REDUCTION OF 4-ETHYLPHENOL CONCENTRATION USING LYOPHILIZED YEAST BIOMASSES AS BIOADSORBENT: INFLUENCE ON THE ANTHOCYANIN CONTENTS AND CHROMATIC PARAMETERS

Palomero, F., Ntanos, K., Benito, S., Morata, A., Calderón, F., & Suárez-Lepe, J.A.
felipe.palomero@upm.es
XXXII CONGRESO MUNDIAL DE LA VIÑA Y EL VINO. OIV 2010

Dpto. Tecnología de Alimentos. ETSI Agrónomos
Universidad Politécnica de Madrid
Ciudad Universitaria S/N. Madrid 28040

Gl. Enología, enotecnia y biotecnología enológica
Dpto. Tecnología de Alimentos

enotecUPM
Dept. Food Technology
ETS Ingenieros Agrónomos
Universidad Politécnica de Madrid
Ciudad Universitaria S/N
Madrid 28040 SPAIN
Tel. 0034 91 336 57 45
Fax. 0034 91 336 57 46

INTRODUCTION

A new investigation trend, based on the parietal adsorption activity showed by yeast cell-walls, opens up the possibility to use yeast lees or derived products like inactive dry yeast preparations to reduce 4-ethylphenol concentrations in wines. These type of natural products entails an interesting eco-friendly alternative to common physical treatments.

In this work the bioadsorption capacity of 4-ethylphenol of different wine yeast biomasses have been studied -*Saccharomyces cerevisiae* G37 and *Schizosaccharomyces pombe* 936-, in order to diminish the negative impact on the sensorial profile of this type of compound (Figure 1). the repercussions of this palliative treatment over the chromatic properties and anthocyanin concentration have also been studied by means of UV-Vis and HPLC-PDAD/ESI-MS analysis

MATERIALS AND METHODS

The experiments were conducted using a red wine of *Vitis vinifera* L. cv Merlot of the D.O. Wines of Madrid. The above mentioned wine was added by a known concentration of 4-ethylphenol (Table 1). The different used biomasses were obtained as described in Palomero *et al*., 2009. The above mentioned lyophilized biomasses were contacted during periods of 90 minutes with the wines, following the methodology of Chassagne *et al*., 2005.

The analyses of the concentrations of 4-ethylphenol in the different samples proposed (doses 5, 10, 15, 20, 25 30 g/l) was realized by means of SPME-GC/MS (Benito *et al*., 2009). HPLC-PDAD-ESI/MS was used to determine anthocyanin concentrations and chromatic parameters were analyzed by means of UV-Vis spectrophotometry, after the treatments and previous centrifugation (4000 rpm) according to Palomero *et al*., 2009.

RESULTS AND DISCUSSION

Table 1 shows the reduction of 4-ethylphenol depending on the dose of yeast used. There is a strong correlation between the decreases in concentrations of 4-ethylphenol and doses of yeast used. Not surprisingly, the largest reductions are obtained when higher doses are added (30 g / l). Moreover, *Schizosaccharomyces pombe* (936) showed higher retention capacity of 4-ethylphenol to lower doses of lees than *Saccharomyces cerevisiae* (G37). A significant reduction in anthocyanin content was also observed, being more important in the case of the biomass of *Schizosaccharomyces pombe* (936) (Figure 2; Table 2). The decreases in concentrations of anthocyanins as used increasing doses of freeze-dried yeast are consistent with the decreases in color intensity values for both samples (Figure 3). These results justify the selection of yeast of low parietal adsorption and question the possible adaptation of the technique to industry routine, at least in the conditions commonly described in the literature.

CONCLUSIONS

The palliative treatment of wines with high concentrations of 4-Ethylphenol based on short time contact shows certain efficiency when very high doses of yeast lees are added. On the contrast this technique provokes important reductions in the contents of anthocyanins and colour losses questioning its possible practical application, at least in the experimental studied conditions.

ACKNOWLEDGEMENTS

The authors thank Bodegas Val Azul (Chinchon, Madrid) and *Proyecto Cenit Démeter* Lallemand Bio S.L-UPM for the financial support.

REFERENCES

Chassagne, D., Guilloux-Benatier, M., Alexandre, H., & Voilley, A. (2005). Sorption of wine volatile phenols by yeast lees. Food Chemistry, 91, 39-44

Benito, S., Palomero, F., Morata, A., Uthurry, C., & Suárez-Lepe, J.A. (2009). Minimization of ethylphenol precursors in red wines via the formation of pyranoanthocyanins by selected yeasts. International Journal of Food Microbiology, 132, 145-152

Palomero, F., Morata, A., Benito, S., Calderón, F., & Suárez-Lepe, J.A. (2009). New yeast genera for over-lees ageing of red wine. Food Chemistry, 112, 432-442

Morata, A., Gómez-Cordovés, M.C., Colomo, B., & Suárez-Lepe (2005). Cell wall anthocyanin adsorption by different Saccharomyces strains during the fermentation of *Vitis vinifera* L.cv Graciano grapes. European Food Research & Technology, 220, 341-346

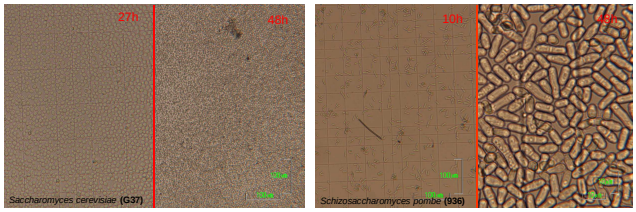

Figure 1. Microscopy pictures of the biomass production of the two strains used previous to lyophilization.

Yeast lees (g/l)	*Saccharomyces cerevisiae* (G37)	*Schizosaccharomyces pombe* (936)
0	434,11±23,96 a	434,11±23,96 a
5	415,01±29,29 ab	379,90±24,88 b
10	390,98±12,25 bc	371,21±10,48 bc
15	362,25±21,06 cd	359,86±11,17 bcd
20	342,67±16,14 d	343,40±7,43 cde
25	338,64±4,61 d	325,84±24,50 de
30	334,11±21,10 d	314,26±30,15 e

Table 1. Concentrations of 4-Ethylphenol (ppb) in a *Vitis vinifera* L. cv. Merlot wine added with different concentrations of lyophilized yeast biomasses. Values are means ± standard deviations (n=3).

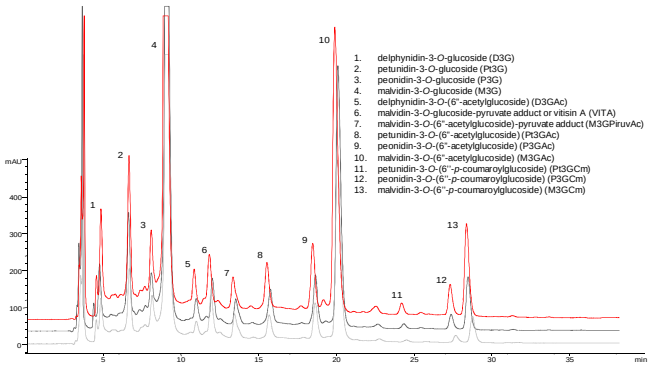

Figure 2. HPLC-DAD-ESI/MS chromatograms of the anthocyanins detected in the control wine (red line), in a sample with 30 g/L of lyophilized biomass of *Saccharomyces cerevisiae* (G37) (grey line) and in a sample with 30 g/L of lyophilized biomass of *Schizosaccharomyces pombe* (936) (light grey line).

Saccharomyces cerevisiae (G37)

Lyophilized biomasses weight (g/l)	Monomeric anthocyanins	Pyranoanthocyanins	Acetylated anthocyanins	Coumarylated anthocyanins
0	237,17±1,82	18,19±0,21	124,79±0,04	37,84±1,03
15	212,27± 0,51	16,41±0,89	108,14±1,87	25,29±1,07
30	197,48±1,92	15,44±0,75	100,91±2,71	19,51±1,22
% Reduction	**16,73**	**15,11**	**19,40**	**48,44**

Schizosaccharomyces pombe (936)

Lyophilized biomasses weight (g/l)	Monomeric anthocyanins	Pyranoanthocyanins	Acetylated anthocyanins	Coumarylated anthocyanins
0	210,39±9,10	18,85±0,14	104,55±5,29	29,46±1,82
15	179,14± 6,61	16,56±0,37	89,76±3,60	16,77±0,86
30	157,62±7,59	14,53±0,24	7,95±4,43	10,52±64,29
% Reduction	**25,08**	**22,92**	**23,89**	**64,29**

Table 2. Concentrations of the anthocyanin concentrations (mg/L) and percent of reduction (%; 30 g/L of yeast biomass) in the wines with different concentrations of lyophilized *Saccharomyces cerevisiae* (G37) biomasses. Values are means ± standard deviations (n=3).

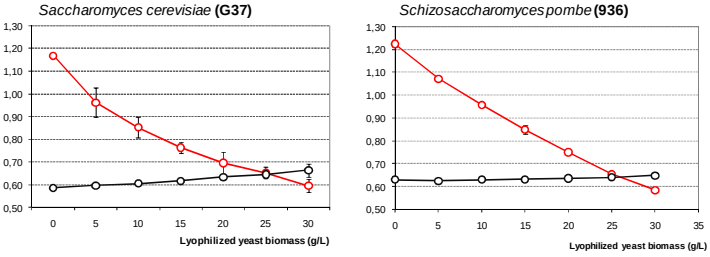

Figure 3. Change in colour intensity (red line) and hue (black line) for all the assayed concentrations and studied yeast.