

Smoke Taint: Analysis and Remediation Strategies

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- **Smoke Taint**
- **Background on Vinquiry Labs smoke taint analysis**
- **Smoke Taint Markers**
- **Free vs. Total markers**
- **Smoke and Sensory**
- **Interpreting Results**

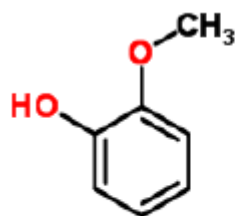


- Wines made from vineyards exposed to smoke from wildfires can develop characteristic aromas and flavors
 - Smokey
 - Ashy
 - Cigar or cigarette smoke
- Strong ashy, cigar-butt aftertaste can also occur
 - In many cases, the aftertaste is more offensive than the aroma
 - Ashy, cigarette smoke notes linger long after the wine is gone.

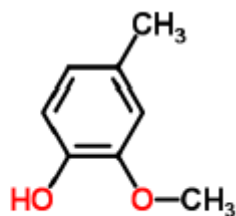


- 2007 - First smoke taint research done to show smoke affected fruit produced smokey wines, identified some of smoke compounds (Kennison et al. 2007)
- 2009 - Industry was still not fully aware that smoke compounds were present in grapes as glycosides. Most research was only on free smoke taint compounds
- 2010 - Determined smoke compounds can be converted into glucosides in the vine (Hayasaka et al. 2010)
- 2013 - Relative levels of free smoke compounds compared to bound forms in grapes was relatively small (Parker et al. 2013)
- 2013 - cont. Vinquiry labs begins development for bound smoke taint marker analysis
- 2015 - Vinquiry Labs begins offering total smoke taint markers analysis
- 2018 – AWRI proposes methodology for measurement of free and glycosylated smoke taint compounds

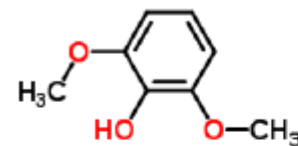
Smoke Taint Compounds



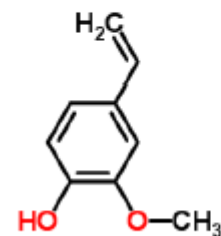
guaiacol



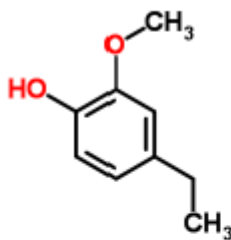
4-methyl guaiacol



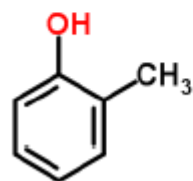
syringol



4-vinylguaiacol



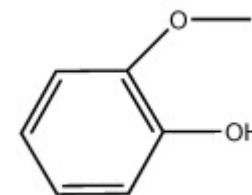
4-ethyl guaiacol



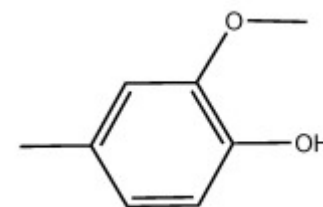
o-cresol

Why Vinquiry Labs utilizes Guaiacol and 4-Methyl Guaiacol smoke markers:

- Both compounds contribute strongly to smoky character in wine (Parker et al. 2012)
- Commonly found smoke compounds among different kinds smoke from different fuels
- Faster and more cost effective than measuring all total smoke taint compounds



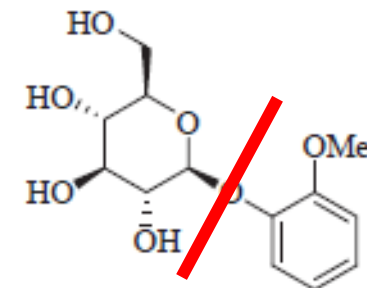
Guaiacol



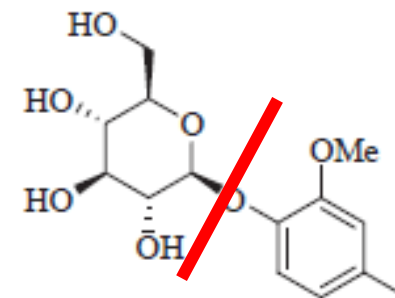
4-Methyl
Guaiacol

**Total smoke markers = Free + Bound Guaiacol
and Free + Bound 4-Methyl Guaiacol**

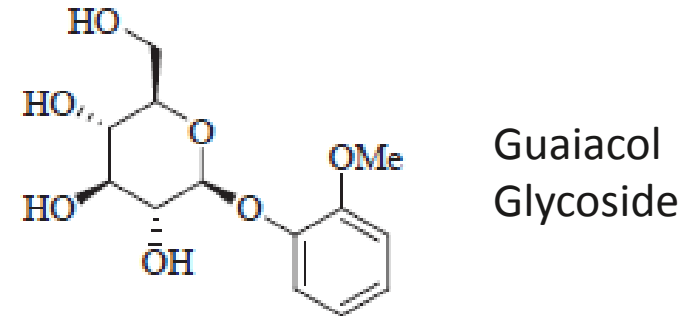
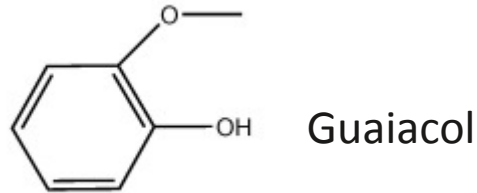
1. Extraction of slurry (grapes only)
2. Hydrolysis of compounds utilizing acid and heat (grapes and wine)
3. Measurement of headspace (GCMS/ SPME)



Guaiacol
Glycoside



4-Methyl
Guaiacol
Glycoside



Free (volatile)

- Often very low in grapes/ young wine
- Varies greatly depending on variety, fermentation parameters, enzyme use
- Aromatically detectable

Bound (Glycosylated)

- Much higher in grapes/ young wine
- Will decrease over time as glycosides release
- Is detected on the palate on the finish, and with retronasal effect (Mayr et. al 2014)

What are some of the reported sensory impact levels?

Best Estimate Thresholds

compound	BET ($\mu\text{g/L}$)	SE
<i>m</i> -cresol ($n = 23$)	20	0.6
guaiacol ($n = 23$)	23	0.8
guaiacol (flavor, $n = 22$)	27	0.6
<i>p</i> -cresol ($n = 22$)	64	0.5
<i>o</i> -cresol ($n = 22$)	62	0.8

(Parker et al. 2012)

Like many other sensory properties, smoke perception varies from one individual to the next

Table 2. Release of Guaiacol from Guaiacol Monoglucoside Following Incubation with Saliva Obtained from Four Subjects in Vitro^a

subject	mean release (standard deviation) %	minimum release (%)	maximum release (%)	number of replicates
A	17 (6)	9.7	25	6
B	31 (13)	21.0	52	9
C	12 (8)	3.8	20	4
D	63 (5)	57.0	68	4

^a30 min incubation, 37 °C.

(Mayr et al 2014)

- **Sugar level**

(3 g/L) reduced release of VPs by salivary enzymes (Mayr 2014)

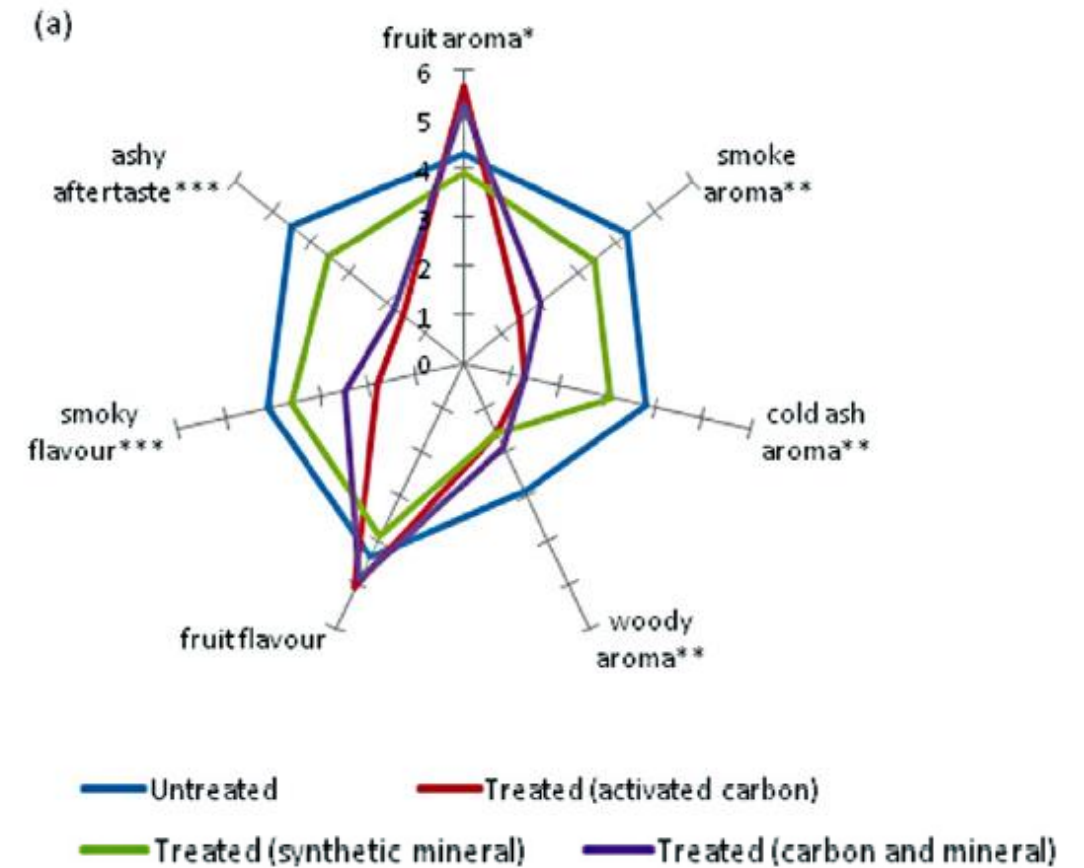
- **Ethanol**

Increasing levels decreased release of VPs by salivary enzymes (Mayr 2014)

- **Other fruity compounds**

Fruity fermentation aromas mask smoke perception (Wilkinson 2011)

- Activated Carbon
- Activated Chitosan



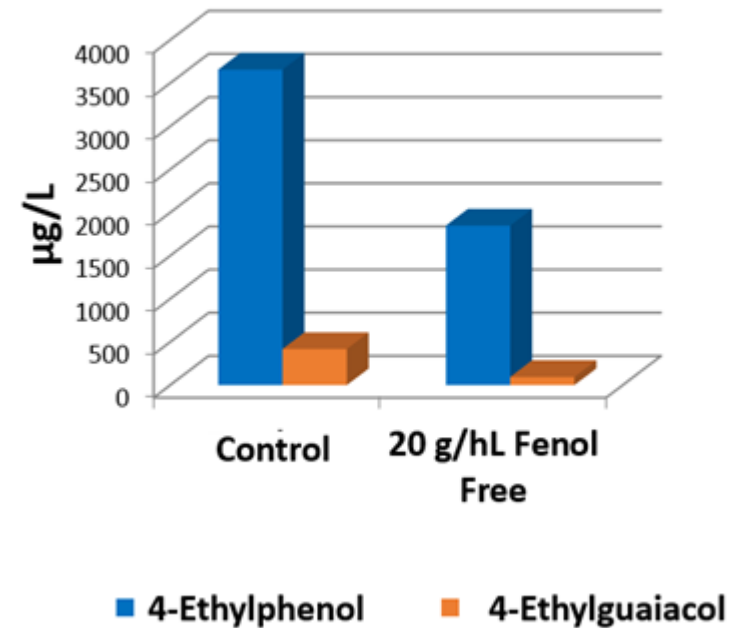
(Fudge et. al 2012)

Enartis Activated Carbon Options: Fenol Free



Fenol Free

- Low de-colorizing effect
- Removes volatile phenols



Enartis Activated Carbon Options: Enoblack Perlage



ENOBLACK



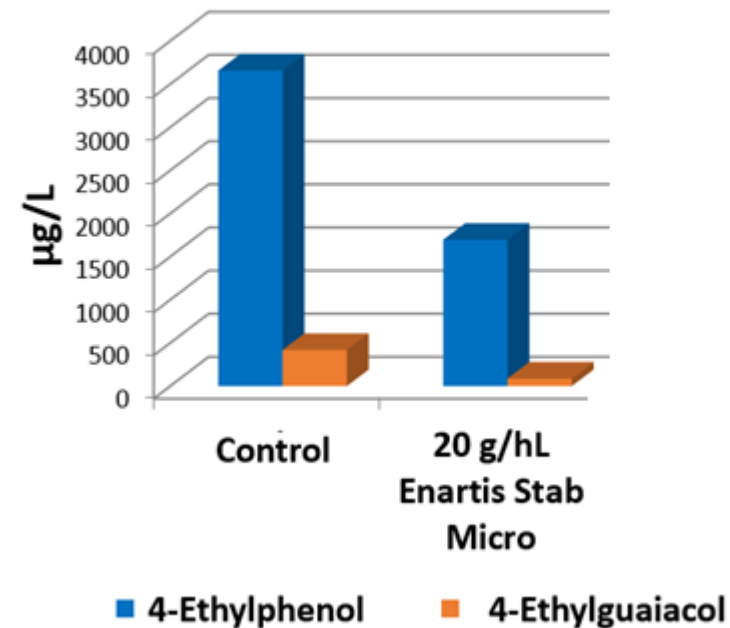
- Pelletized/ Less mess
- Effective for smoke taint remediation
- Strong effect, but strips color

Fining Options: Stab Micro



Pre-Activated Chitosan

Antimicrobial fining agent
which also removes volatile
phenols and smoke taint



What do the numbers mean? Can we put a number on the amount smoke which will be a problem?

It's all about risk levels and comparatives at this point

- Refer to reported sensory thresholds for reference
- Regional off-fire year background levels for different varieties are recommended (ex. Merlot and Syrah)
- ND levels indicate low smoke risk, high Total levels ($>30 \mu\text{g/L}$) indicate there is greater risk of smoke issue



- **2 – 3 weeks before harvest: total smoke markers**
- **After fermentation and settling: free and total smoke markers**
- **Mid way aging: free and total smoke markers**
- **Prior to fining/bottling: free and total smoke markers**

Why the partnership?

- Service for clients which want to have additional smoke markers data
- All classes of free compounds with additional specific glucosides
- Facilitate and expedite analysis with AWRI
- Off season advantage



- **A.L. FUDGE, M. SCHIETTECATTE, R. RISTIC, Y. HAYASAKA and K.L. WILKINSON** Amelioration of Smoke Taint in Wine by Treatment with Commercial Fining Agents, *Australian Journal of Grape and Wine Research* **18**, 302–307, 2012
- Hayasaka, Yoji, Gayle A. Baldock, Mango Parker, Kevin H. Pardon, Cory A. Black, Markus J. Herderich, and David W. Jeffery **Glycosylation of Smoke-Derived Volatile Phenols in Grapes as a Consequence of Grapevine Exposure to Bushfire Smoke.***Journal of Agricultural and Food Chemistry* **2010** 58 (20), 10989-10998 DOI: 10.1021/jf103045t
- Christine M. Mayr, Mango Parker, Gayle A. Baldock, Cory A. Black, Kevin H. Pardon, Patricia O. Williamson, Markus J. Herderich, and I. Leigh Francis **Determination of the Importance of In-Mouth Release of Volatile Phenol Glycoconjugates to the Flavor of Smoke-Tainted Wines.** *Journal of Agricultural and Food Chemistry* **2014** 62 (11), 2327-2336 DOI: 10.1021/jf405327s
- Patricia O. Williamson, Markus J. Herderich, and I. Leigh Francis,*Parker et al. **Contribution of Several Volatile Phenols and Their Glycoconjugates to Smoke-Related Sensory Properties of Red Wine** *Journal of Agricultural and Food Chemistry* **2012** 60 (10), 2629-2637DOI: 10.1021/jf2040548
- Parker, M., Baldock, G., Hayasaka, Y., Mayr, C., Williamson, P., Francis, I. L. and Johnson, D. 2013. **Seeing through smoke.** *Wine Vitic. J.* 28: 42–46.

Thank you for your participation!

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Fill out our survey!

Downloadable Materials

Q&A