UNIVERSITY OF PADOVA
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OENO-Macrowine 2023 – Bordeaux 9-13th July 2023

Università degli Studi di Padova

The effect of bentonite fining on the volatile and non-volatile profile of Italian white wines

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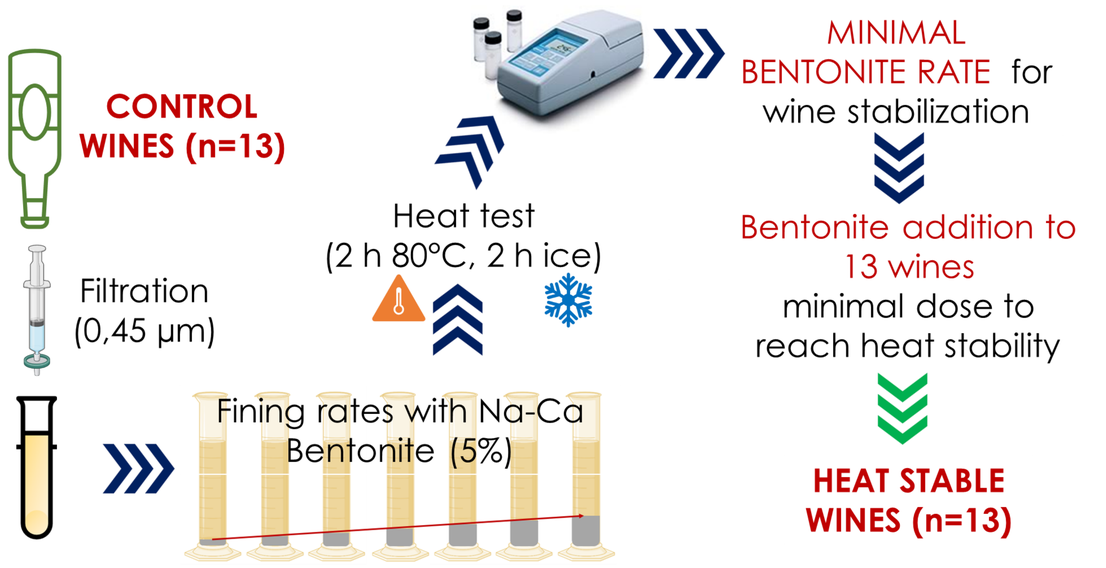
BACKGROUND AND AIM

Bentonite is used in white winemaking to remove the heat unstable wine proteins responsible for haze formation [1], but being a non-specific adsorbent, it removes other wines compounds linked to wine quality including volatiles [2].

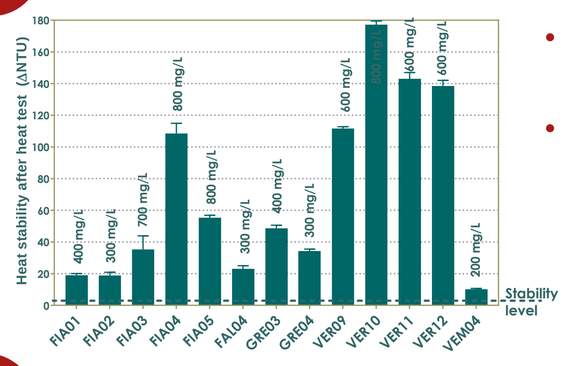
Using some Italian monovarietal white wines, this study was designed to investigate whether the depletion of non-volatiles and volatiles specifically differs according to the variety, when the right amount of bentonite is used to reach full stability.

EXPERIMENTAL DESIGN

Thirteen unfined white wines from 5 Italian varieties (Fiano - FIA, Falanghina - FAL, Greco di Tufo - GRE, Vernaccia di San Gimignano - VER, Vermentino di Gallura - VEM), were treated with the minimum bentonite (Na-Ca Bentonite) dose required to reach protein stability, and compared with the untread wines for chemical composition (by HPLC-SEC), protein profiles (by RP-HPLC), polysaccharide (by HR-SEC) and phenolic concentration (by colorimetric method), particles' size (by nanoparticles tracking analysis) and volatile profiles (by GC-MS/MS [3,4]).



HEAT STABILITY



- Wines heat stability ranged from 10 to 177 NT
- These values did not correlate well with their bentonite requirements (R^2 = 0.6138) that was between 200 to 800 mg/L.

BENTONITE IMPACT ON WINE COMPOSTION

WINES	pH		Titratable acidity (g/L)		Na		Mg		K		Ca		P	
	C	T	C	T	C	T	C	T	C	C	C	T	C	T
FIA01	3.04	3.06	7.40	6.67	7.91	9.28	78.1	79.9	565	562	74.1	79.2	347	345
FIA02	3.33	3.36	6.37	5.77	9.13	9.85	71.4	73	721	717	46	49.5	167	167
FIA03	3.28	3.33	5.87	5.60	6.43	8.54	69.7	71.2	682	659	46	51.5	201	196
FIA04	3.20	3.26	6.17	5.87	7.97	10.5	71.8	73.7	667	659	49	56.7	136	135
FIA05	3.38	3.44	5.97	5.80	7.53	8.77	78.6	80	800	774	45	49.8	176	175
FAL04	3.28	3.34	6.73	6.50	10	10.6	77.7	78.7	743	728	51.4	55.1	150	151
GRE03	3.18	3.23	7.07	6.47	9.09	10.1	73.5	75.1	712	705	60.6	64.6	168	167
GRE04	3.14	3.22	6.53	6.40	8.78	9.44	69.6	72.1	592	596	68.1	71.3	179	181
VER09	3.33	3.37	5.07	4.90	14.6	17.2	83.4	84	800	791	39.1	44.2	170	169
VER10	3.40	3.40	4.97	4.73	16.5	19.3	83.9	85.9	783	771	51	58.9	223	223
VER11	3.36	3.37	5.23	4.98	16	17.9	83.8	85.8	726	720	58.2	64	234	232
VER12	3.34	3.36	5.35	5.00	15.7	18.1	84.4	86.8	739	740	56.3	62.6	236	237
VEM04	3.47	3.51	4.92	4.80	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
AVERAGE	**3.29**	**3.33**	**5.97**	**5.65**	**10.8**	**12.5**	**77.2**	**78.8**	**710.8**	**701.8**	**53.7**	**58.9**	**198.9**	**198.2**
P-value	P<0.0001		P<0.0001		P<0.0001		P<0.0001		P= 0.005		P<0.0001		P=0.1802	

Bentonite fining generally led to a decrease in wine acidity and K concentration and an increase in Na, Mg and Ca. **C** and **T**: before and after bentonite treatment

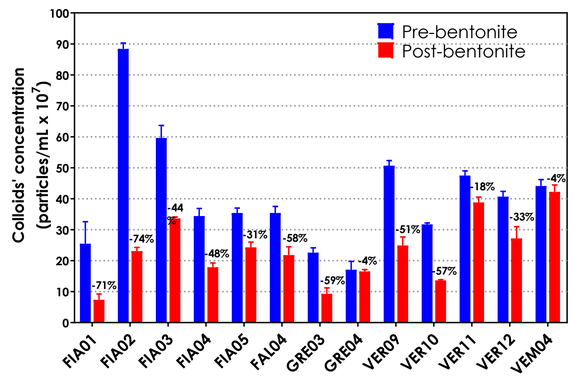
BENTONITE IMPACT ON VOLATILE COMPOUNDS

In general, for the 107 volatile compounds analyzed:

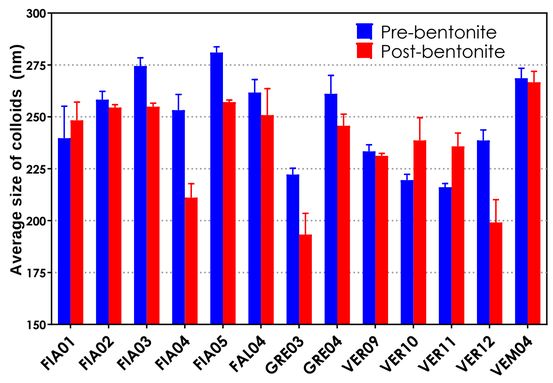
- Bentonite fining led to a **moderate but generalized reduction in volatiles'** concentration
- **Ethyl esters** were the class of compounds most impacted by the treatment, but **differently depending on the wine**
- There was no correlation between the observed % decrease and bentonite fining rates
- **Lack of a clear effect of the variety**

BENTONITE IMPACT ON WINE MACROMOLECULES

- Obvious decrease in protein content (on average -83%).
- Significant **reduction in wine total phenolics** (average -35%, range -25 to -40%)
- Small reduction in total polysaccharides' content (average – 6,5%)



Bentonite fining led to a variable reduction in the concentration of colloidal particles (range **4-74 %**, -41% on average): the rate of **colloids removal by bentonite depends on the wine.**



The average diameter of colloids was slightly reduced (before: 248 nm; after: 237 nm)

Bentonite tends to remove the largest colloids.

Results confirm that bentonite is a non-specific adsorbent that can affect wine quality, but its impact could not be related to the dose necessary to stabilize different wines.

References
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