

# WINE OXIDATION PROFILE ACCESSED BY VOLTAMMETRIC, ANTIOXIDANT SCAVENGING and GC-MS TECHNIQUES

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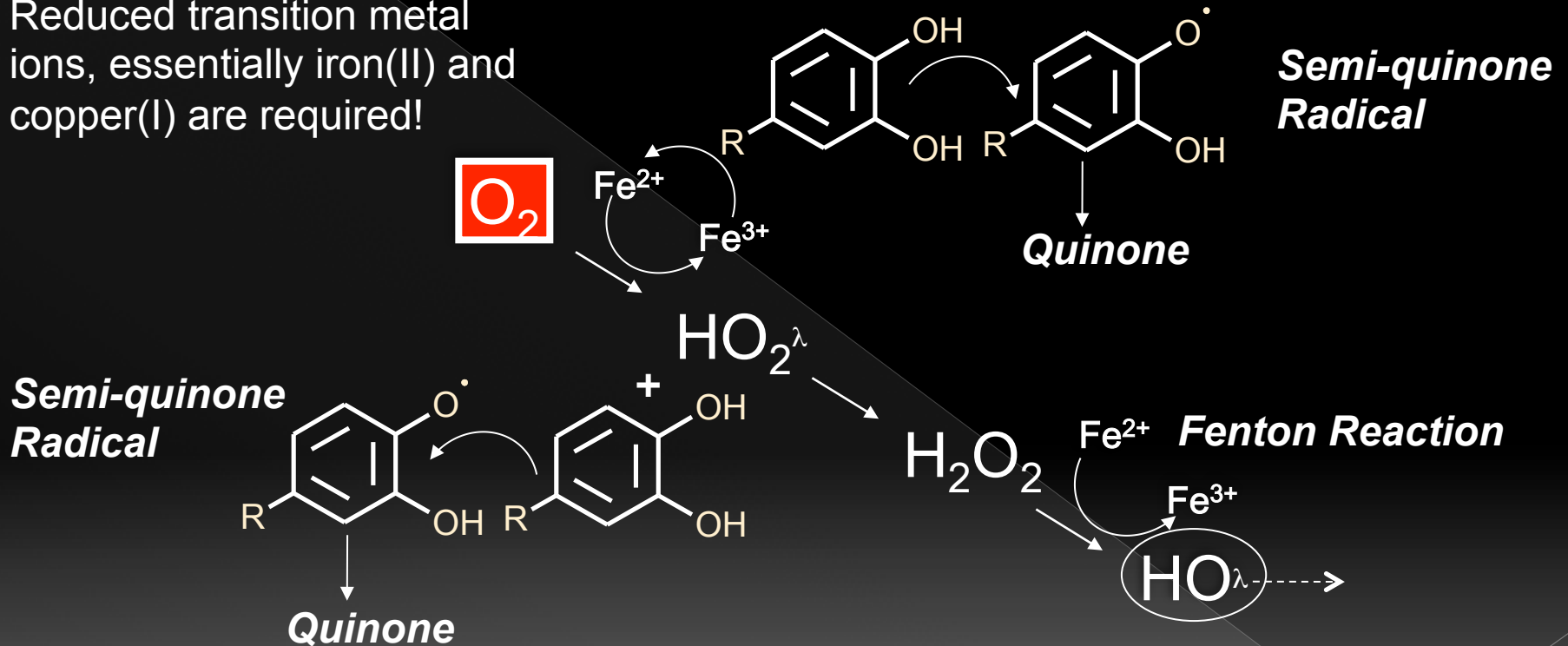


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# Wine Oxidation



Reduced transition metal ions, essentially iron(II) and copper(I) are required!



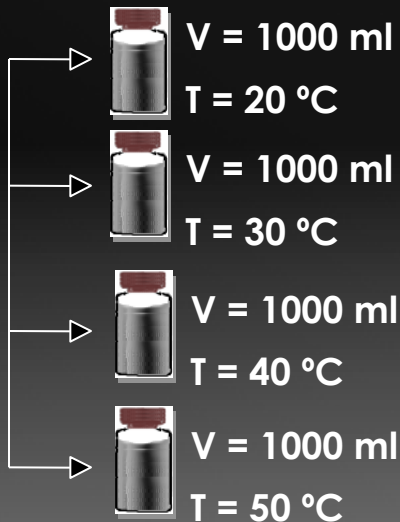
**Phenolic Compounds in Wine:  
Primary Substrates for Oxidation**

# Material and Methods

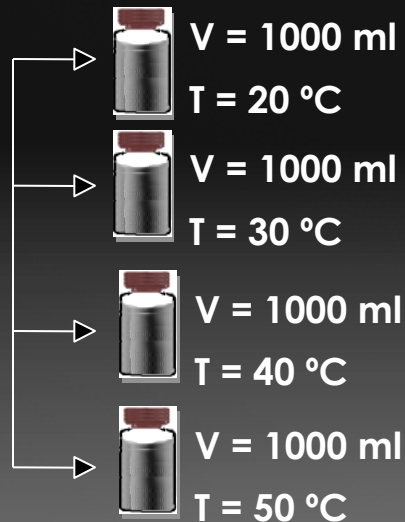
## • Forced Aging Protocol – 42 days (6 weeks)

Fourteen liters of white wine (pH = 3.2): 4 oxygen regimes

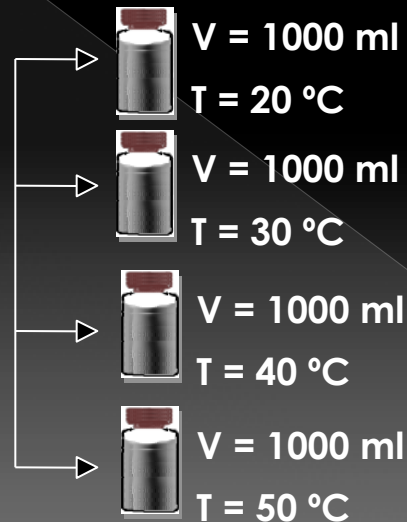
**Treatment I:**  
no oxygen addition  
(F1)



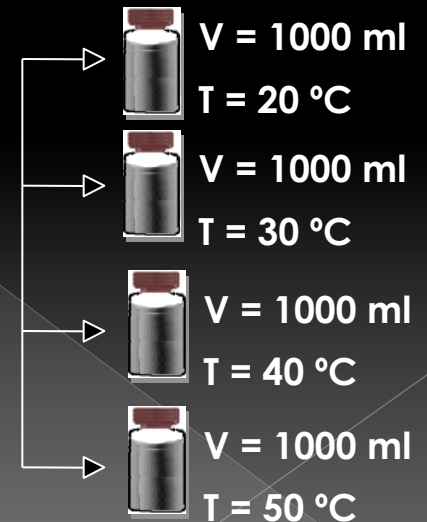
**Treatment II:**  
2 times saturated  
(F2)



**Treatment III:**  
3 times saturated  
(F3)



**Treatment IV:**  
saturated  
every sampling point (F4)



**Voltammetric and Volatile analysis**

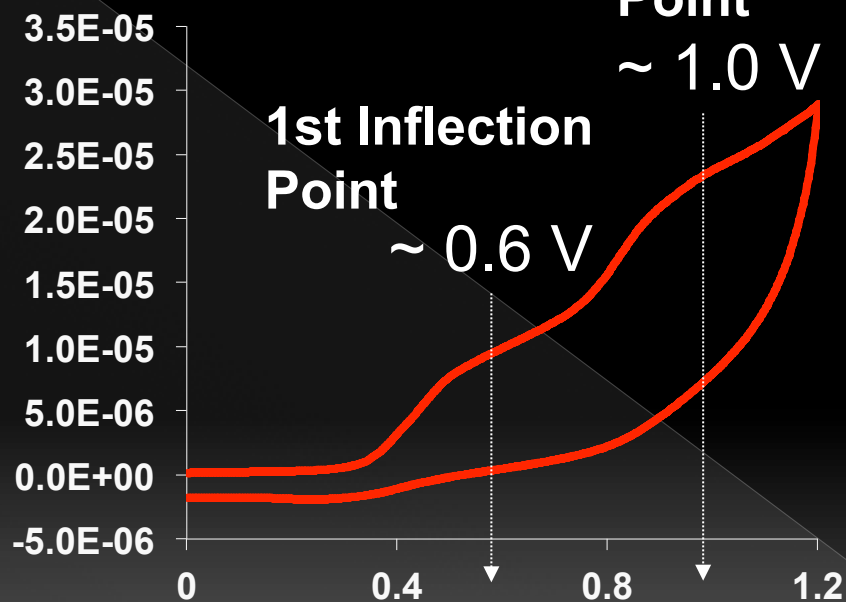
# Cyclic voltammetry

Scanning of electroactive compounds - Antioxidant profile

2nd Inflection Point  
~ 1.0 V

1st Inflection Point  
~ 0.6 V

Current Intensity  
I / A



E (mV)

815	Coumaric acid
800	Vanillic acid
680	Syringic acid
670	Ferulic acid
500	Rutin
470	Gallic acid
460	Caffeic acid
425	Quercetin
420	Catechin

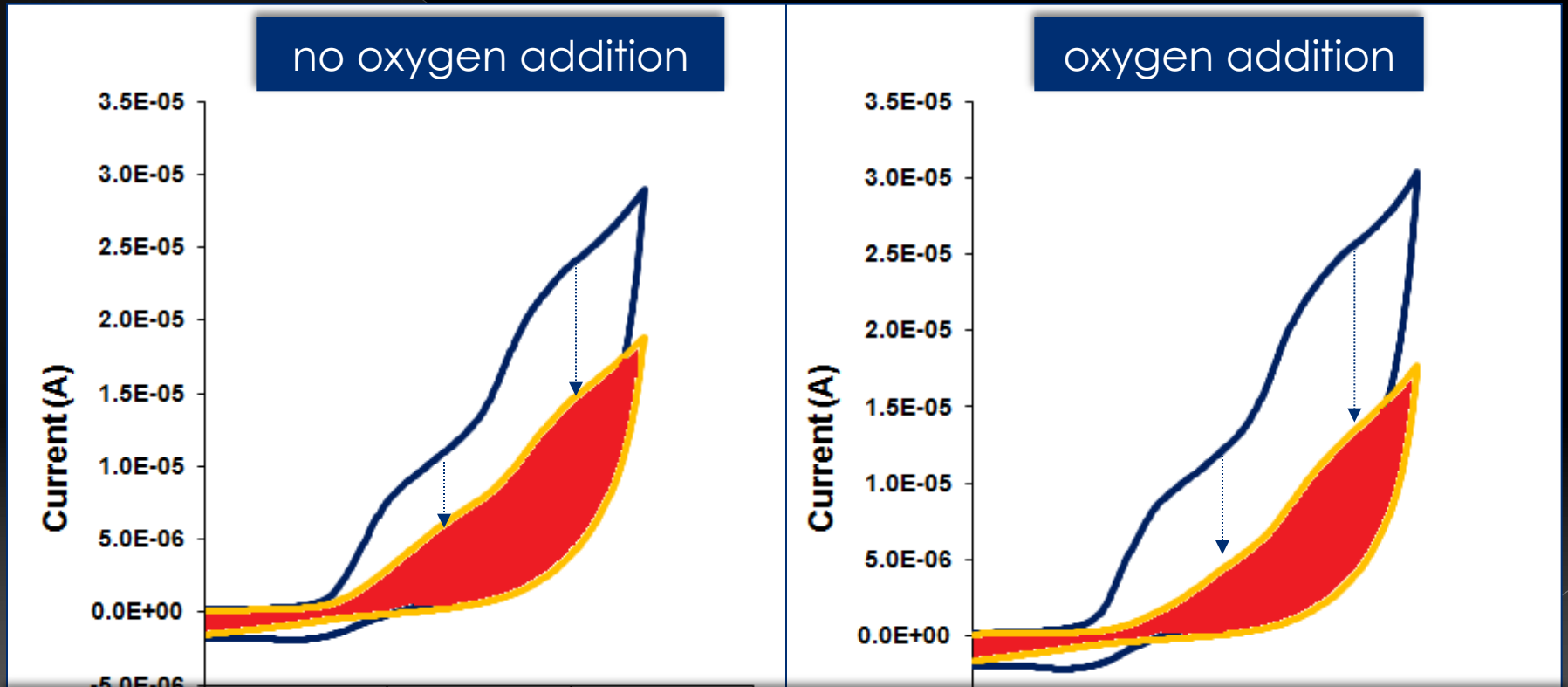
Applied Potential Difference  
E (vs SCE) / V

3 mm diameter glass carbon electrode  
Scan Range: 100 mV / sec (diffusion)

# Cyclic voltammetry

## Voltammetric analysis

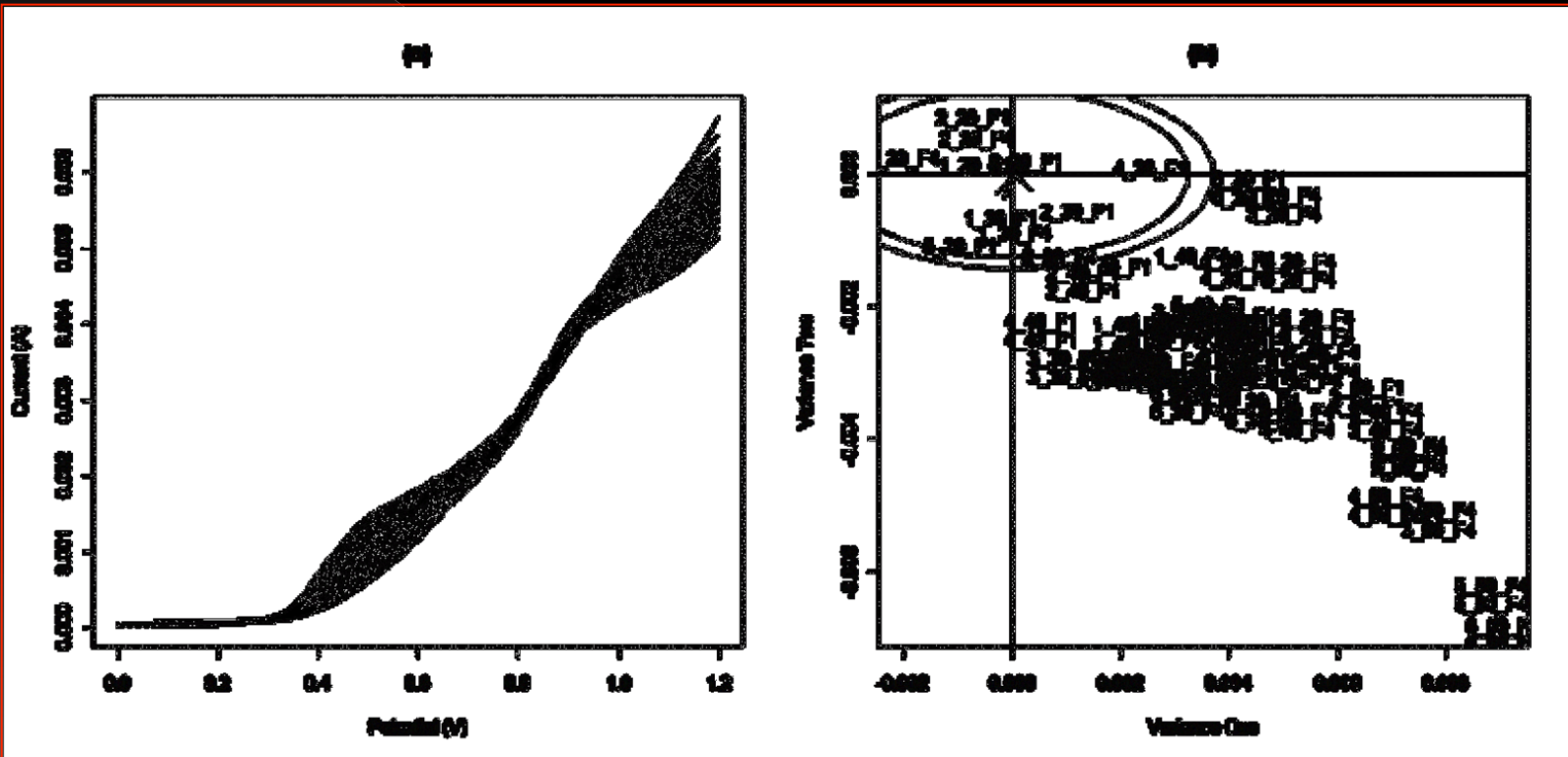
- First sampling point P1
- Last sampling point P6



Decrease in the current intensities  $\Rightarrow$  Higher with oxygen treatments

# Cyclic voltammetry - Chart Control

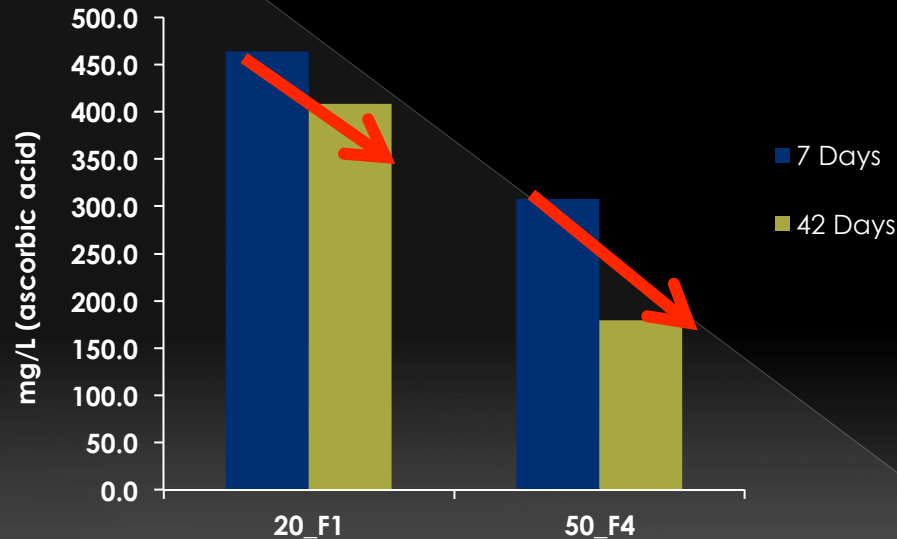
## Multivariate Chart Control



It is possible to monitor the oxidation status and to diagnose the effect of oxygen and temperature regimes

# ANTIOXIDANT SCAVENGING

Results have showed that oxygen consumption and temperature exposure decreases the antiradical activity of the forced aged wine samples, evaluated by the ABTS methodology



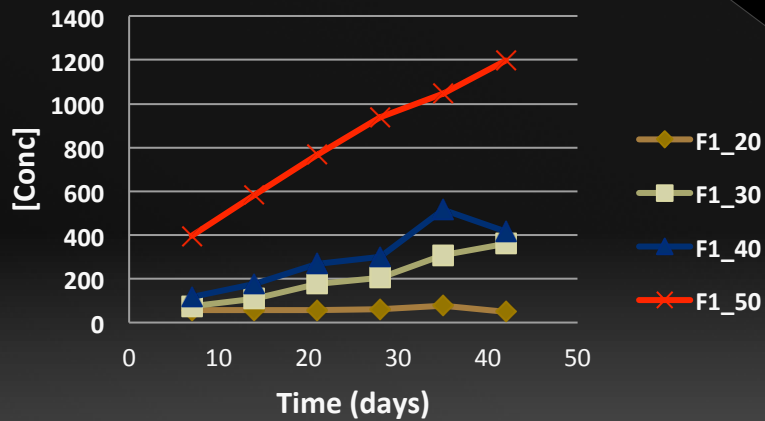
Decrease was of 13% for the sample kept at 20°C with **no oxygen increments** (20°C\_F1);

and of 48% for the sample kept at 50°C and **saturated every sampling point** (50°C\_F4)

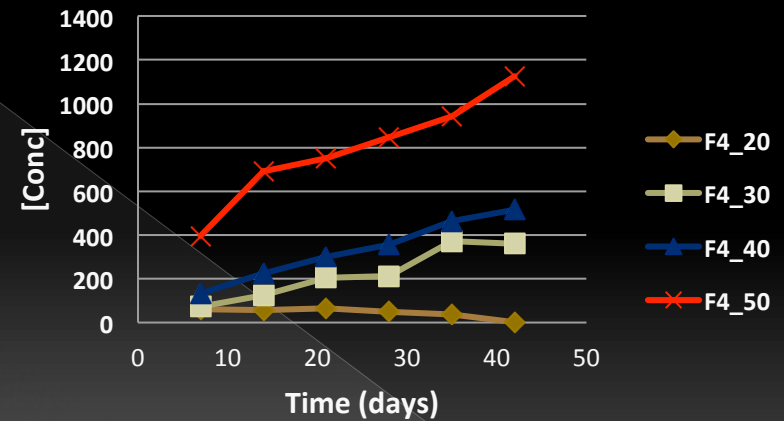
# GC-MS-Target methodology

Compounds not modulated by oxygen treatments

no oxygen addition



oxygen addition



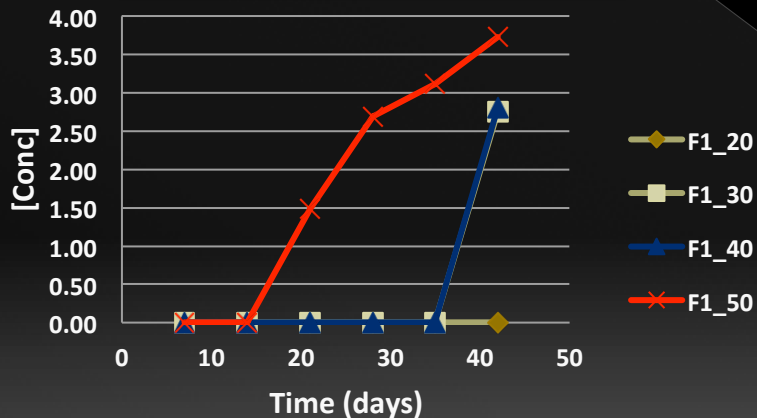
2-Furfural in the forced aged wines.

Concentration in  $\mu\text{g/L}$ ; F1 and F4 (oxygen saturation levels); 20, 30, 40, and 50°C (temperature regimes).

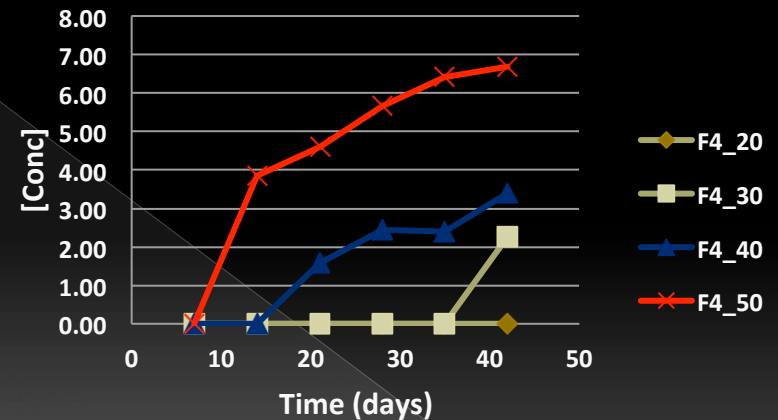
# GC-MS-Target methodology

Compounds modulated by oxygen treatments

no oxygen addition



oxygen addition



Methional in the forced aged wines.

Concentration in  $\mu\text{g/L}$ ; F1 and F4 (oxygen saturation levels); 20, 30, 40, and 50°C (temperature regimes).



# *Acknowledgments*



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*R. C. Martins*