EFFECT OF FINING AND FILTRATION ON THE POLYSACCHARIDE AND PROANTHOCYANIDIN COMPOSITION OF RED WINES

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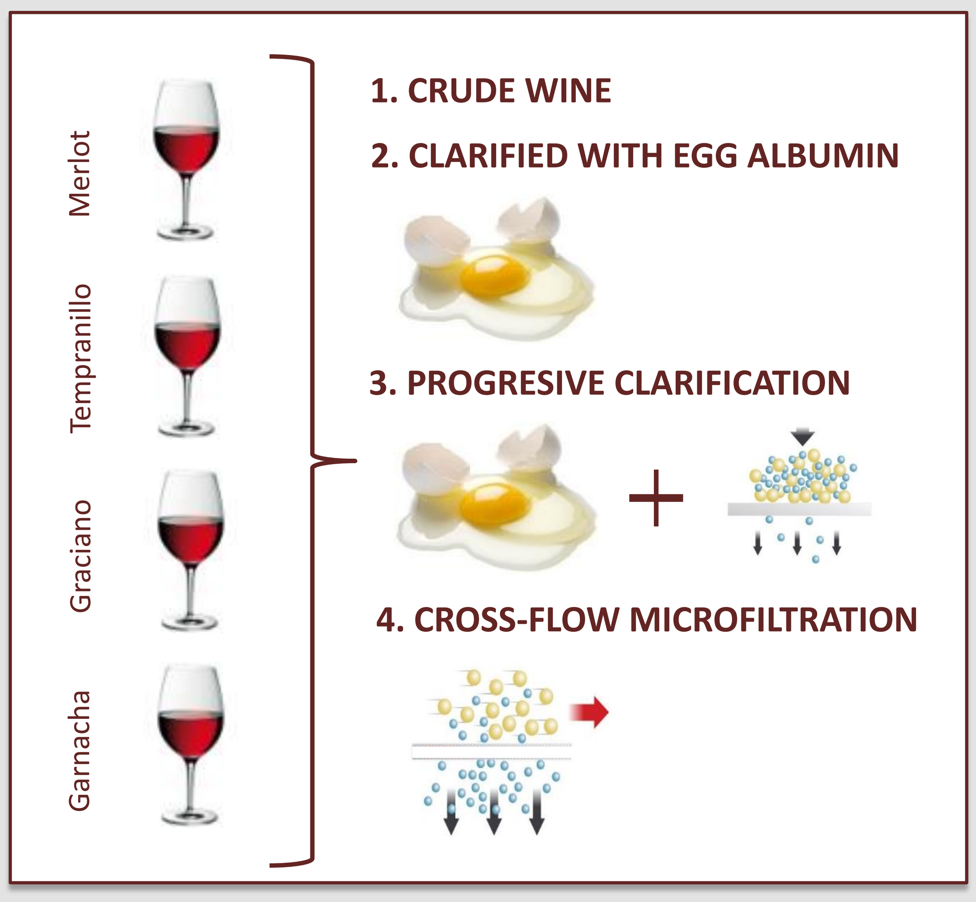
INTRODUCTION

- Polysaccharides and polymerized phenolic compounds are the main compounds of colloidal nature in red wine.
- Natural colloids cause turbidity in the crude red wine after alcoholic and malolactic fermentation.
- Enologists subject the crude wines to a progressive clarification by using several cleaning techniques: natural clarification by gravity, clarification with fining agents, several filtration steps on diatomaceous or on cellulose prior to the final microbial stabilization obtained by dead end filtration on sheets or membranes.
- Cross-flow microfiltration is a relatively new technique that can substitute a one-step procedure to the conventional processes of progressive clarification

OBJECTIVE

To analyze the effect of the clarification with egg albumin, progressive clarification and cross-flow microfiltration on the proanthocyanidin and polysaccharide composition of red monovarietal wines.



EXPRIMENTAL

- Vinifications were carried out following the traditional red winemaking process using the red grapes *Vitis vinifera* cv. Merlot, Tempranillo, Graciano and Garnacha.
- Crude wines were submitted to different clarification processes after malolactic fermentation: (i) clarification with egg albumin; (ii) progressive clarification (clarification with egg albumin followed by filtration plates on cellulose); (iii) cross-flow microfiltration.
- Samples for analysis were taken from crude wines (C), wines clarified with egg albumin (EA), wines submitted to progressive clarification (PC), and wines submitted to cross-flow microfiltration (CFMF).
- Wine polysaccharides were recovered by precipitation and the monosaccharide composition of the total soluble polysaccharides was determined by GC−MS [1]. For analyzing proanthocyanidins, wine samples were fractionated [2] and phloroglucinol adducts were analyzed by reversed-phase HPLC [3].

RESULTS AND CONCLUSIONS

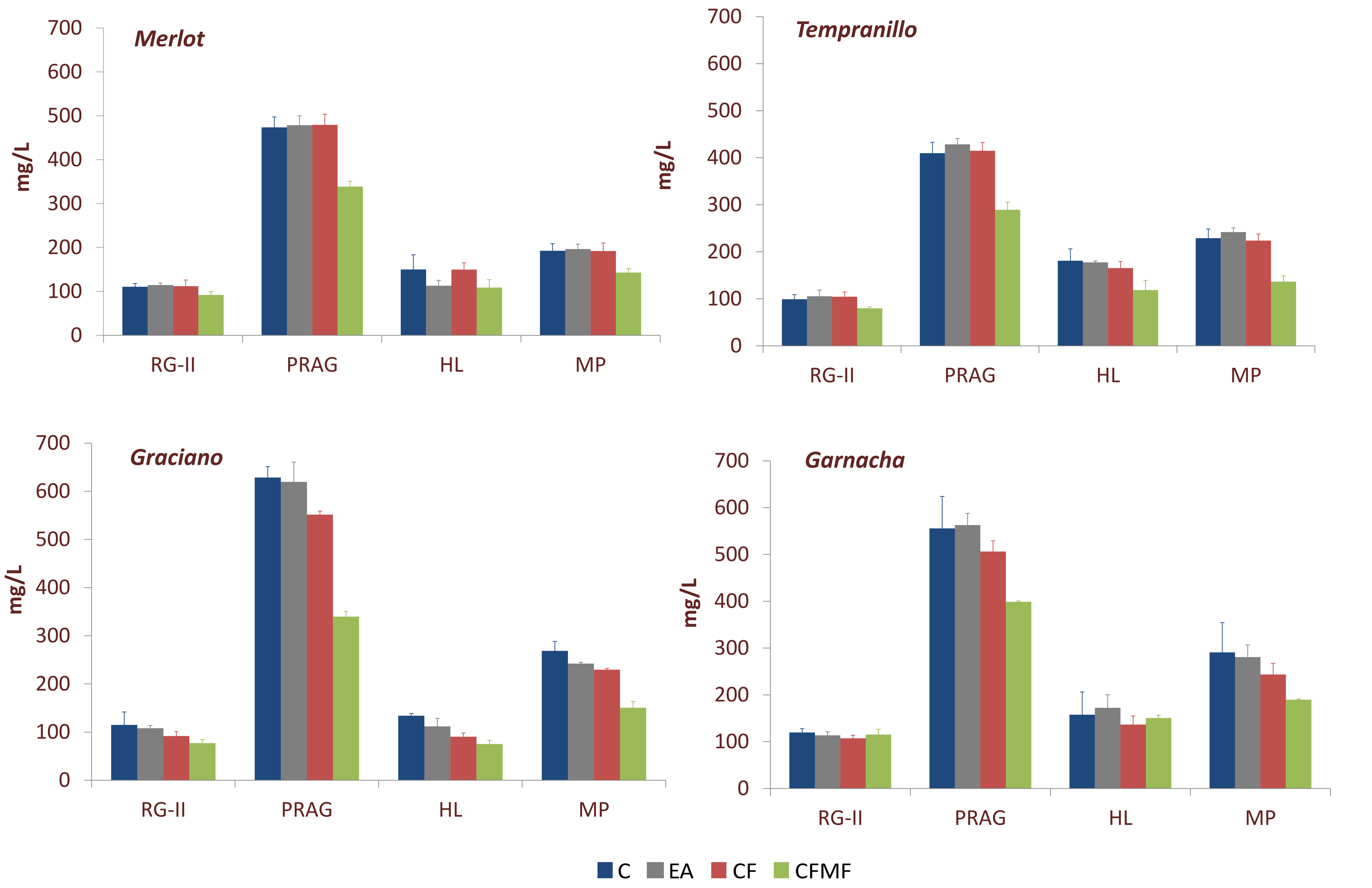


Figure 1. Concentration of Rhamnogalacturonan type II (RG-II), Polysaccharides Rich in Arabinose and Galactose (PRAG), Homogalacturonans (HL) and Mannoproteins (MP) in Merlot, Tempranillo, Graciano, and Garnacha wines during the different treatments: C, crude wines; EA, wines clarified with egg albumin; PC, wines submitted to progressive clarification; CFMF, wines submitted to cross-flow microfiltration. Values are means ± SD (n = 3). Different letters in the polysaccharide families represent means significantly different at $p < 0.05$.

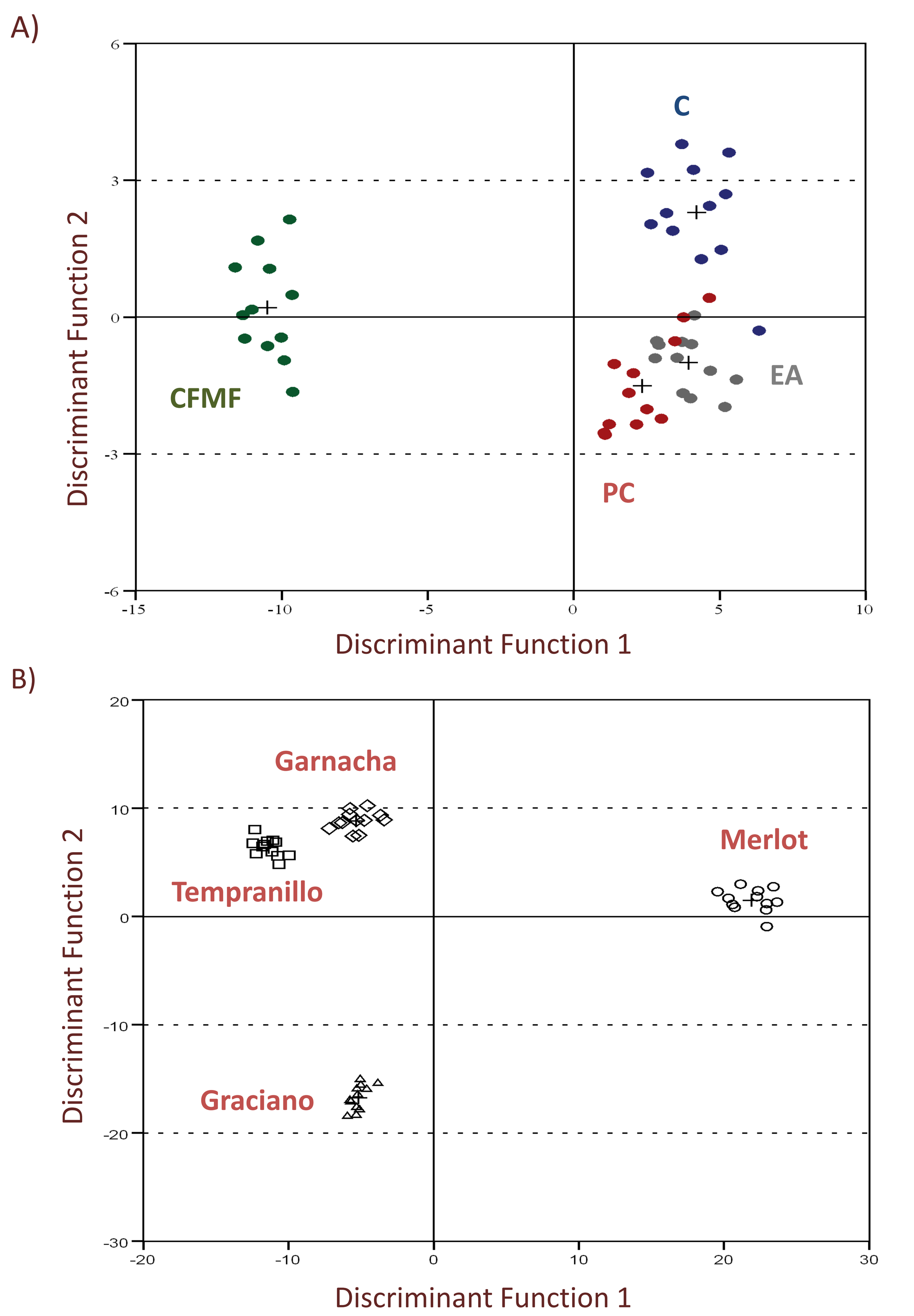


Figure 2. Distribution of the wines in the plane defined by the first two discriminant functions by (A) treatment and by (B) grape variety. + centroids, ○ Merlot, □ Tempranillo, Δ Graciano, ◊ Garnacha. ● crude (C), ● clarified with egg albumin (EA), ● progressive clarification (PC), ● cross-flow microfiltration (CFMF)

Table 1. Proanthocyanidin composition

		PA[b]	mDP[b]	ECG-ext[c]	C-ext[c]	EC-ext[c]	EGC-ext[c]	ECG-term[c]	C-term[c]	EC-term[c]	Galloyl[d]
Merlot	C[a]	750.95 c	7.58 c	23.79 a	3.05 ab	53.79 a	6.17 b	3.59 b	6.54 a	3.07 a	27.38 b
	EA[a]	728.92 c	7.46 b	23.47 a	3.35 bc	55.42 bc	4.36 a	3.38 b	6.80 a	3.22 a	26.85 ab
	PC[a]	700.87 b	7.83 d	22.87 a	2.62 a	55.76 c	5.98 b	2.81 a	6.74 a	3.22 a	25.68 a
	CFMF[a]	537.36 a	6.67 a	23.77 a	3.68 c	54.16 ab	3.39 a	3.54 b	7.57 b	3.89 b	27.32 b
Tempranillo	C	582.99 c	15.01 c	12.53 ab	4.98 b	65.79 a	10.04 c	0.76 a	4.79 a	1.11 a	13.29 ab
	EA	501.93 b	13.36 b	13.17 b	3.28 a	66.53 a	9.54 b	0.74 a	5.50 b	1.24 bc	13.91 b
	PC	490.00 b	13.27 b	13.13 b	3.91 ab	66.96 a	8.46 a	0.76 a	5.60 b	1.18 ab	13.89 b
	CFMF	421.19 a	12.25 a	12.02 a	3.98 ab	66.59 a	9.48 b	0.65 b	5.97 c	1.30 c	12.66 a
Graciano	C	355.97 c	9.65 b	15.18 a	4.76 b	55.20 a	14.49 b	1.25 c	5.68 a	3.44 a	16.43 b
	EA	275.63 b	9.03 b	14.63 a	4.51 ab	55.65 a	14.10 ab	1.01 b	5.75 a	4.36 b	15.64 ab
	PC	264.88 b	9.10 b	14.95 a	4.77 b	55.50 a	13.79 ab	1.07 b	5.76 a	4.17 b	16.02 b
	CFMF	237.82 a	7.82 a	14.37 a	4.12 a	56.13 a	12.58 a	0.71 a	6.82 b	5.25 c	15.10 a
Garnacha	C	586.55 d	11.89 c	13.13 a	3.75 c	67.77 a	6.94 c	0.84 b	5.69 a	1.88 a	13.97 a
	EA	470.85 c	10.48 b	13.99 a	3.40 b	67.61 a	5.45 b	1.00 c	6.65 b	1.88 a	14.99 a
	PC	448.34 b	9.94 a	13.03 a	2.94 a	68.78 a	4.96 ab	0.67 a	7.66 d	1.97 a	13.70 a
	CFMF	421.11 a	10.24 ab	12.97 a	4.10 d	68.64 a	4.53 a	0.69 a	6.99 c	2.09 a	13.65 a

[a] C, crude wines; EA, wines clarified with egg albumin; PC, wines submitted to progressive clarification; CFMF, wines submitted to cross-flow microfiltration. [b] PA, total proanthocyanidins content (mg/L); mDP, mean degree of polymerization. [c] Tannin subunit composition expressed in mole %. ECG, (-)-epicatechin-3-O-gallate; C, (+)-catechin; EC, (-)-epicatechin; EGC, (-)-epigallocatechin; -ext, extension subunit; -term, terminal subunit. [d] % Galloyl, percentage galloylated units (ECG-term and ECG-ext) of the total. Different letters within the same wine column indicate statistical differences ($p < 0.05$).

- CFMF had the most significant effect on the polysaccharide and highly polymerized proanthocyanidins retention.
- Mannoproteins and polysaccharides rich in arabinose and galactose were the only polysaccharides families retained during cross-flow microfiltration.
- Total monosaccharides forming polysaccharides were proved to be the most profoundly influential for wine treatment differentiation. The percentage of galloylated units and (-)-epigallocatechin extension subunit exerted a profound influence on wine varietal differentiation.

REFERENCES

[1] Guadalupe et al. (2012). Food Chemistry. 131, 367-374.
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