Phenolic Compounds in Wine: Primary Substrates for Oxidation

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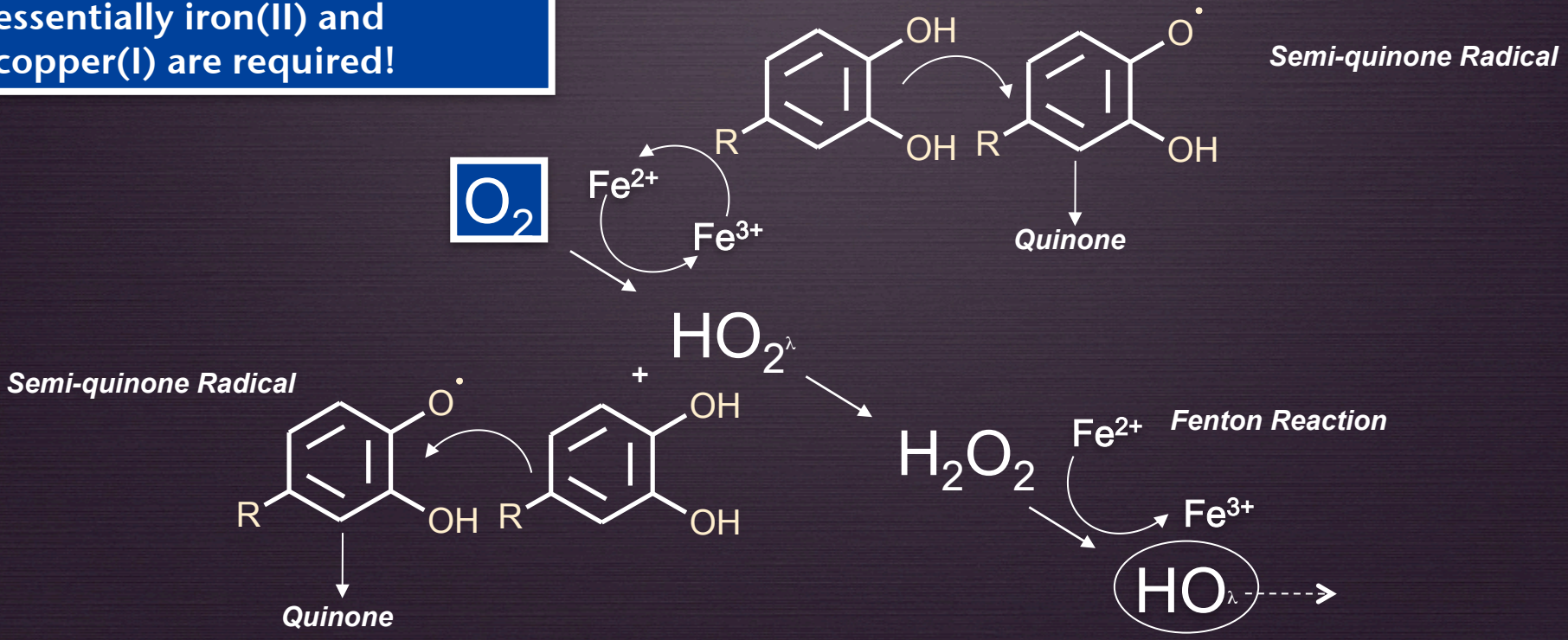
Wine Oxidation

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



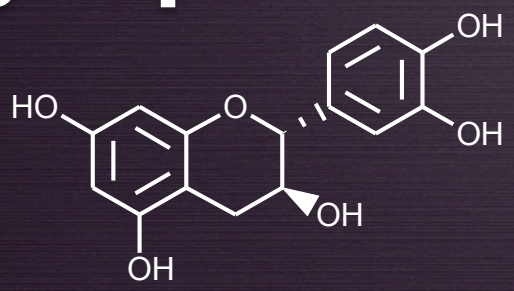
Phenolic Compounds: Primary Substrates for Oxidation

Objectives:

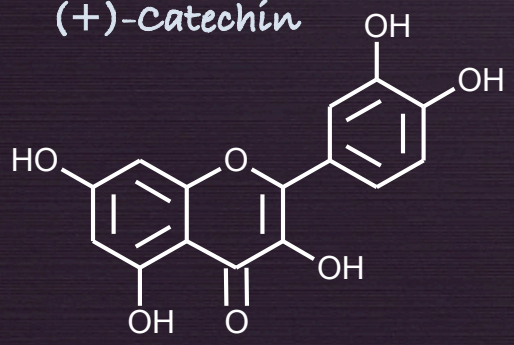
- The identification and quantification of phenolic compounds related with the wine oxidation process using a forced aging protocol
- The influence of oxygen supplements in the consumption of phenolic compounds
- The expression between identified phenolic compounds and the antiradical activity giving by ABTS methodology

Chemical oxidation of wine begin by the oxidation of polyphenols containing a catechol or a galloyl group

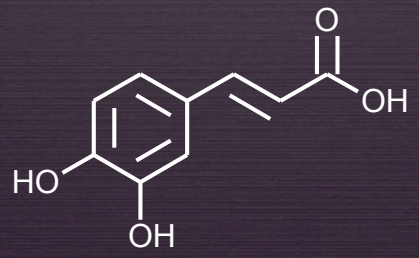
(an ortho-catechol)



(+)-Catechin



Quercetin

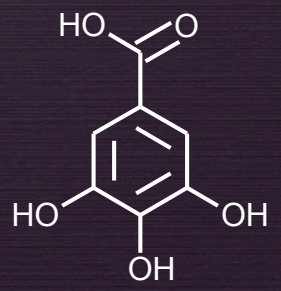


Caffeic acid and its derivatives

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

O. Makhotkina, P.A. Kilmartin / Analytica Chimica Acta 668 (2010) 155–165

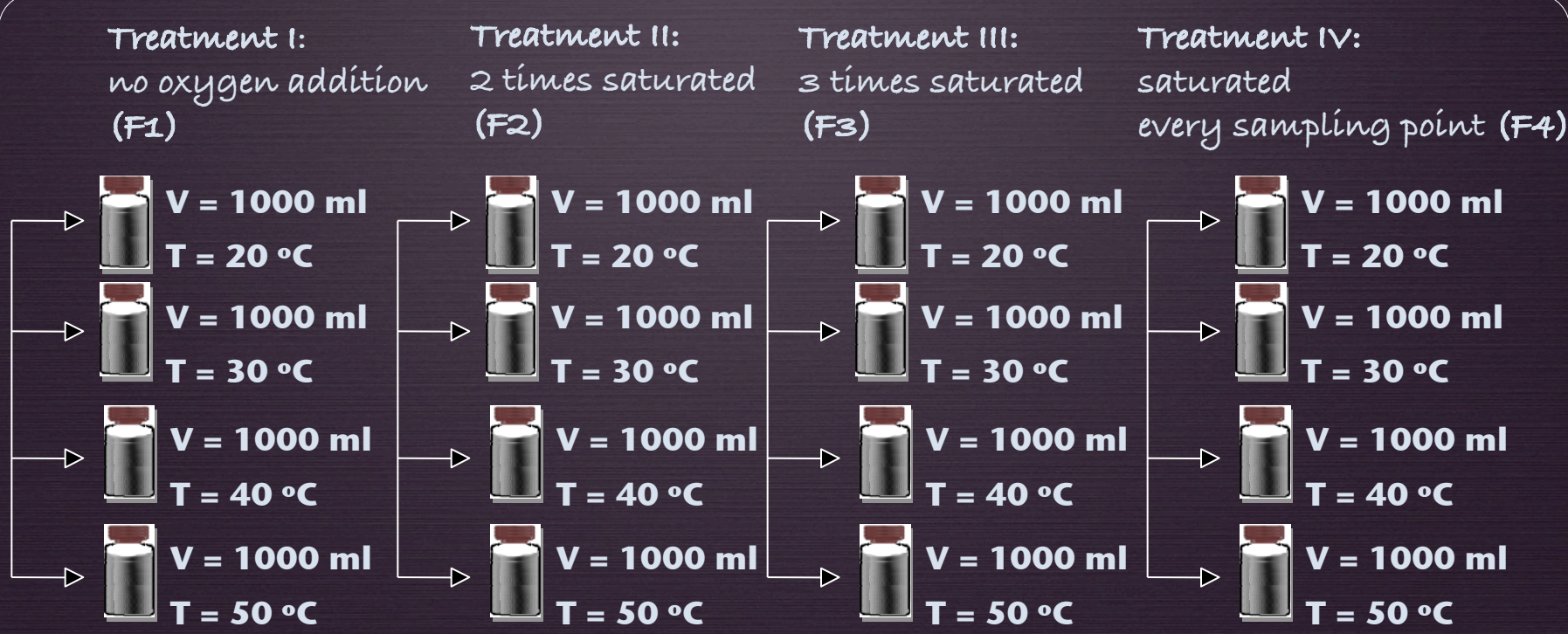
(a galloyl group)



Gallic acid
and its derivatives

• Forced Aging Protocol - 42 Days

White wine (pH = 3.2): 4 oxygen regimes



Samples were taken and analyzed weekly

HPLC/DAD and antiradical activity analysis

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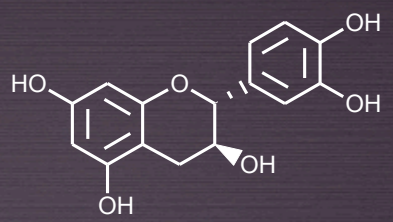
Phenolics with lower oxidation potentials

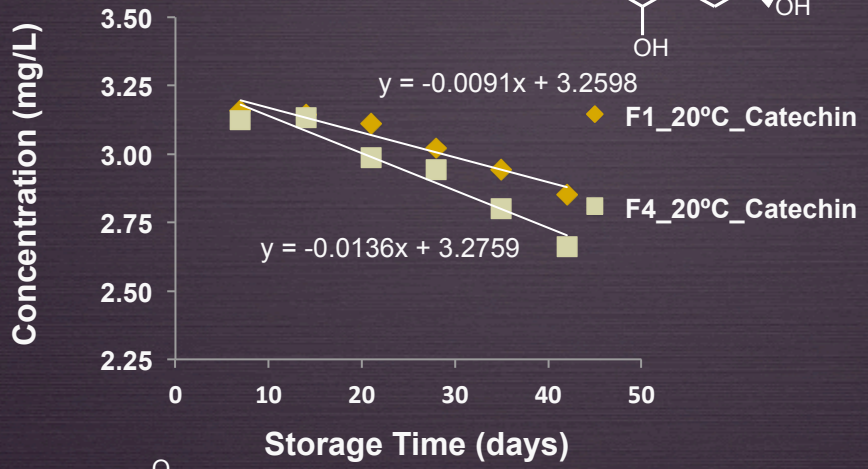
E (mV)	
470	Gallic acid
460	Caffeic acid
420	Catechin

no oxygen addition

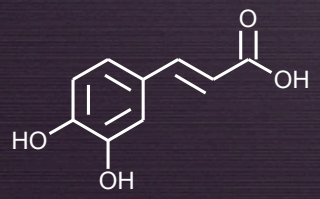
oxygen addition

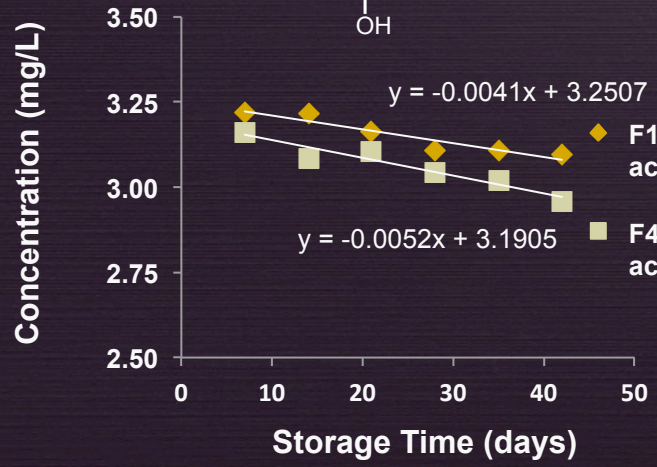
RRC = 1.5



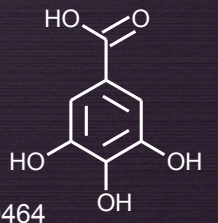


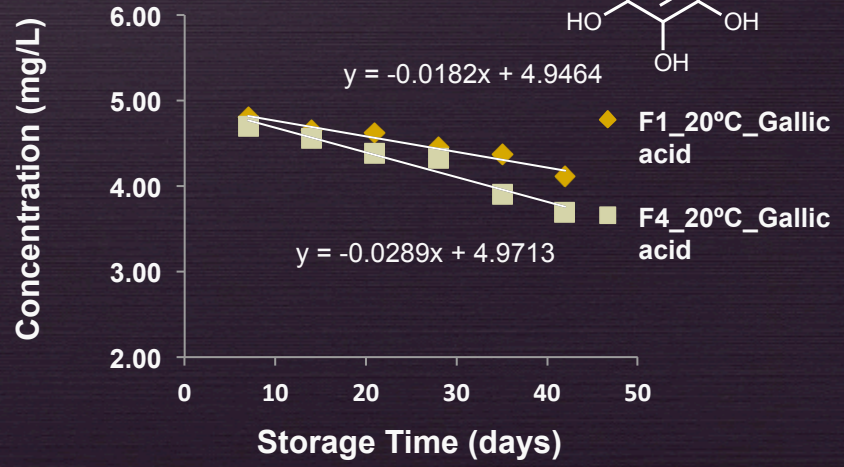
RRC = 1.3





RRC = 1.6





Phenolics with higher oxidation potentials

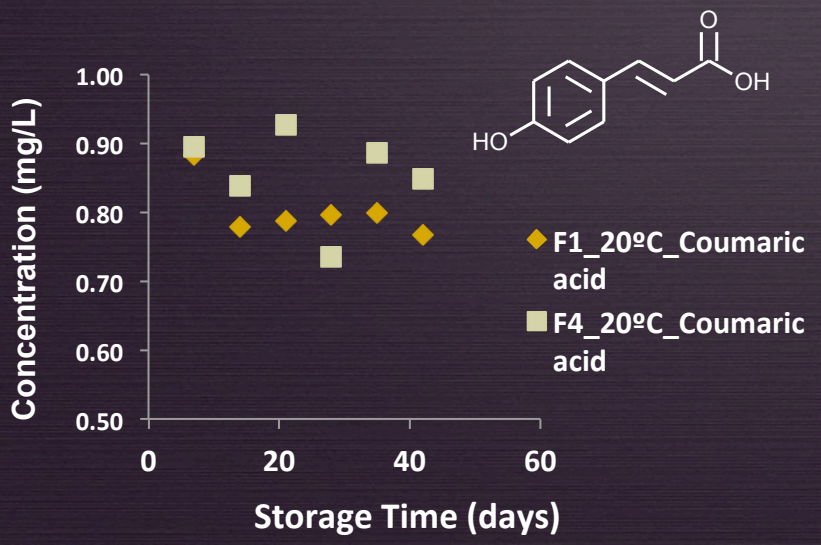
no oxygen addition

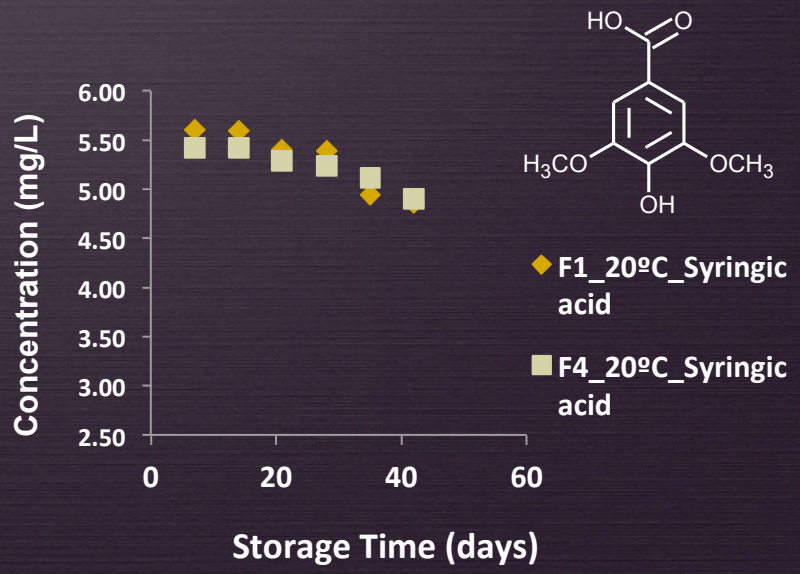
oxygen addition

E (mV)

815 Coumaric acid

680 Syringic acid





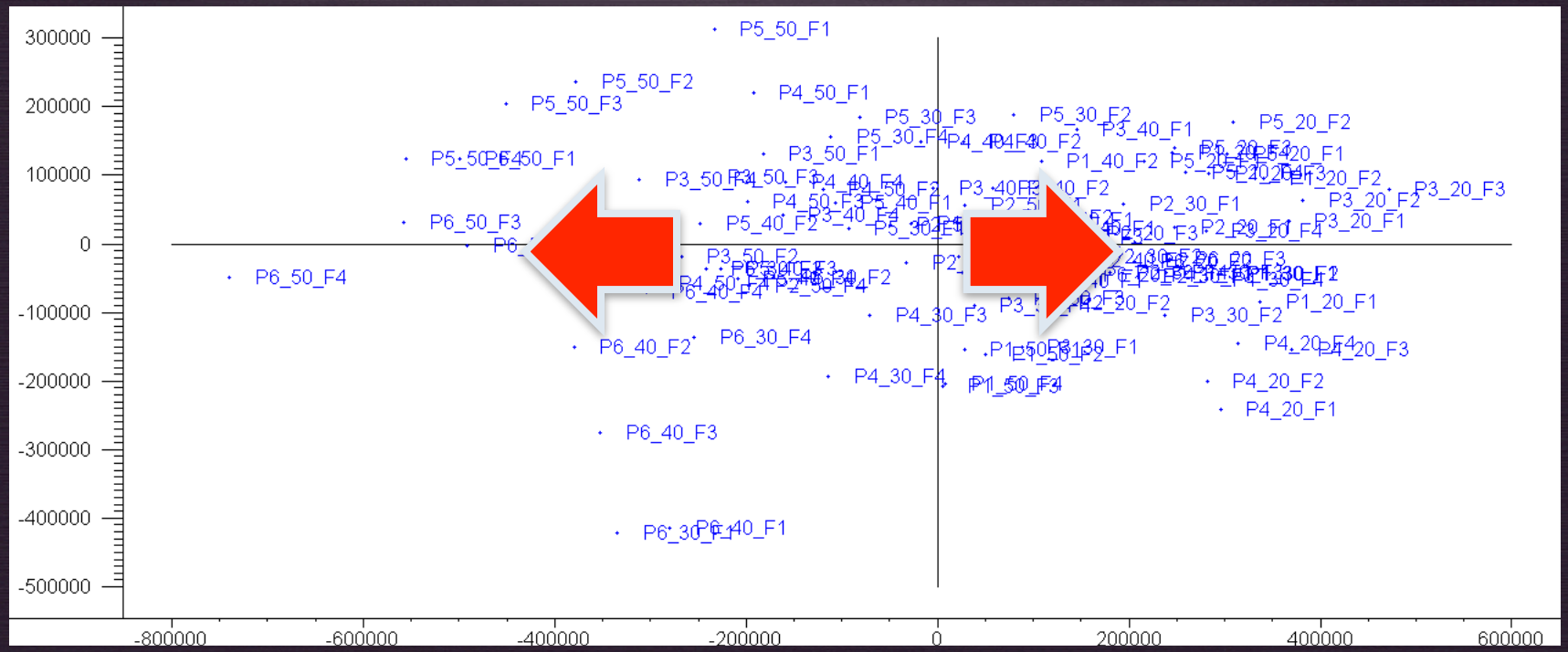
No significant decrease was found

Classification

PCA illustrate the global chemical differences of 15 compounds identified at 280 and 320 nm

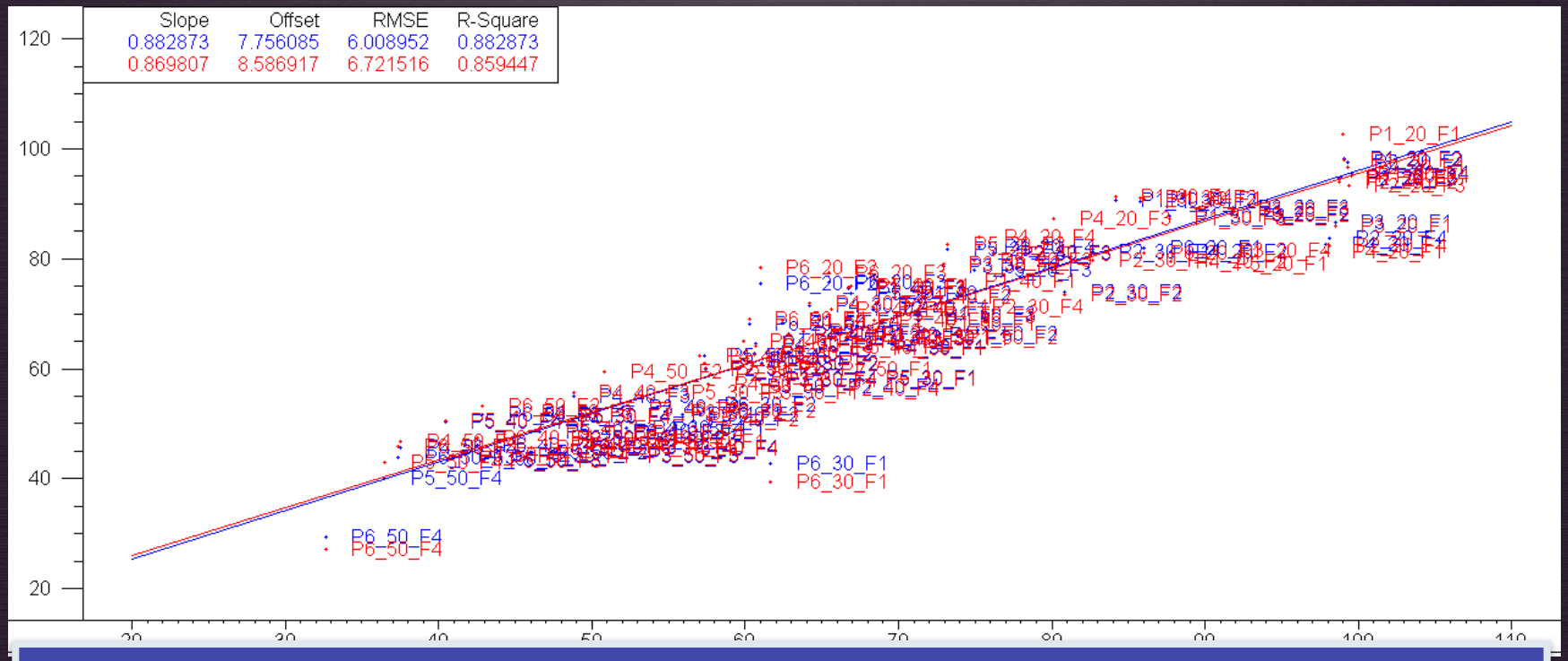
More oxidized wines

Less oxidized wines



PCA scores analysis: First versus second principal components (75%).

PLS can be used to determine the expression between antiradical activity giving by ABTS and the 15 phenolic compounds identified



Results have showed that wines with higher levels of phenolic compounds have higher antiradical activity.

However, in the presence of oxygen, phenolics oxidation undergoes further oxidation reactions.

Conclusion

- During the process of non-enzymatic oxidation the oxidative processes begin by the oxidation of polyphenols containing a galloyl group or an ortho-diphenol like gallic acid, (+)-catechin and caffeic acid;
- Moreover, oxygen supplements increase the consumption of these easily oxidizable phenolic compounds that undergoes further oxidation reactions;
- A wine oxidative process classification can be achieve by both phenolics quantification and ABTS antiradical activity.

Thank You