Phenolic Extraction and Juice Expression during White Wine Production

by

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ABSTRACT

Phenolic compounds are important constituents of white wine that can impart bitterness and astringency and influence stability and colour. The specific types and concentrations of phenolic compounds vary between the different grape tissues. For example grape skins contain much higher concentrations of phenolics than grape pulp. Consequently, grape processing techniques, particularly the method by which juice is expressed, can influence the phenolic profile of white wines. Concerns of elevated phenolic levels tend to lead to conservative practices such as limiting the time between machine harvesting and winery processing, and the use of relatively expensive batch draining and pressing equipment.

Phenolic extraction during pomace contact, such as might occur after machine harvesting prior to winery processing, was investigated at a controlled laboratory scale. Contact time significantly increased phenolic extraction as did the fraction of broken berries. However, given the uncertainty in the amount of berry breakage in industrial practice, full scale transport trials should be performed by wineries where economic advantage could be gained from relaxing restriction on times between harvesting and winery processing.

Techniques used for white grape juice expression both now and in the past were critically reviewed and winery sampling was performed to develop a practical understanding of operational issues. For the expression of juice from white grapes, pneumatic membrane presses have been increasingly adopted both for pressing and draining. This is principally a product of their ability to express high yields of juice with relatively low levels of phenolics and suspended solids. These devices can be operated in many different manners and quality and productivity is highly dependent on the specific mode of operation. Adaptive programmes based principally on continuous assessment of juice flow rate, and the use of conductivity measurement to monitor skin extraction are important tools that can aid economic optimisation of expression operations.

The principal problem with the pneumatic membrane press is that it is a batch operation with a relatively low throughput. In the longer term, the ideal outcome would be the development of expression equipment that achieved the high throughput and relatively low cost per tonne of continuous inclined drainers and screw presses, while still maintaining the quality obtained with pneumatic membrane presses. Continuous devices that mimic the repeated cycles of compression and crumbling of these batch presses may be one means of achieving this. Exploration of the different continuous screw presses used historically suggests that there still may be room for improvement in these devices. This merits further specific investigation.

Experiments involving repeated cycles of compression and crumbling were performed with a constant rate laboratory apparatus. These experiments demonstrated the importance of bed height, pressing speed, sieve plate design and crumbling on press operation. Solids content appears to be a major

issue in the development of rapid juice expression equipment. One means of achieving appropriately low solids levels, without requiring large devices with large cake beds for juice filtration, may be to maintain the structure of the grape for as long as possible so that juice is filtered as it is expelled from the berry.

THESIS DECLARATION

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution to Simon Jonathan Nordestgaard and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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1. **Nordestgaard, S.**, Waters, E., Jones, G. and O'Neill, B. (2009) Laboratory studies of white grape compression and its application to winery pressing. In: Proceedings of Chemeca 2009, Engineering our Future: Are we up to the Challenge? 27-30 September 2009, Perth, Australia.
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