4,6-tribromoanisole
- TBP: 2,4,6-tribromophenol

Testing for Environmental Taints

Because of the extremely low concentration, testing for environmental taints is usually only conducted by an experienced, certified environmental laboratory. Generally, for determining potential problems in the winery atmosphere bentonite traps are used. Bentonite placed into collection vials and placed in various locations within the winery for about three weeks. Vials are then sealed and sent to a laboratory which and de-adsorb the taint compound(s) from the trap. Materials such as pallets, boxes, etc., can be sampled directly.

References

Amon et al., 1989.

Duerr, 1985.

Ribéreau-Gayon et al., 2000.

Simpson et al., 1986.

Tanner and Zanier, 1981.