ABSTRACT

Winemaking processes or techniques are known to impact wine composition and thus quality. Because of the significant influence of phenolic compounds on red wine quality, many winemaking processes have been developed to enhance the extraction of these compounds during the fermentation process. This dissertation focuses on the potential impact of different cold soak (CS) and pump-over techniques on phenolic composition and thus quality. The impact of different CS durations (0-10 days) at 10 °C on phenolic extraction was examined during CS and fermentation as well as in the finished wines after bottling. Our study indicate that in the case of Cabernet Sauvignon and the CS and winemaking conditions used in this study, CS only had small effect on some phenolics (gallic acid, (+)-catechin, and (-)-epicatechin) with increasing CS duration when compared to non-CS wine for two harvests using Cabernet Sauvignon grapes with different phenolic content. Trends of increased seed tannin contribution showed with increasing CS duration, although there were no significant differences among wine treatments in the bottled wines. Similarly, sensory analysis indicated very little difference among the wines made with different CS duration. Furthermore, similar trends in phenolic extraction with different CS duration in research-scale wines were also seen in commercial-scale wines.

Different of pump-over conditions were studied in research-scale Cabernet Sauvignon fermentations to understand the effect of the different pump-over volumes (two, one, and half volume twice a day), pump-over frequencies (one, two, four, and eight times per day), and low extremes of pump-over volume and frequency (half volume two times, half volume one time, quarter volume two times, and no pump-over) on phenolic extraction during fermentation. The results showed that initial pump-over volumes and frequencies investigared had no significant impact on the

extraction of phenolics during fermentation. Furthermore, when low extremes of pump-over volume and frequency were studied there was a trend of increased phenolic extraction when comparing pump-over wine treatments with no pump-over, although it was not significant.

To understand the kinetics of phenolic release during fermentation, pilot-scale (2000 L) Cabernet Sauvignon fermentations were performed using a tank modified with a custom sampling grid that allowed the fermentations to be sampled at four layers (two in the cap and two in the liquid portion). Chemical gradients for skin phenolics, such as the anthocyanins, were observed to develop early during fermentation whereas phenolics located more predominantly in the seed, such as (+)-catechin, extract later. Seed extraction trends were confirmed using phloroglucinolysis. Interestingly, phenolic gradients were eliminated following a pump-over event, but were re-established during the subsequent few hours and reached a saturation point approximately 8 hours post-pump-over with no further extraction.

Thus for Cabernet Sauvignon in the winemaking conditions studied, CS had no impact on color but could lead to increase extraction of seed flavanols if applied for more than four days of CS. Additionally, different pump-over volumes and frequencies did not have a significant influence on phenolic extraction, although it was determined that pump-overs twice a day with as little as half the liquid volume is enough to ensure temperature control of the cap and fermentation homogeneity.

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