

# Novel methods for the amelioration of smoke tainted wine



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# Aims of ARC Smoke Taint Project

In 2009, University of Adelaide established an ARC Linkage Project on smoke taint  
Industry partners: Yalumba Wine Company, Brown Brothers, Treasury Wine Estates, PIRSA

*The impact of vineyard exposure to smoke on vine physiology and the composition of grapes and wine*

Project Aims:

To identify vineyard management practices that minimise grapevine uptake of smoke.

To identify grape varieties less susceptible to the effects of smoke exposure (and therefore be suitable for planting in smoke-prone regions to manage the risk of smoke exposure).

To identify winery processing methods that minimise the concentration and sensory impact of smoke derived volatile organic compounds in finished wine.

To evaluate ultraviolet/visible/near-infrared/mid-infrared (UV/Vis/NIR/MIR) spectroscopy as a rapid analytical technique for the detection of smoke taint in juice and wine.

# Effect of winemaking techniques on intensity of smoke taint in wine

Investigate the influence of winemaking on intensity of smoke taint in wine

- duration of skin contact
- influence of yeast selection
- addition of oak chips and tannins

Control and smoked Grenache grapes fermented, either

- 1) Rosé style      3 day cold soak at 0°C  
prior to fermentation
- 2) Red style      fermentation on skins followed  
by malolactic fermentation

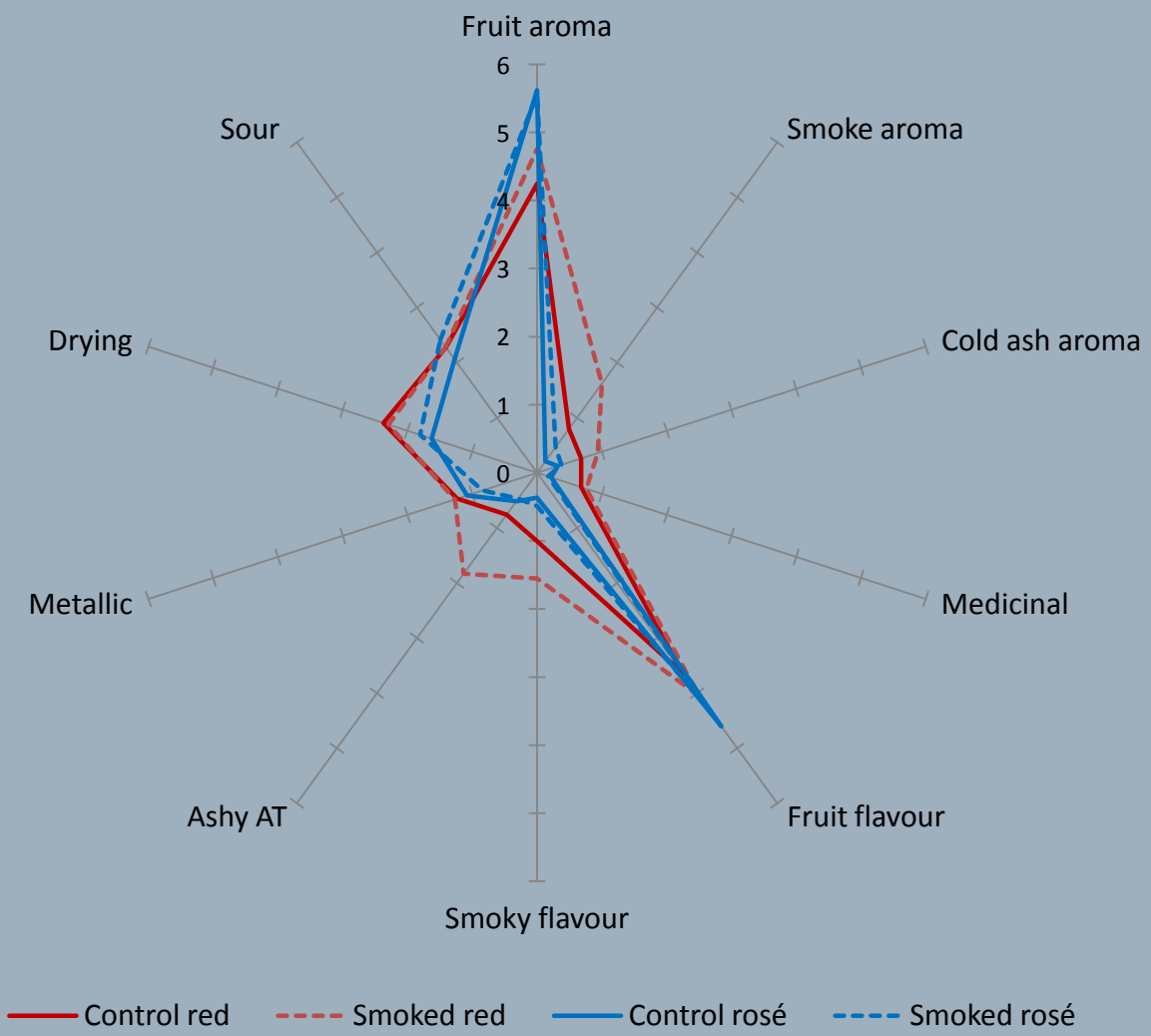


# Effect of winemaking techniques on intensity of smoke taint in wine

Duration of skin contact influenced wine composition and the intensity of attributes

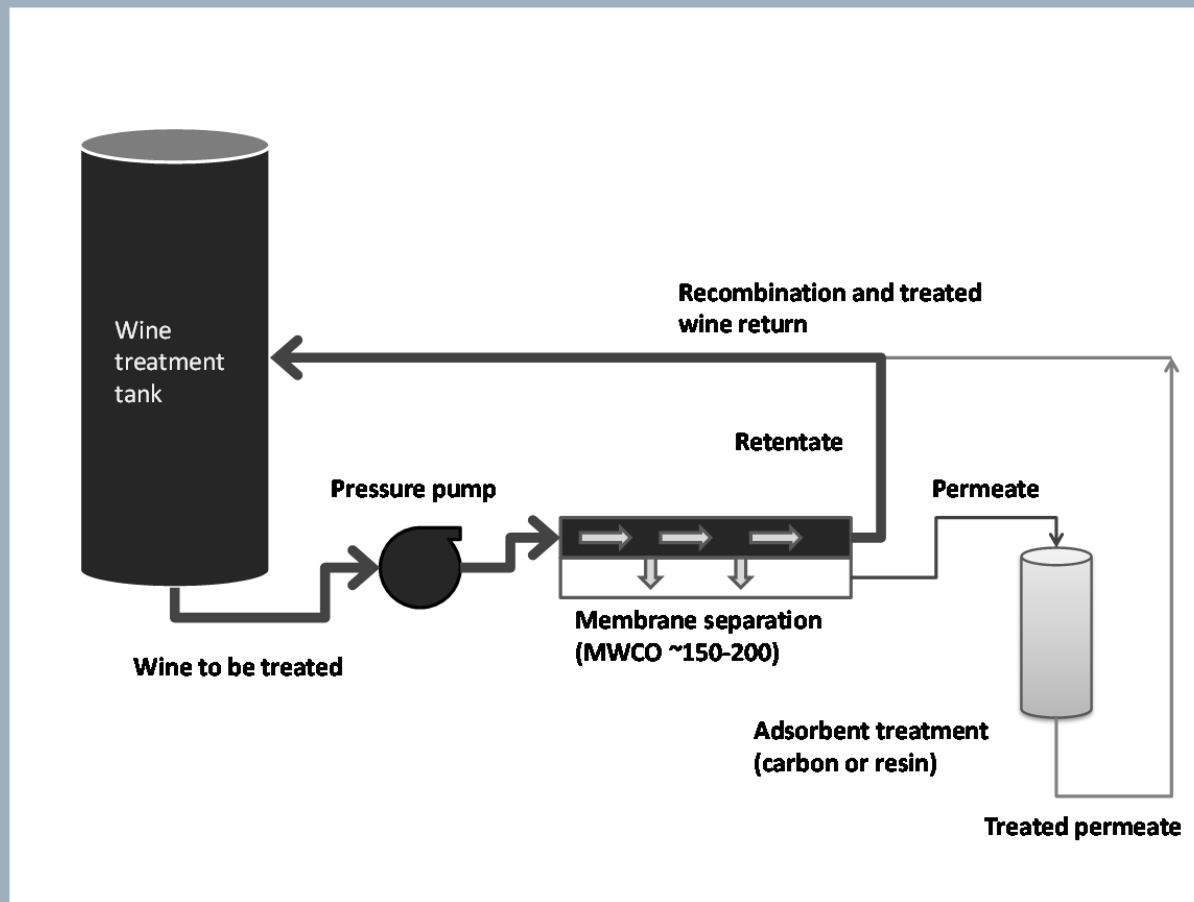
	Guaiacol ( $\mu\text{g/L}$ )	Guaiacol glycoconjugates ( $\mu\text{g/L}$ )
Rosé (control)	nd	22
Rosé (smoked)	2	204
Red (control)	trace	38
Red (smoked)	5	290

# Effect of winemaking techniques on intensity of smoke taint in wine



# Evaluation of reverse osmosis and solid phase adsorption for amelioration of smoke taint

Investigate the capacity of reverse osmosis/solid phase adsorption to remove smoke taint  
Smoke-affected Pinot Noir wines treated using pilot and commercial scale systems



# Evaluation of reverse osmosis and solid phase adsorption for amelioration of smoke taint

Investigate the capacity of reverse osmosis/solid phase adsorption to remove smoke taint

Smoke-affected Pinot Noir wines treated using pilot and commercial scale systems

Significant reduction in volatile phenol content with treatment time

	Concentration ( $\mu\text{g/L}$ )			
	Guaiacol	4-Methyl guaiacol	4-Ethyl guaiacol	4-Ethyl phenol
Untreated	49	36	294	391
Treated (t = 0.5 h)	35	28	225	277
Treated (t = 1 h)	27	23	190	214
Treated (t = 2 h)	18	15	134	126
Treated (t = 3 h)	13	11	94	78

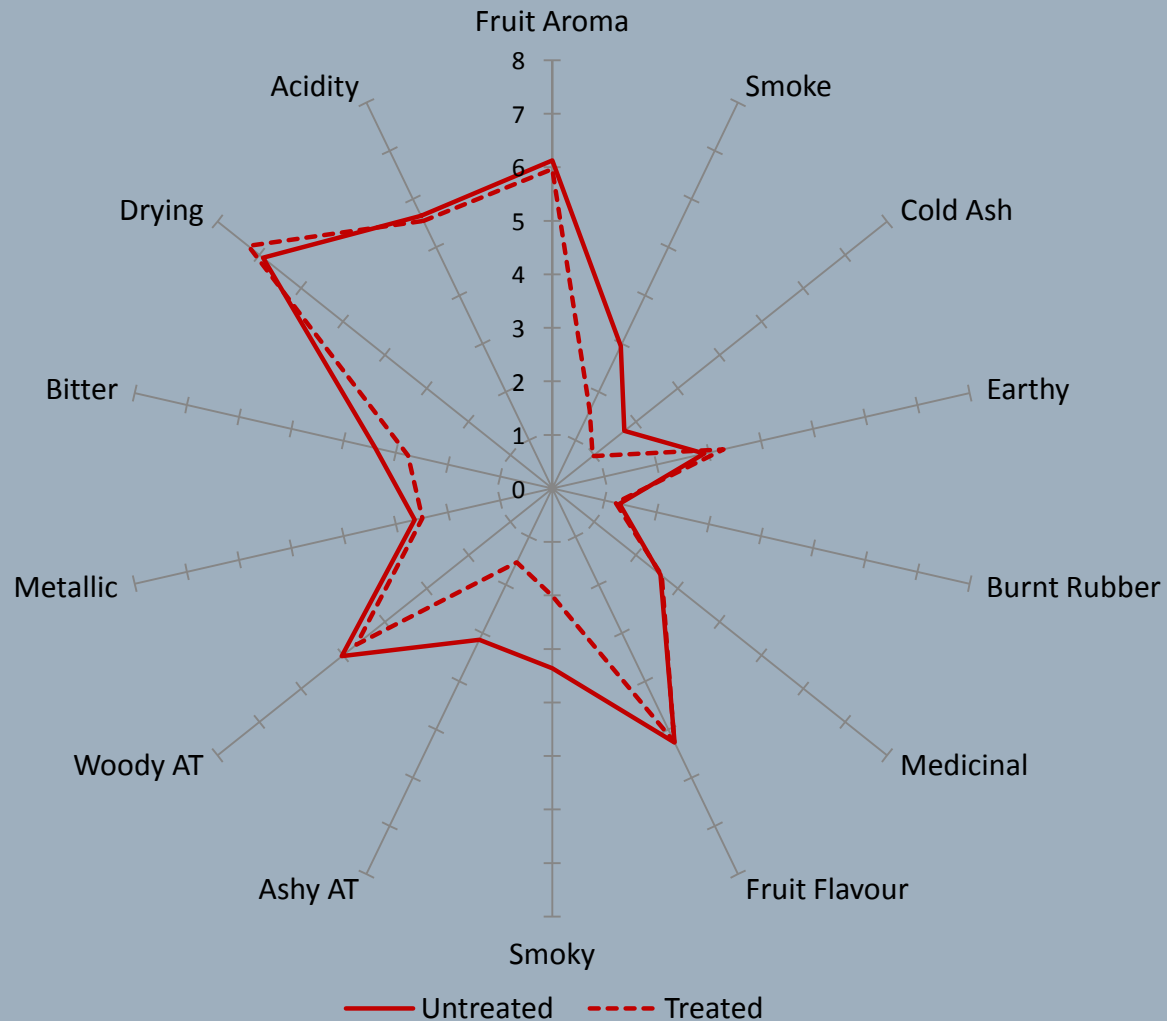
# Evaluation of reverse osmosis and solid phase adsorption for amelioration of smoke taint

Minimal impact on other wine quality parameters

	pH	TA (g/L)	Alcohol (%, v/v)	Phenolics (au)	Colour density (au)	Colour hue
Untreated	3.31	5.6	14.3	69.24	7.68	0.83
Treated (t = 0.5 h)	3.34	5.5	14.4	70.51	7.82	0.84
Treated (t = 1 h)	3.26	5.6	14.4	71.98	7.98	0.84
Treated (t = 2 h)	3.22	5.6	14.4	73.04	7.97	0.84
Treated (t = 3 h)	3.21	5.5	14.4	75.39	8.09	0.84



# Evaluation of reverse osmosis and solid phase adsorption for amelioration of smoke taint



# Evaluation of reverse osmosis and solid phase adsorption for amelioration of smoke taint

Glycoconjugate precursors remained after treatment, so potential for return of smoke taint

	Concentration ( $\mu\text{g/L}$ )	
	Guaiacol	4-Methyl guaiacol
Untreated (0 months)	12	5
Untreated (6 months)	12	3
Untreated (12 months)	15	4
Untreated (30 months)	16	4
Treated (0 months)	3	trace
Treated (6 months)	5	2
Treated (12 months)	6	3
Treated (30 months)	9	4

# Evaluation of commercial fining agents for amelioration of smoke taint

Evaluate capacity of fining agents to remove smoke taint from wine

Fining agent		Dose (g/L)
Active ingredient	Trade name	
egg albumin		0.4
potassium caseinate	Clarito® Spray Dry	0.3
activated carbon	FPS	1.0
isinglass	Premium® Fish	0.1
sodium bentonite 1	Plusgran® gel	4.0
PVPP	Polyclar® 10	0.5
gelatine	Instantgel 45	0.3
yeast cell walls 1	Biolees	0.4
silica sol/activated carbon	Toxicol	0.6
calcium bentonite	Microcol-CI	4.0
sodium bentonite 2	Volclay	4.0
yeast cell walls 2	Biocell	0.4
synthetic mineral	BA/S-00-1A	2.0

# Evaluation of commercial fining agents for amelioration of smoke taint

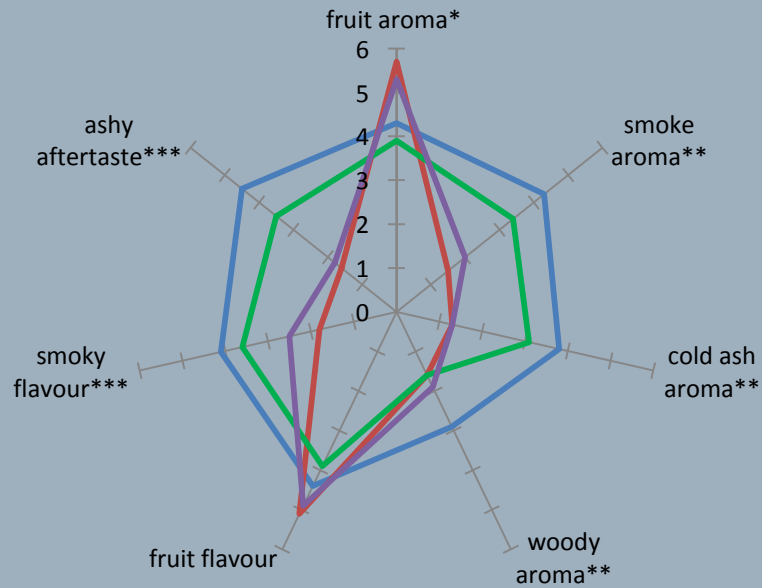
Sample	Concentration ( $\mu\text{g/L}$ )				TA (g/L)	total phenolics (au)	colour density (au)	colour hue
	guaiacol	4-methyl guaiacol	total cresols	syringol				
Untreated (control)	24 <sup>a</sup>	7 <sup>a</sup>	15 <sup>c</sup>	36 <sup>a</sup>	5.0 <sup>a</sup>	64.0 <sup>ab</sup>	4.95 <sup>a</sup>	1.2
Treated egg albumin	24 <sup>a</sup>	7 <sup>a</sup>	15 <sup>c</sup>	35 <sup>ab</sup>	4.6 <sup>cd</sup>	60.1 <sup>abcde</sup>	4.55 <sup>d</sup>	1.2
Treated potassium caseinate	24 <sup>a</sup>	7 <sup>a</sup>	15 <sup>c</sup>	35 <sup>ab</sup>	4.8 <sup>b</sup>	61.4 <sup>abcd</sup>	4.80 <sup>b</sup>	1.2
Treated activated carbon	10 <sup>d</sup>	2 <sup>c</sup>	5 <sup>f</sup>	14 <sup>d</sup>	4.5 <sup>d</sup>	52.4 <sup>e</sup>	4.50 <sup>d</sup>	1.2
Treated isinglass	24 <sup>a</sup>	7 <sup>a</sup>	16 <sup>b</sup>	35 <sup>ab</sup>	4.2 <sup>ef</sup>	61.8 <sup>abcd</sup>	4.20 <sup>ef</sup>	1.2
Treated sodium bentonite 1	23 <sup>ab</sup>	7 <sup>a</sup>	15 <sup>c</sup>	33 <sup>c</sup>	3.9 <sup>g</sup>	62.5 <sup>abcd</sup>	3.85 <sup>g</sup>	1.3
Treated PVPP	24 <sup>a</sup>	7 <sup>a</sup>	15 <sup>c</sup>	35 <sup>ab</sup>	4.2 <sup>ef</sup>	53.6 <sup>de</sup>	4.20 <sup>ef</sup>	1.2
Treated gelatine	24 <sup>a</sup>	7 <sup>a</sup>	15 <sup>c</sup>	36 <sup>a</sup>	3.5 <sup>h</sup>	55.5 <sup>cde</sup>	3.50 <sup>h</sup>	1.3
Treated yeast cell walls 1	24 <sup>a</sup>	7 <sup>a</sup>	16 <sup>b</sup>	36 <sup>a</sup>	4.3 <sup>e</sup>	59.5 <sup>abcde</sup>	4.30 <sup>e</sup>	1.2
Treated silica sol/activated carbon	22 <sup>bc</sup>	6 <sup>b</sup>	14 <sup>d</sup>	33 <sup>c</sup>	4.5 <sup>d</sup>	66.3 <sup>a</sup>	4.50 <sup>d</sup>	1.2
Treated calcium bentonite	22 <sup>bc</sup>	6 <sup>b</sup>	14 <sup>d</sup>	33 <sup>c</sup>	4.1 <sup>f</sup>	58.1 <sup>bcde</sup>	4.10 <sup>f</sup>	1.3
Treated sodium bentonite 2	23 <sup>ab</sup>	6 <sup>b</sup>	15 <sup>c</sup>	34 <sup>bc</sup>	3.9 <sup>g</sup>	64.4 <sup>ab</sup>	3.85 <sup>g</sup>	1.3
Treated yeast cell walls 2	24 <sup>a</sup>	7 <sup>a</sup>	23 <sup>a</sup>	35 <sup>ab</sup>	4.6 <sup>cd</sup>	62.5 <sup>abcd</sup>	4.60 <sup>cd</sup>	1.2
Treated synthetic mineral	21 <sup>c</sup>	5 <sup>c</sup>	13 <sup>e</sup>	15 <sup>d</sup>	4.7 <sup>bc</sup>	59.7 <sup>abcde</sup>	4.70 <sup>bc</sup>	1.2
<i>P</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.001	ns

# Evaluation of commercial fining agents for amelioration of smoke taint

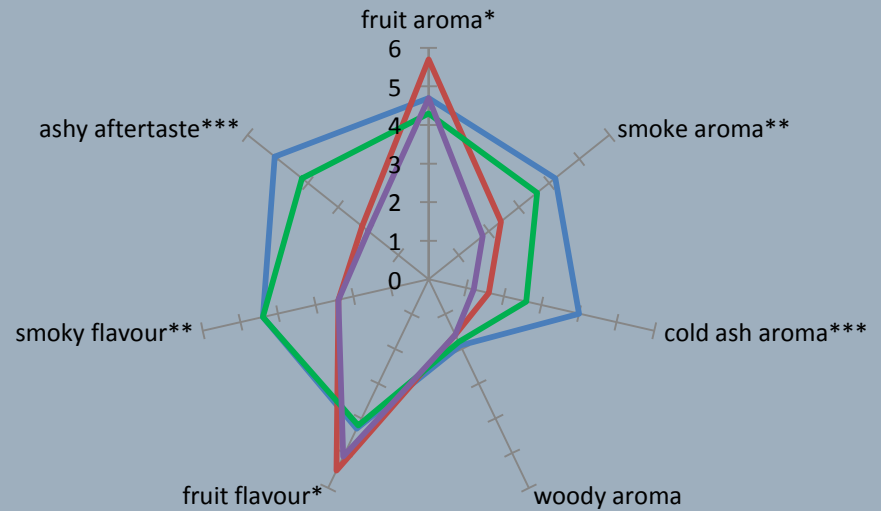
Sample	Concentration ( $\mu\text{g/L}$ )				TA (g/L)	total phenolics (au)	colour density (au)	colour hue
	guaiacol	4-methyl guaiacol	total cresols	syringol				
Cabernet Sauvignon								
Untreated (control)	18 <sup>a</sup>	3 <sup>a</sup>	7 <sup>a</sup>	18 <sup>a</sup>	7.1 <sup>a</sup>	55.0 <sup>a</sup>	8.8	0.7
Treated activated carbon	8 <sup>c</sup>	1 <sup>c</sup>	2 <sup>c</sup>	7 <sup>c</sup>	6.9 <sup>b</sup>	51.9 <sup>b</sup>	8.5	0.7
Treated synthetic mineral	15 <sup>b</sup>	2 <sup>b</sup>	6 <sup>b</sup>	9 <sup>b</sup>	6.9 <sup>b</sup>	53.1 <sup>ab</sup>	9.1	0.7
Treated carbon and mineral	7 <sup>d</sup>	tr	2 <sup>c</sup>	5 <sup>d</sup>	6.8 <sup>c</sup>	49.4 <sup>c</sup>	9.1	0.7
<i>P</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	ns	ns
Merlot								
Untreated (control)	17 <sup>a</sup>	3 <sup>a</sup>	6 <sup>a</sup>	15 <sup>a</sup>	6.0 <sup>a</sup>	48.1 <sup>a</sup>	7.1 <sup>b</sup>	0.7
Treated activated carbon	8 <sup>c</sup>	1 <sup>b</sup>	2 <sup>c</sup>	6 <sup>c</sup>	6.0 <sup>a</sup>	44.1 <sup>b</sup>	6.9 <sup>b</sup>	0.7
Treated synthetic mineral	15 <sup>b</sup>	3 <sup>a</sup>	4 <sup>b</sup>	7 <sup>b</sup>	5.8 <sup>ab</sup>	47.7 <sup>a</sup>	7.6 <sup>a</sup>	0.7
Treated carbon and mineral	7 <sup>d</sup>	1 <sup>b</sup>	1 <sup>d</sup>	4 <sup>d</sup>	5.7 <sup>b</sup>	44.4 <sup>b</sup>	7.0 <sup>b</sup>	0.7
<i>P</i>	<0.001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	ns

# Evaluation of commercial fining agents for amelioration of smoke taint

(a)



(b)



— Untreated

— Treated (activated carbon)

— Treated (synthetic mineral)

— Treated (carbon and mineral)

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