Towards better use of waste: unravelling the composition of grape marc

Josh L. Hixson, Paul A. Smith

The Australian Wine Research Institute, PO Box 197, Glen Osmond (Adelaide) SA 5064, Australia

Corresponding author’s email: josh.hixson@awri.com.au

INTRODUCTION
Approximately 20-25% of grape crush is removed as solid by-product (skin, seed or stalk), or around 300,000-400,000 tonnes in Australia every year. In a push towards sustainability and maximising the benefit of natural resources, the possible uses of agricultural wastes are becoming a topic of great interest. Although, to make valued judgements on the potential uses for our waste streams, the composition will ultimately determine where it can be used.

SAMPLES AND ANALYSIS

- Sixty-six grape marc samples obtained from across Australia and throughout marc processing, including fresh red (n = 15), fresh white (16), seed (4) and skin only samples (4), stalks (2), and a range of processed samples including ensiled (11) and steam distilled (14), were analysed for tannin chemistry.
- A subset of 20 samples was selected for in-depth compositional analysis for extractable sugars, organic acids, tannin features, fatty acids (AgResearch, NZ) and nutritional/carbohydrate properties (Dairy One, NY, USA).

TANNIN ANALYSIS

- Concentration extremes were seen in fresh, low extracted samples (high tannin: white seed; lightly pressed skin; stalk) and steam distilled, oxidised samples (low tannin: older marc samples; long ensiling time).
- Most samples (25th-75th percentile) contained tannin at concentrations of 40-80 g/kg DM (Figure 1).
- Good, highly significant correlation exists between compositional variables.
- Seed only and skin only samples exhibited opposite extremes in composition (skin: high mDP; high cis/trans; high %Tri-OH; low %Gall, seed: opposite characteristics).
- Grape marc subsamples were selected to represent grape marc processing (processed and fresh), as well as extremes in tannin concentration and composition (seed and skin, Table 1).

MARC COMPOSITIONAL ANALYSIS

- Water extractable tannin was observed in white seeds and stalks (Figure 2).
- Extractable compounds are higher in fresh samples that have undergone limited extraction during winemaking (fresh white, red sparkling base, skin only samples).
- The presence of ‘other organic acids’ (succinic, lactic, acetic) and glycerol is a product of storage and ageing.
- Soluble carbohydrates are higher in samples that have undergone less extraction during winemaking (Figure 3).
- Other components proportionally increase as soluble sugars decrease, including lignin, cellulose and hemicellulose.
- Highly bound tannin increases with oxidative exposure of the grape marc.
- Marc and seed only samples show similar fatty acid composition, but skin and stalk samples are compositionally different (Figure 4).

CONCLUSIONS

- Grape marc, regardless of processing, is rich in useful components (tannins, fatty acids, fermentable carbohydrates, readily extractable compounds).
- The concentration of extractable compounds is a product of marc processing/extraction.
- Processed samples are reasonably uniform in composition, which is beneficial for re-use applications.