The extraction of anthocyanins through different winemaking techniques (Part 2)



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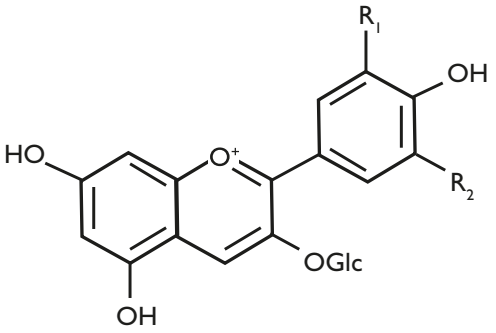
Introduction

The notion that more anthocyanins may be obtained through a pre-alcoholic maceration (Gonzales-Neves *et al.*, 2008) is widely held. This concept dates from the mid 1980s when it was first applied by a Lebanese winemaker, a certain Guy Accad, to Pinot noir. His contention, that cold maceration would extract more colour from Pinot noir, was apparently correct. The question then arose whether it would apply to all cultivars.

Improved tannin extraction takes place through an alcoholic medium, therefore more tannins will be extracted during alcoholic fermentation, or even during extended skin contact. This concept was addressed in a previous article. More tannins in a wine have the potential to stabilise the colour during maturation and to improve the ageing potential of the wine.



Compound	R_1	R_2
Cyanidin-3-glucoside	OH	H
Delphinidin-3-glucoside	OH	OH
Peonidin-3-glucoside	OMe	H
Petunidin-3-glucoside	OMe	OH
Malvidin-3-glucoside	OMe	OMe

FIGURE 1. Different types of anthocyanins.

This brings us to the importance of anthocyanins in wine. It is obvious that anthocyanins provide the red colour in wine and that, with tannins, they stabilise the colour. There are five main groups of anthocyanins in wine, namely delphinidin, malvidin, peonidin, petunidin and cyanidin (Fig. 1). Each of these anthocyanins are derivatised with coumaric acid and acetate, resulting in the 15 types of anthocyanins encountered in wines today. These anthocyanins, with their derivatives, occur in different concentrations and combinations and also range in colour from pink to red.

Material and method

Two farms in different climatological areas were chosen for this study. One farm is situated in a Winkler scale III and is called the cooler farm. The other farm is situated in a Winkler scale IV and is called the warmer farm. Two cultivars were used, namely Cabernet Sauvignon (CS) and Shiraz (SH). The two cultivars were crushed at two levels of ripeness, namely before commercial harvest (LB) and after commercial harvest (HB).

Five different vinification treatments were used. The treatments are the following:

- Control (C) – the grapes were crushed, inoculated with WE372 and pressed at the end of fermentation.
- Enzyme treatment (E) – as for the control, except that a pectolytic preparation was used.
- Cold maceration (CM) – the crushed skins were held at 10°C for three days before the grapes were inoculated with WE372. After fermentation the grapes were pressed.
- Post maceration / extended skin contact (PM) – crushed grapes were inoculated with WE372 and after fermentation the skins were left on the wine for a further two weeks before being pressed.
- Combination of cold maceration and post maceration (CM + PM) – crushed skins were kept at 10°C for three days before the grapes were inoculated with WE372. After fermentation the skins were left on the wine for a further two weeks before being pressed.

Total anthocyanins were measured by making use of the Iland method. Colour density was measured by adding A420 + A520 + A620 and colour hues were measured by dividing A420 / A520 into each other.

Results

From Figure 2 it is obvious that on Plaisir de Merle (warmer farm) the PM treatment had a negative effect. A possible explanation may be that with an increase in tannins, polymerisation occurs that binds to excessive anthocyanins, thereby effecting a decrease in total anthocyanins. The CM treatment shows a slight increase in total anthocyanins, but the increase is not significant. For the LB the CM + PM and E treatment showed no effect, whereas for the HB the E treatment showed the most significant increase in total anthocyanins.

On Morgenster (cooler farm) all the treatments showed negative effects for the LB. For the HB, the PM treatment showed a negative effect, while the other treatments did not show any effect. This trend was also observed in Shiraz (data not shown).

An interesting case is the effect of the E treatment on the extraction of anthocyanins. One would have expected enzymes to promote the extraction of anthocyanins, but it looks as though enzymes have a

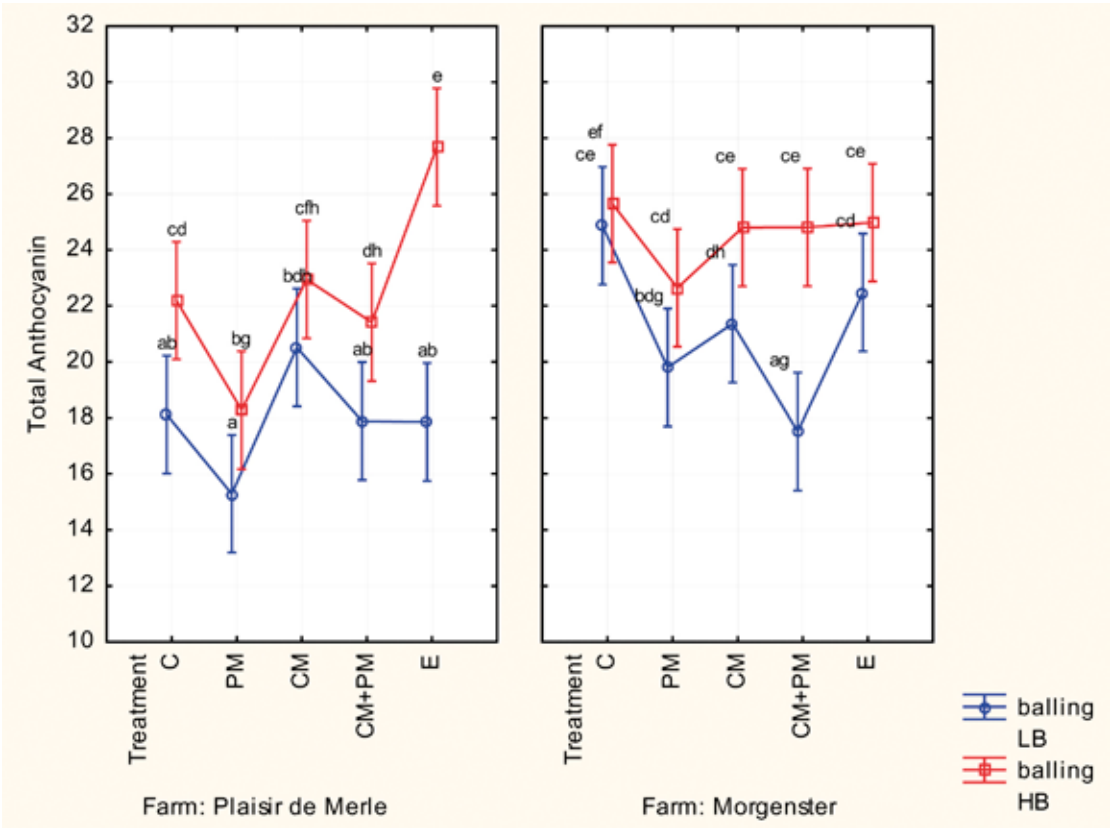


FIGURE 2. Total anthocyanins of Cabernet Sauvignon from the 2009 harvest season.

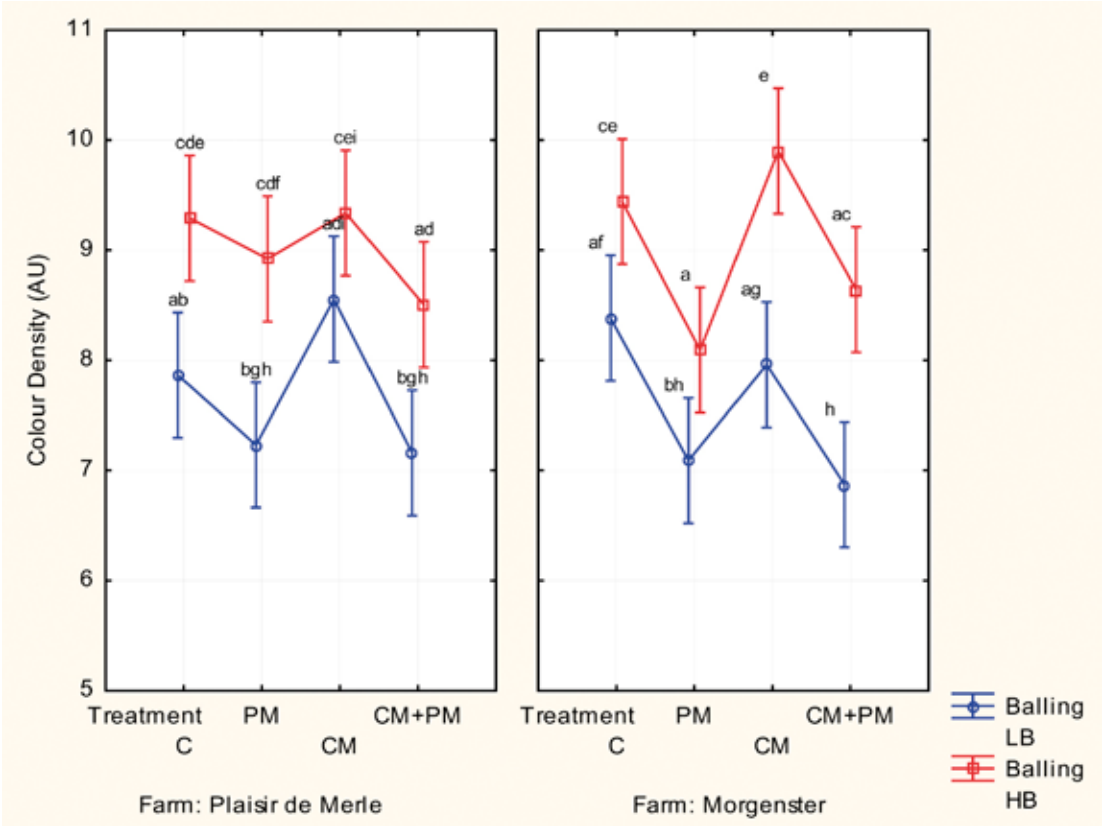


FIGURE 3. Colour density of Cabernet Sauvignon from the 2008 harvest season.

bigger effect on the extraction of tannins than anthocyanins. The reason is possibly that enzymes break down the bondings between the tannins and the cell wall components and that the enzymes themselves do not break down the cell walls (Arnous & Meyer, 2009). Likewise, improved release of anthocyanins occurs through mechanical breakdown of cell walls (Arnous & Meyer, 2009).

According to Figure 3 it is clear that the CM treatment had a positive effect on both farms and at both degrees of ripeness. The PM and CM + PM treatments in turn show negative effects. This may be because more aldehydes are formed during extended skin contact, which results in the formation of pyrano-anthocyanins that tend towards the yellow-brown colour spectrum. Although the CM treatment showed a positive increase, it is not significant compared to the control.

The colour intensity ("hue") indicates the ratio of yellow-brown compared to the red spectrum. This may be a good way of measuring wine that could be oxidised or aged. In older wine, or in wine that has oxidised, the colour spectrum shifts toward the yellow-brown spectrum, thereby increasing the colour intensity.

Conclusion

In the course of this study it became obvious that cold maceration had no noteworthy effect on the increase of total anthocyanins. This applied to both Cabernet Sauvignon and Shiraz. According to studies conducted by Gomez-Plaza *et al.* (2000 and 2001) on Monastrell, Alvarez *et al.* (2009) on Tempranillo and Gil-Munoz *et al.* (2009) on Cabernet Sauvignon and Shiraz, it was found that the longer the period on skins (5 to 7 days) and the colder the temperature (8 to 10°C), the higher the total anthocyanins in the eventual wine. This raises the question of whether cold maceration has any effect on other cultivars and whether the effect will be greater if the skins are left on the juice for a longer period at colder temperatures. According to Dr Johann Marais (2003) Pinotage benefits from cold maceration.

This study was conducted without using enzymes apart from the treatment where a pectolytic enzyme was used. The question is what the effect on cold maceration and extended skin contact will be if enzymes are used as a matter of course in everyday winemaking? The answers to such questions await further research.

Acknowledgement

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Summary

It is well-known that Pinot noir is a cultivar that does not have much colour. It is not known as the heartbreak cultivar for nothing. In the mid 1980s, however, a Lebanese winemaker came upon a method to extract more colour from Pinot noir. That method is now known as cold soaking or cold maceration. But, the question on everyone's lips is, does it work? In this study it was found that cold soaking does not have any significant effect on the extraction of total anthocyanins. It also shows that PM and CM + PM treatments have a negative effect on total anthocyanin. This is probably due to polymerisation with tannins. Cold soaking does not show significant increases in colour density and again the PM and CM + PM treatments show negative effects on colour density. The hue is the ratio between yellow-brown and the red spectrum. The older the wine or more oxidised the wine, the higher the hue of the wine will be.

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