Impact of harvesting and processing conditions on green leaf volatile development and phenolics in Concord grape juice

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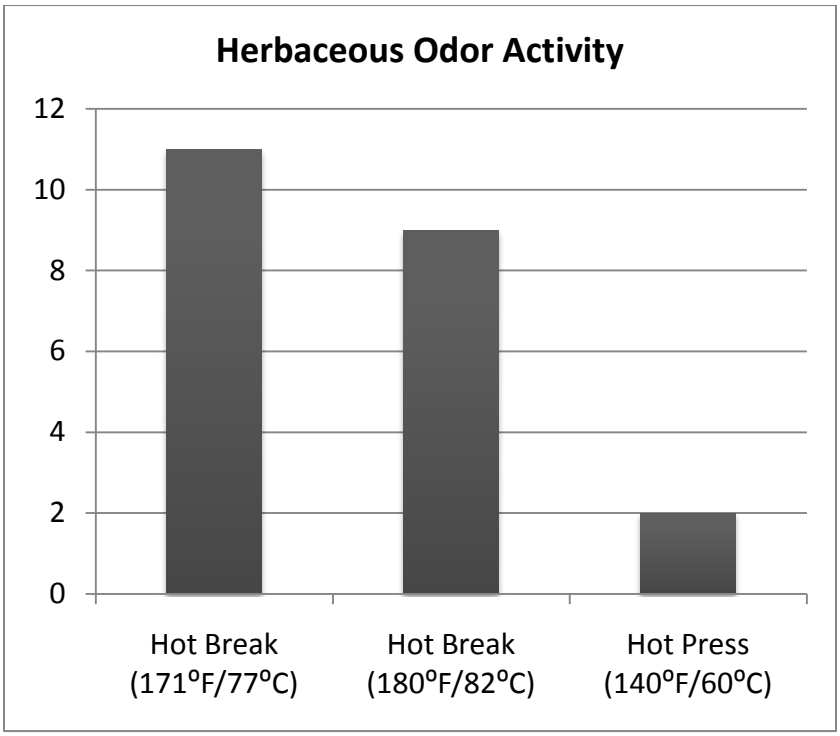
Background. "Vegetative" or "green" aromas in the fresh juice and must of many grapes, including Concord, are in part due to a class of compounds called green leaf volatiles (GLVs). GLVs are not found in intact berries but are instead produced after crushing through a series of enzymatic reactions with their chemical precursors. The majority of Concord juice processing practices utilize heat to increase color extraction and decrease the activity of enzymes responsible for browning. However, the impact of these thermal processes on the enzymatically produced GLV is not known. Our goal was to assess the impact of thermal processing methods on GLV levels in Concord grape juice during all stages of processing.

Experimental design. Finger Lakes Concord grapes were harvested at a range of maturities: 11.4° Brix (unripe) to 17.0 ° Brix (fully mature). Two thermal processing techniques were tested following de-stemming and crushing. For "hot press" samples, must was heated to 140°F (60°C) and treated to remove pectin. For "hot break" samples, must was briefly heated to at least 171°F (77°C) before depectinization at 140°F (60°C). GLVs were measured in must, depectinized and pressed juice, juice prior to cold stabilization, and bottled juice. Anthocyanins and phenolics were also measured in bottled juice.

Results. In freshly crushed grapes, only one of the five GLV compounds studied (*trans*-2-hexenal) was found at levels detectable by the human nose. Trans-2-hexenal was also the most potent GLV in finished juice. Generally, trans-2-hexenal decreased with increasing berry maturity and decreased during juice processing (depectinization, pasteurization, and cold-stabilization). The "hot break" method resulted in noticeably higher concentrations of trans-2-hexenal in finished juice (Figure 1). This higher concentration of trans-2-hexenal was hypothesized to be due to a loss of enzymes during the "hot press" processing that could convert trans-2-hexenal to other compounds. No differences were observed in anthocyanins and phenolics among samples.

Figure 1. Herbaceous odor activity (from trans-2-hexenal) in Concord juice after thermal processing.



Conclusions:

- "Hot break" processing (heating of must to at least 171°F just after crushing) resulted in 5-6 fold **increases** in GLVs in final juice
- Heating of the must in this fashion likely deactivates enzymes that would normally convert the herbaceous smelling GLVs to a non-odorous compound
- "Hot break" processing did not affect levels of phenolics or anthocyanins in juice

The bottom line: Immature Concord grapes produce high concentrations of herbaceous-smelling GLVs. Our results suggest that use of "hot break" processing instead of the traditional "hot press" approach results in a higher concentration of GLVs in finished Concord juice, a potentially undesirable result.

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