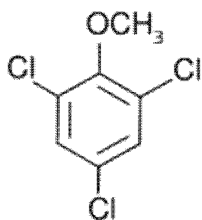


## Cork taint

### 2,4,6-Trichloroanisole



### Properties

<a href="#">Molecular formula</a>	C <sub>7</sub> H <sub>5</sub> Cl <sub>3</sub> O
<a href="#">Molar mass</a>	211.47 g/mol
<a href="#">Melting point</a>	60-62 °C
<a href="#">Boiling point</a>	140 °C at 28 torr

### Hazards

<a href="#">R-phrases</a>	<a href="#">R22</a> <a href="#">R36</a>
<a href="#">S-phrases</a>	<a href="#">S26</a>

Except where noted otherwise, data are given for materials in their [standard state \(at 25 °C, 100 kPa\)](#)

**Cork taint** is a broad term referring to a [wine fault](#) characterized by a set of undesirable smells or tastes found in a bottle of [wine](#), especially spoilage that can only be detected after bottling, [aging](#) and opening. Though modern studies have shown that other factors can also be responsible for taint – including wooden barrels, [storage conditions](#) and the transport of corks and wine – the [cork](#) is normally considered to be responsible, and a wine found to be tainted on opening is said to be "corked". Cork taint can affect wines irrespective of price and quality level.

The chief cause of cork taint is the presence of **2,4,6-trichloroanisole (TCA)** in the wine. Corked wine containing TCA has a characteristic odor, variously described as resembling a moldy newspaper, wet dog, damp cloth, or damp basement. In almost all cases of corked wine the wine's native [aromas](#) are reduced significantly, and a

very tainted wine is completely undrinkable (though harmless). While the human threshold for detecting TCA is measured in the single-digit parts per trillion, this can vary by several orders of magnitude depending on an individual's sensitivity. Detection is also complicated by the [olfactory system](#)'s particularly quick [habituation](#) to TCA, making the smell less obvious on each subsequent sniff.

## **Production**

The production of TCA in wine is complex, but most results when naturally-occurring airborne [fungi](#) are presented with [chlorophenol](#) compounds, which they then convert into [chloroanisole](#). Chlorophenols taken up by cork trees are an industrial pollutant found in many [pesticides](#) and wood [preservatives](#), which may mean that the incidence of cork taint has risen in modern times. Chlorophenols can also be a product of the [chlorine](#) bleaching process ironically used to [sterilize](#) corks, which has led to the increasing adoption of methods such as [peroxide](#) bleaching.

TCA is responsible for the vast majority of cases of cork taint, but other less common and less known compounds that can cause different varieties include [guaiaicol](#), [geosmin](#), [2-methylisoborneol](#) (MIB), [octen-3-ol](#) and [octen-3-one](#) - each has its own aroma, all of them considered objectionable in wine.

## **[[edit](#)] Estimated occurrence of cork taint and industry response**

The cork-industry group [APCOR](#) cites a study showing a 0.7-1.2% taint rate. In a 2005 study of 2800 bottles tasted at the [Wine Spectator](#) blind-tasting facilities in Napa, California, 7% of the bottles were found to be tainted.<sup>[1]</sup>

Improvements in cork and winemaking methodology continue to strive to lower the incidence, but the media attention given to cork taint has created a [controversy](#) in winemaking, with traditional cork growers on one side and the makers of newer [synthetic closures](#) and screw caps (such as [Rio Tinto Alcan](#)'s [Stelvin cap](#)) on the other. Screw caps and synthetic corks, however, can be prone to another aroma taint: sulphidisation, which arises from the reduced oxygen supply which concentrates sulphurous smells arising from universal preservatives.<sup>[2]</sup>

## **[[edit](#)] Systemic TCA**

Systemic TCA tainting occurs when TCA has infiltrated a winery via means other than cork and can affect entire production of wine instead of just a few bottles. This occurs when [wine barrels](#), drain pipes, wooden beams in the cellars, and rubber hoses are tainted by TCA. Sometimes entire cellars have to be rebuilt in order to extinguish all potential systemic TCA culprits. Rubber hoses or gaskets have a high affinity for TCA and therefore concentrate TCA from the atmosphere. Wine or water that subsequently passes through infected hoses can become tainted with TCA.

Another possible means of TCA contamination is through the use of [Bentonite](#), a clay preparation used in treating wine for heat stability. Bentonite has a high affinity for TCA and will absorb TCA and related chemicals in the atmosphere. If an open bag of Bentonite is stored in an environment with a high (1-2 ng/g or ppb) TCA concentration, this TCA will be absorbed in the Bentonite and transferred to the wine lot to which the Bentonite is added.

It is notable that often this systemic TCA will impart a trace (1-2 ng/L or ppt) to the wine, which itself is not detected by most consumers. However, with this high baseline level of TCA in bottled wine, even a relatively clean cork can elevate the TCA level in the wine above threshold levels (4-6 ng/L or ppt), rendering the wine "corked."

The primary chemical precursor to TCA is TCP ([2,4,6-Trichlorophenol](#)), an anti-microbial agent used in processing wood. Molds (and some suspect bacteria such as [Streptomyces](#)<sup>[3]</sup>) are able to de-toxify TCP by methylating the -OH to -OCH<sub>3</sub>, which is not toxic. Chlorinated phenols can form chemically when hypochlorous acid (HOCl-, one of the active forms of [chlorine](#)) or chlorine radicals come in contact with wood (untreated, such as [barrels](#) or [pallets](#).) The use of chlorine or other halogen-based sanitizing agents is being phased out of the wine industry in favor of [peroxide](#) or [peracetic acid](#) preparations. It should be noted that [Chlorine dioxide](#) has not been shown to produce these spontaneous chlorophenols. *Wine Spectator* has reported that such [California wineries](#) as [Pillar Rock Vineyard](#), [Beaulieu Vineyard](#), [E & J Gallo Winery](#) and [Chateau Montelena](#) have had trouble with Systemic TCA.<sup>[4]</sup>

### **[edit]** Treatment

There are now filtration and purification systems available which attempt to remove the TCA from corked wine to make it drinkable again, though there are few means of reducing the level of TCA in tainted wine that are approved by the [TTB](#) (formerly [BATF](#)).

One method of removing TCA from tainted wine is to soak [polyethylene](#) (a plastic used for applications such as milk containers and plastic food wrap) in the infected wine. The non-polar TCA molecule has a high affinity for the polyethylene molecule, thereby removing the taint from the wine. The surface area of polyethylene needed to reduce the taint to sub-threshold levels is based on the TCA level in the affected wine, temperature, and the alcohol level of the wine.

This can be done at home, as advocated by Andrew Waterhouse, professor of wine chemistry at [University of California, Davis](#), by pouring the wine into a bowl with a sheet of [plastic wrap](#). For ease of pouring, a [pitcher](#), [measuring cup](#), or [decanter](#) can

be used instead. Effective within a few minutes, the 2,4,6-trichloroanisole molecule is chemically similar to [polyethylene](#) and will stick to the plastic.<sup>[5]</sup>

Some vintners have used Half & Half to remove TCA from wine (the TCA in the wine is sequestered by the butterfat in Half & Half).

The French company Boffin markets a product called "Dream Taste" which uses a copolymer shaped like a cluster of grapes to remove the TCA taint from commercial wine.