LC-MS METABOLOMICS SHOWS A SMART WAY TO REDUCE SULFITES IN WINE

authors
Panagiotis Arapitsas[1*], Maurizio Ugliano[2]
Daniele Perenzoni[1], Andrea Angeli[1]
Paolo Pangrazzi[3], Fulvio Mattivi[1]

[1]*Department of Food Quality and Nutrition, Research and Innovation Centre, Fondazione Edmund Mach, via E. Mach 1, San Michele all'Adige, Italy*
[2]*Nomacorc France, Domaine de Donadille, Avanue Yves Cazeaux, 30230 Rodilhan, France*
[3]*MezzaCorona winery, 38016 Mezzocorona, Italy*
**panagiotis.arapitsas@fmach.it*

Introduction

The impact of minute amounts of headspace oxygen on the post-bottling development of wine is generally considered to be very important, since oxygen, packaging and storage conditions can either damage or improve the quality of wine, in terms of its characteristics.

Experimental Design

The sample set included 12 white wines from 6 varieties. 10 samples of each wine were bottled using the standard industrial process, with inert headspace and variable exposure to oxygen (Low O_2), along with a further 10 bottles produced using the same line, but without inert gas and with extra headspace (High O_2). The wines were analyzed after two months of storage.

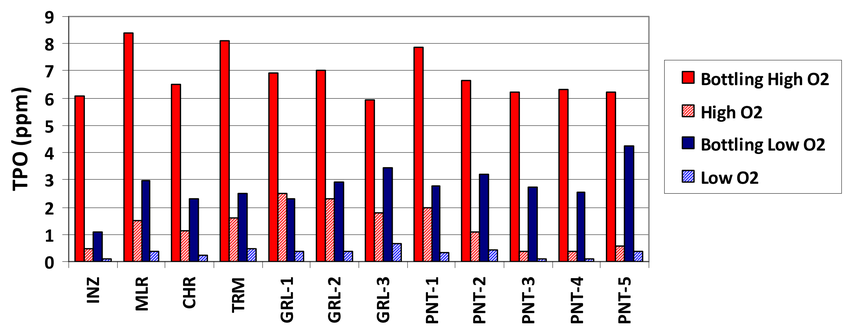
			Bottles bottled	
Variety	**Code**	**Wine**	**Low O_2**	**High O_2**
Pinot gris	PNT	x 5	x 10	x 10
Grillo	GRL	x 3	x 10	x 10
Chardonnay	CHR	x 1	x 10	x 10
Muller Thurgau	MLR	x 1	x 10	x 10
Traminer	TRM	x 1	x 10	x 10
Inzolia	INZ	x 1	x 10	x 10

Total 240 bottles

Results I

The mean concentrations of total package oxygen (TPO) in each wine under the two bottling conditions (respectively, High vs Low O_2) at the time of bottling and after two months of storage.

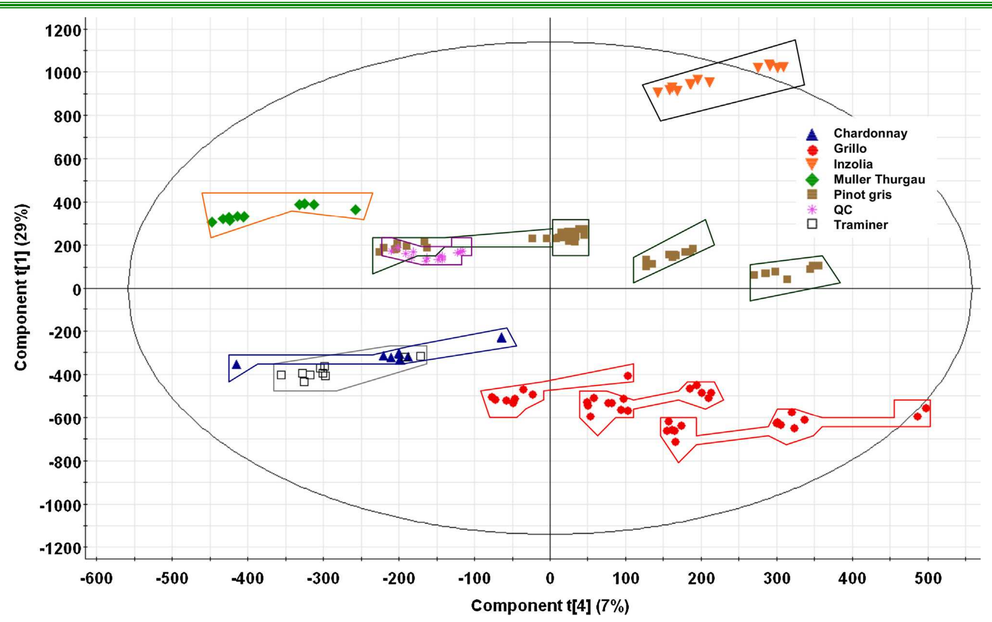

NomaSense™ oxygen analyzer

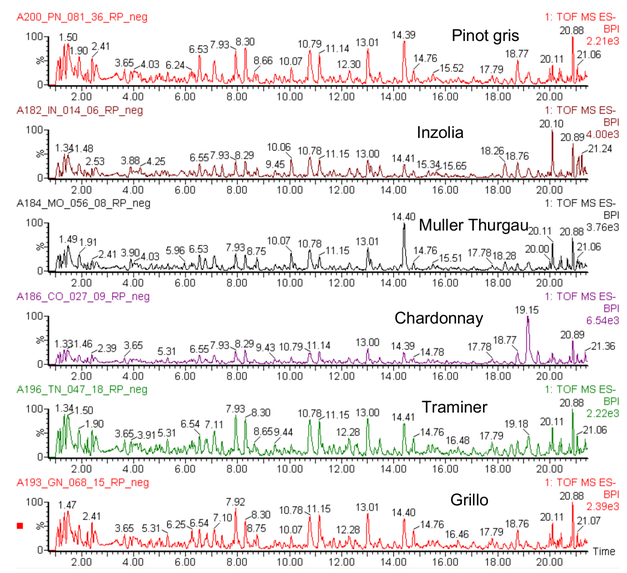



Low O_2 **High O_2**

Results II

UHPLC-QTof MS untargeted analysis pointed out the power of metabolomics to discriminate the various wines; but supervised multivariate statistical analysis were necessary to detect O_2 related markers. This was due to the "statistical noise" generated by the cultivar variability.



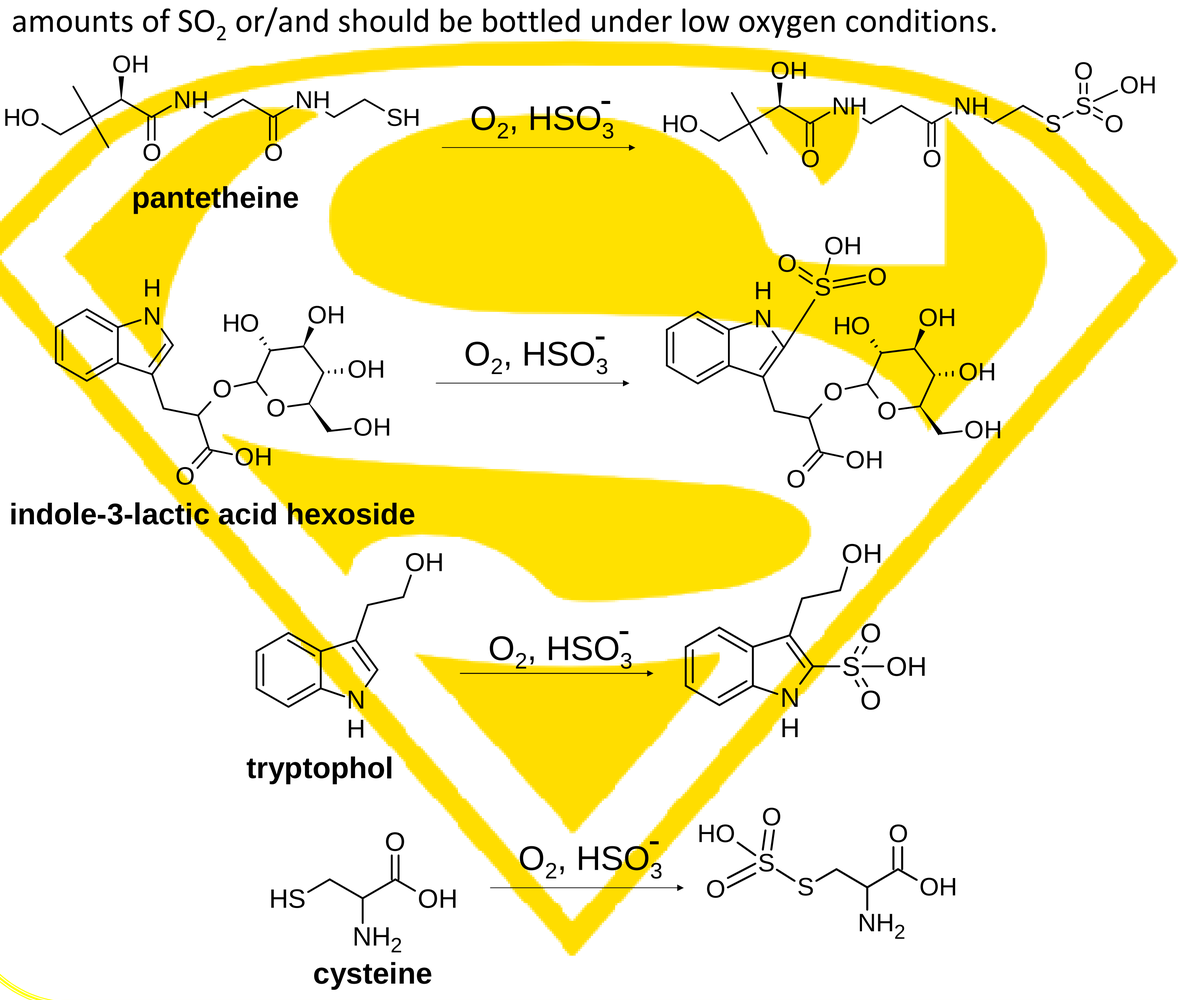


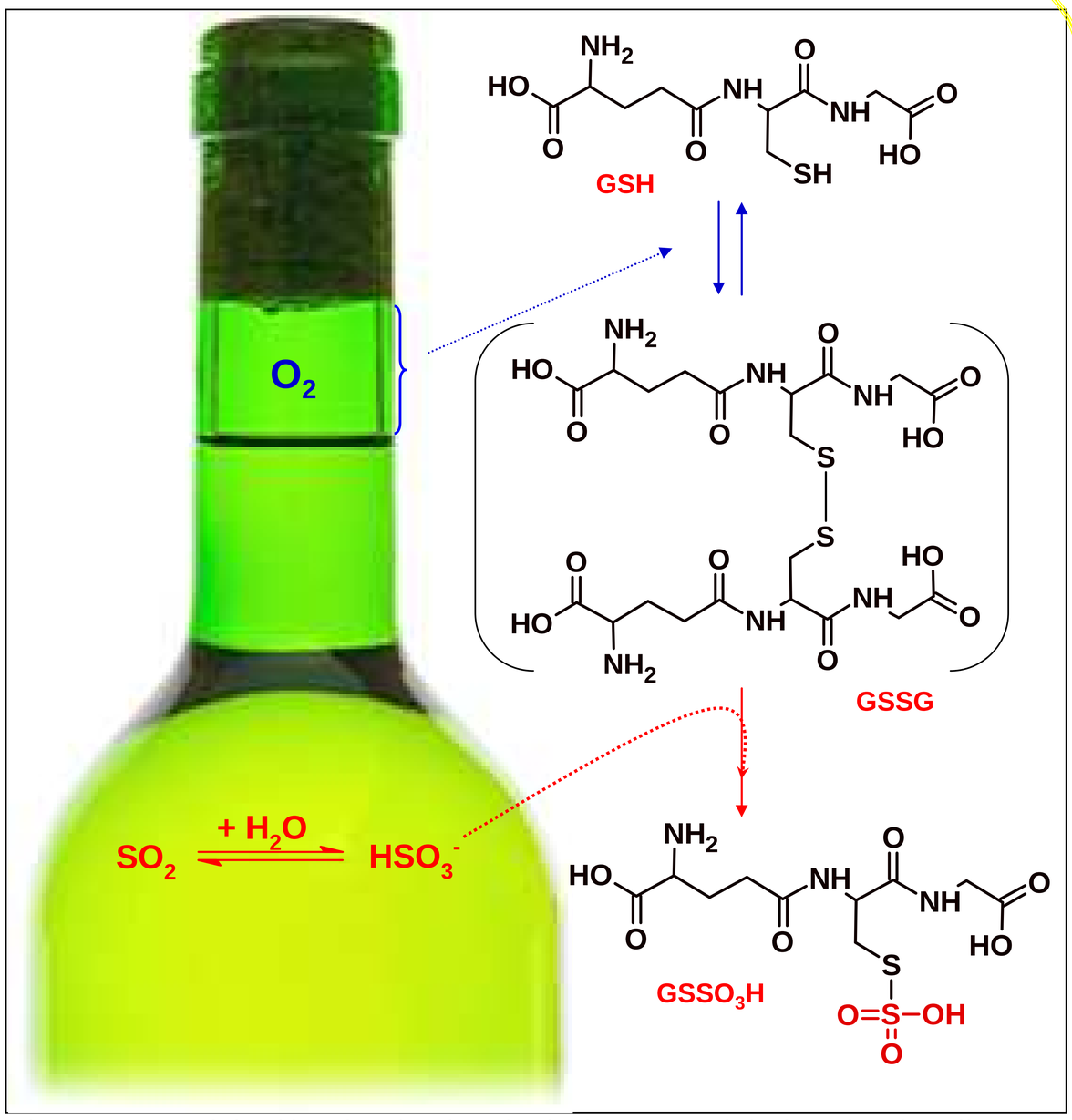
Results III

New reactions discovered: The main reactions driven by O_2 were involving Sulfur. The antioxidant SO_2, added to protect wine from unwanted reactions, takes part in various reactions, several of which were unknown in wine to date and would appear to be of practical significance.

Possible additive interaction effects, between SO_2 and glutathione, should be revaluated, since these could also turn out to be antagonistic, and their co-addition/co-presence could provide less effective protection.

Wines containing large amounts of indoles might require the addition of larger amounts of SO_2 or/and should be bottled under low oxygen conditions.





The co-presence of glutathione (GSH) and SO_2 in wine has as a result the formation of *S*-sulfonated glutathione ($GSSO_3H$). The mechanism of the reaction requires first the oxidation of GSH to GSSG (glutathione disulfide), which reacts very fast to produce $GSSO_3H$. This is the cause why GSSG is not detectable in wine.

For further information read: Arapitsas, P.; Ugliano, M.; Perenzoni, D.; Angeli, A.; Pangrazzi, P.; Mattivi, F. Wine metabolomics reveals new sulfonated products in bottled whitewines, promoted by small amounts of oxygen, Journal of Chromatography A, vol. 1429, pp. 155-165, 2016.