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How do Accentuated Cut Edges and Macerating Enzyme affect Phenolic Compounds Extraction on 'Marquette' Wines?

INTRODUCTION

- Marquette is an interspecific hybrid red grape variety that can survive through the harsh and cold winter in the Midwest regions. However, 'Marquette' wines tend to be acidic and low in tannins, which negatively impacts wine quality.
- Accentuated cut edges (ACE) and addition of macerating enzymes are a mechanical and a biological process, which breaks grape skins into small fragments and degrades skin cell walls, respectively.
- Both winemaking techniques have shown an enhancement of extractability of skin-derived condensed tannins from *Vitis vinifera* grapes [1,2]. However, further investigations are needed to elucidate the role of phenolic compounds and cell wall material on polyphenols extraction and on red wine quality made from cold-hardy grape varieties.
- Considering the importance of astringency in wine quality, this study focused on using ACE and pectinase addition at crush to extract more phenolic compounds from Marquette grapes and improve Marquette red wine quality.

MATERIALS AND METHODS

- Destemming/ **crushing**, 'Marquette' must (pH 3.3, 11.1 g/L titratable acidity (TA), 26.7 °Brix): three treatments in triplicate:
1) Accentuated cut edges (ACE)
2) Pectic enzyme (ENZ)
3) Control (CTL)

- Alcoholic fermentation for 7 days + co-inoculation MLF
- Pressing

- Racking and cold stabilization 6 ºC for 1 month.

- After **bottling**, stored at 12 ºC for **6 months aging**

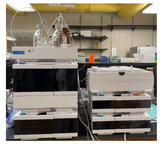
<u>Sampling at crushing, at bottling, and after aging to measure</u>:

- Monomeric phenolics – HPLC DAD and fluorescence detector (FLD)
- Polymeric phenolics (iron-reactive) – modified Harbertson-Adams assay [3]
- Color characteristics – UV-VIS spectrophotometry

ACE Apparatus - Blender

Scottzyme® PEC5L

UV-vis light spectrophotometry



High-performance liquid chromatography (HPLC-DAD/FLD)

RESULTS & DISCUSSION

Table 1. Concentration of monomeric phenolic compounds after treatments applied at crushing

Time point	Treatment	Total flavan-3-ol (mg/L epicatechin eq.)	Total flavonol (mg/L quercetin-3-glucoside eq.)	Total anthocyanin (mg/L oenin and malvin eq.)
Crushing	ENZ	12.77 ± 8.68 a	1.01 ± 0.29 ab	270.46 ± 150.04 a
	ACE	11.03 ± 12.57 a	1.65 ± 0.36 a	311.42 ± 200.13 a
	CTL	11.18 ± 9.37 a	0.92 ± 0.09 b	208.94 ± 129.25 a
Bottling	ENZ	76.84 ± 3.15 b	7.23 ± 1.02 a	552.77 ± 27.15 a
	ACE	104.44 ± 1.47 a	8.49 ± 0.69 a	547.22 ± 16.62 a
	CTL	68.85 ± 0.94 c	7.16 ± 0.30 a	548.98 ± 14.15 a
Aging	ENZ	86.26 ± 3.24 b	9.59 ± 0.91 ab	334.42 ± 13.80 a
	ACE	117.05 ± 2.98 a	10.81 ± 1.18 a	333.73 ± 18.86 a
	CTL	75.02 ± 0.86 c	8.55 ± 0.64 b	328.43 ± 18.09 a

- At bottling and after aging, ACE-treated wines showed the highest concentrations of flavan-3-ols and flavonols, followed by ENZ treated wines compared to the control wines (Table 1). However, no significant difference in total free anthocyanin content were found between treatments.

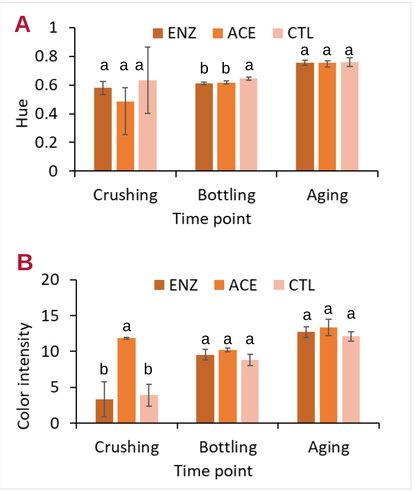


Figure 1. Hue (A) and Color intensity (B) in the wines

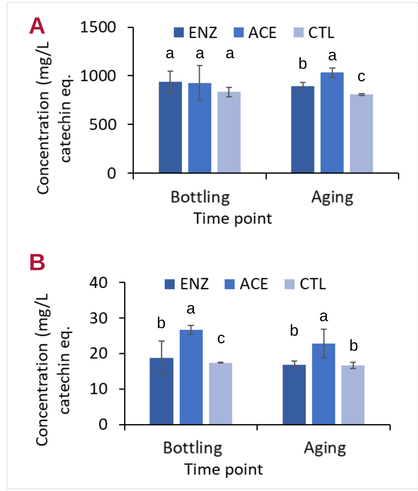


Figure 2. Total phenolics (A) and Tannin content (B) in the wines

- Both ACE and ENZ treated wines showed significantly lower hue than control only at bottling (Fig 1A). The color intensity was significantly higher in ACE treated wines only after the ACE application at crushing (Fig. 1B).
- The increment of color intensity and reduction in monomeric anthocyanin suggested the formation of stable wine pigments.
- After aging, iron-reactive phenolics and tannin content were significantly higher in ACE treated wines than ENZ and control.

Data in the table and figures were expressed as the means of replication (n=3) ± standard deviation. All data were compared by one-way ANOVA with the Tukey HSD significant difference test (α = 0.05). Values not connected by the same letter are significantly different among treatments (p-value < 0.05) at the same time point.

CONCLUSION

- Overall, the ACE treatment had a greater impact on both monomeric and polymeric phenolic compounds extraction than using pectinase treatment.
- ACE treatment showed the ability to extract more anthocyanin and strongly improve the color intensity at the begin of maceration. Although this effect was reduced over time.
- This study showed that ACE treatment applied on 'Marquette' grapes at crushing improves the extraction of phenolic compounds
- The content of tannins was very low in wines whatever the technique applied and further work will be focusing on the sensory perception of wines, including astringency mouthfeel.
- This ACE technique could be used by the Industry to enhance 'Marquette' wine color stability.

Further work will focus on wine sensory evaluation and on a combination of the extraction techniques.

ACKNOWLEDGEMENTS

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