Unravelling the relationship between grape phenolic extractability and wine composition

Keren A. Bindon¹, Neil Scrimgeour¹, Robert G. Dambergs², Stella Kassara¹, Wies U. Cynkar¹, Ella M.C. Robinson¹, Eric N. Wilkes¹, Paul A. Smith¹

¹ The Australian Wine Research Institute, PO Box 197, Glen Osmond (Adelaide) SA 5064, Australia
² WineTQ, PO Box 3, Monash SA 5342, Australia

Corresponding author’s email: keren.bindon@awri.com.au

Defining the issue
- The concentration of tannins and anthocyanins in red wine is an important determinant of wine colour and texture.
- Wine tannin and anthocyanin concentration are dependent not only upon the levels of these compounds in the grapes, but also their relative extraction and retention during the winemaking process.
- A rapid, grape-based analytical technique to predict wine-extractable tannins and anthocyanins is needed by the wine industry.

The approach
- Shiraz and Cabernet Sauvignon grape samples (39) were sourced from different regions in South Australia, and microvinified in triplicate 1 kg lots.
- A ‘wine-like’ extraction method was developed in which 50 g of grapes were gently crushed in a sealed plastic bag, adjusted to 15% v/v ethanol, pH 3.4 and extracted for 40 h.
- Grapes were also homogenised, and extracted for 1 h in 50% v/v ethanol, pH 2.
- Wines and extracts were analysed for tannin using the methyl cellulose precipitation (MCP) method.
- Anthocyanin and colour (wine only) were also determined.
- Dilute, acidified extracts were scanned in the UV-visible range.

The grape to wine relationship
- The application of a wine-like extraction provided a good indication of tannin and anthocyanin concentrations extractable during fermentation (see Bindon et al. 2014).
- When considered on a varietal basis, the ‘total’ tannin levels measured in the grape homogenate samples correlated with those measured in the wines, but were noticeably higher than the actual concentrations achieved through vinification.
- Correlations between grape anthocyanins and wine anthocyanins, as well as wine colour density were strong, independent of grape variety or extraction method.
- The overestimation of tannin in grape homogenate extracts in comparison to wine was greater in Cabernet Sauvignon than in Shiraz.
- Strong regional differences were found for both grape varieties.

Building a spectral calibration for extractable tannin
- In order to develop a rapid method for high-throughput applications, a calibration was built using UV-Vis spectral data, with MCP reference data from wine-like extracts.
- UV-Vis spectral data from 15% ethanol extracts showed a strong correlation with MCP reference data.
- Three key wavelengths can be used to model extractable grape tannins.
- The relationship holds for both Shiraz and Cabernet Sauvignon samples.
- A rapid method for analysis of wine-like extractable tannin is now commercially available via the WineCloud™.

Take-home messages
- Decision-making regarding the optimal winemaking approach for particular grape batches could be enhanced by knowledge of the extractable tannin and anthocyanin during fermentation.
- Rapid measurement techniques (the WineCloud™) can already be used to identify the ‘total potential’ of the grapes; these latest findings indicate that the application of a ‘wine-like’ extraction to grapes provides a strong prediction of the expected tannin and anthocyanin concentration in the finished wine.

Reference