

Cu-organic acids in red wine after bottling: A time-line for inhibition of reductive aroma compounds



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COPPER IN RED WINE

Cu Fraction & Determination	Attributed Forms	Wine Implication
Cu fraction III (Cu F3) Cu fraction III = Total Cu – (Cu fraction I) total Cu measured by ICPOES or colorimetry	sulfide-bound Cu inert Cu-thiol sulfhydryl-bound Cu	Suspended particles in wine (size < 0.2 μm) Not aroma active.
Cu fraction I (Cu F1) Directly measured by filtration-colorimetric or electrochemistry	Cu(II)-organic acid non sulfhydryl-bound Cu	Binds H ₂ S and inhibits its accumulation.

*No Cu fraction II (F2) attributed to loosely bound Cu-thiol complexes was detected in red wines.

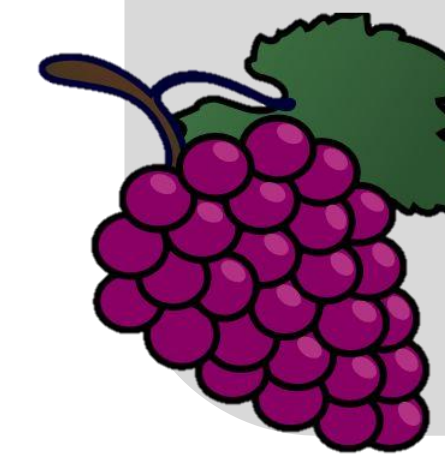
METHOD

Bottling 1

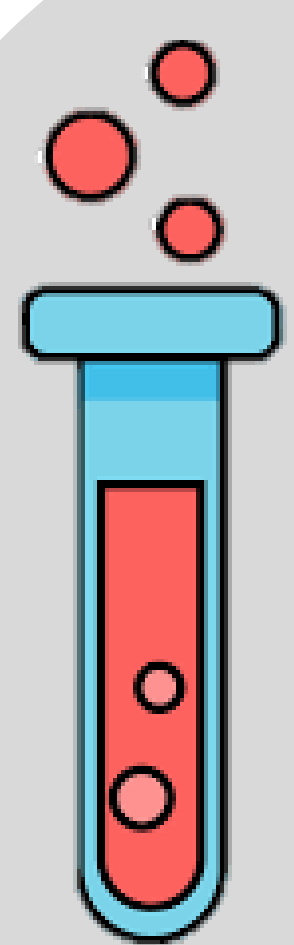
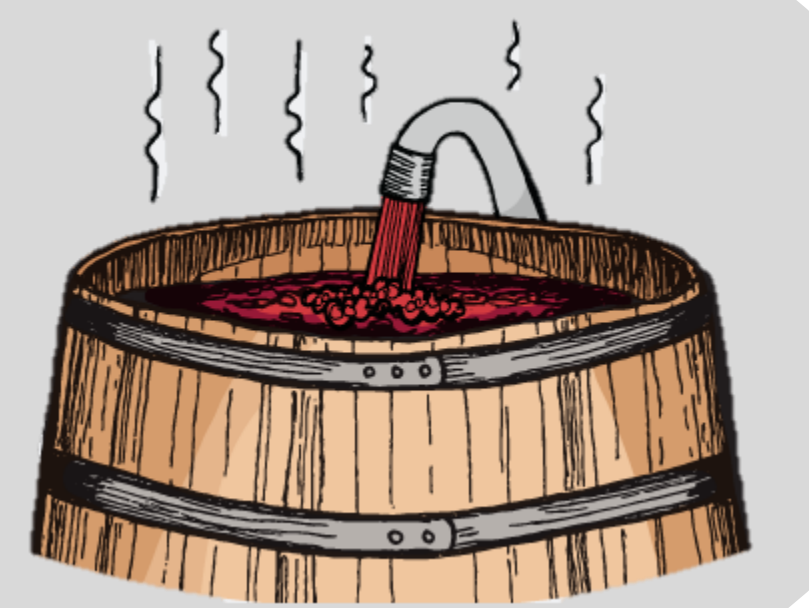
- Shiraz
- Pinot Noir

Bottling 2

- Shz/CabS
- Pinot Noir
- Cabs/Merl



fermentation



analysis:

- SO₂
- H₂S
- Cu fractions
- Sensory (Pivot® Profile)



bottle ageing for 12 months (14 °C, in dark)



Bottling 1

add 0, 0.3 and 0.6 mg/L of Cu(II)

Bottling 2

add to 0.6 mg/L of Cu(II)

RESULTS

- Cu fraction I remained in most wines even after 200 days of bottle ageing (Fig 1).
- Wines with similar total Cu concentration showed different initial Cu fraction I concentrations (Fig 1B).
- No free H₂S accumulated in any of the red wines.
- Free MeSH concentration became lower with higher Cu fraction I concentration.
- Similar decay rate of Cu fraction I (0.010 ± 0.003) in most red wines.
- The time for Cu fraction I to reach half of its initial concentration (half-life) was around 70 days.

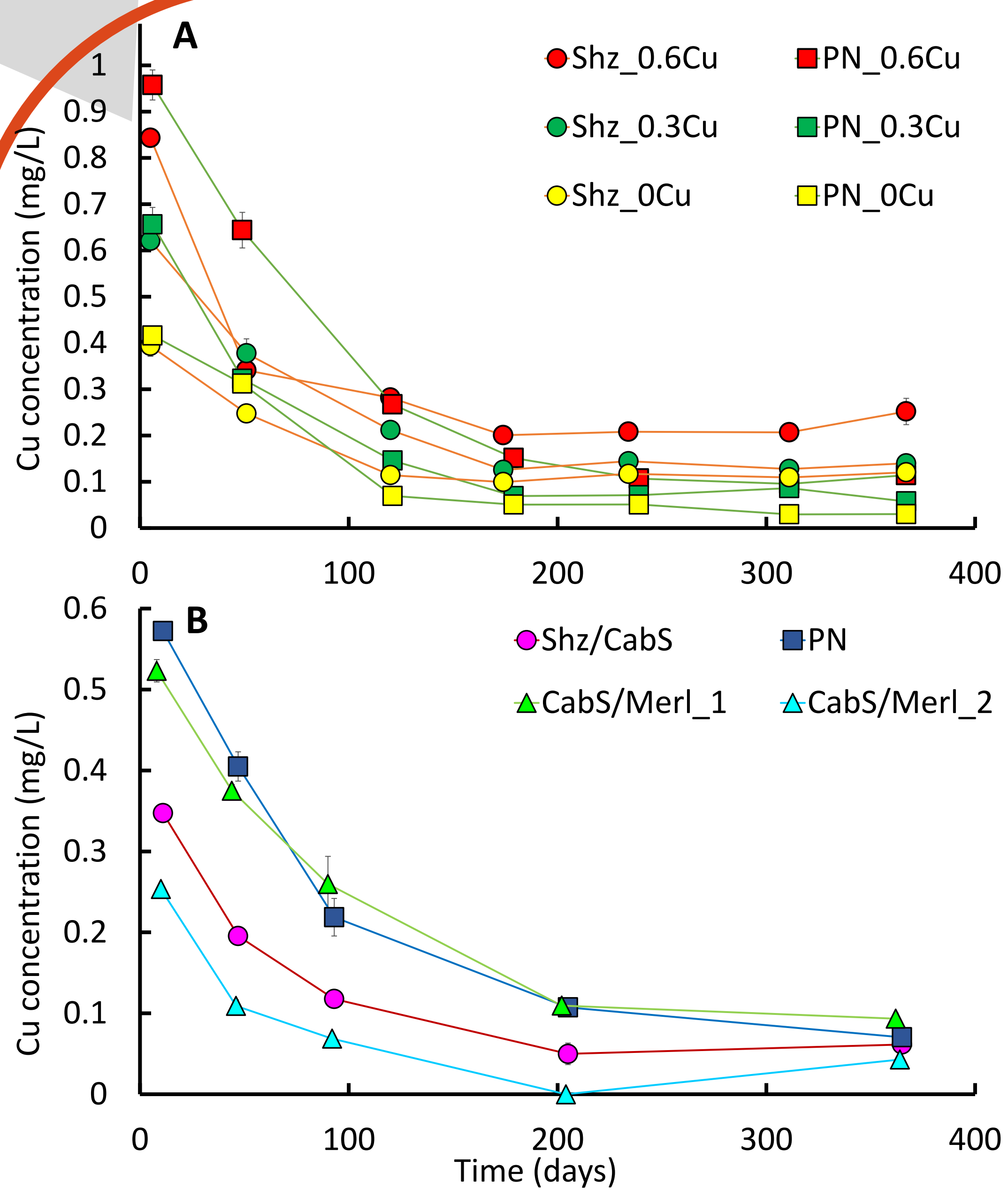


Figure 1. The Cu fraction I concentrations in six Bottling 1 wines (A) and four Bottling 2 wines (B). Error bars represent the standard deviation from triplicate samples.

CONCLUSIONS

Cu fraction I:

- suppresses H₂S & MeSH accumulation;
- similar decay rate among red wines.

Table 1. The decay rate and half-life of Cu fraction I in red wines.

wine	1 st -order decay rate (day ⁻¹)	half-life (day)
Shz_0.6Cu	0.0076	91
Shz_0.3Cu	0.0093	75
Shz_0Cu	0.0085	82
PN_0.6Cu	0.0109	64
PN_0.3Cu	0.0127	55
PN_0Cu	0.0134	52
Shz/CabS	0.0096	72
PN	0.0086	81
CabS/Merl_1	0.0080	87
CabS/Merl_2	0.0157	44
average	0.010 ± 0.003	70 ± 16

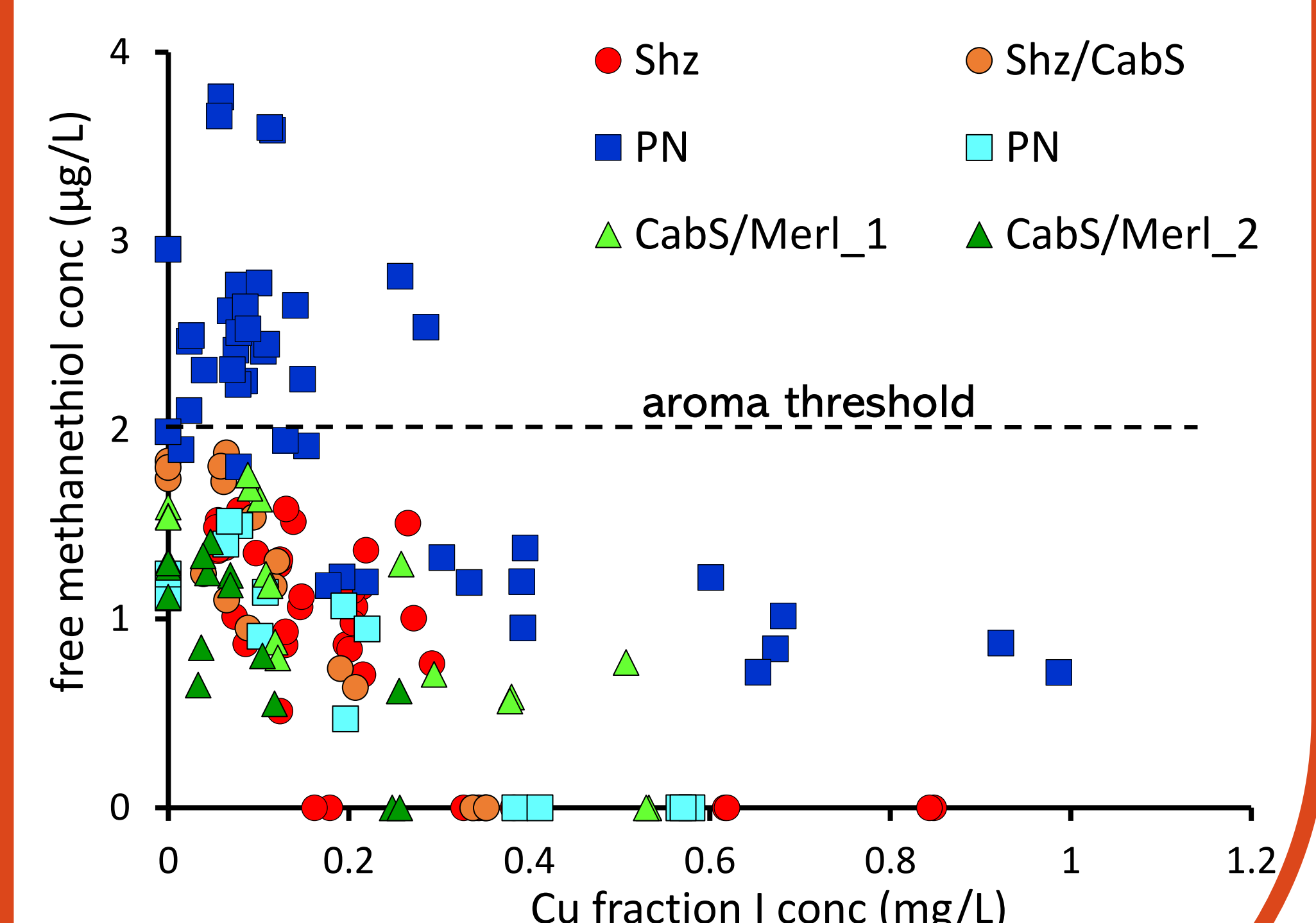


Figure 2. Concentrations of free MeSH in red wines versus Cu fraction I concentrations.