A cap for red wine macromolecules? Defining limits for tannin and polysaccharide extraction during maceration

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Defining the research question:
- Grapes destined for winemaking have a defined tannin, anthocyanin, and polysaccharide concentration
- Extractable tannin and colour expected in primary fermentation (based on a standard yeast EC1118) can be predicted with the extractable grape tannin (EGT) assay (Bindon et al. 2014, see poster 181)
  - How far can the extractability of macromolecules be changed from the predicted measure?
  - This work aimed to test the upper and lower limits of extraction using winemaking techniques known to affect macromolecules and determine effects on macromolecule composition and interactions (complexes).

Wine colour and tannin composition:
- Extracted anthocyanin and non-bleachable pigments were not affected.
- Tannin concentration was strongly increased by yeast strain (2323 > 1503) but this effect was lost with enzyme-treatment/30-day maceration.
- Yeast 2323 consistently increased tannin molecular mass, and a greater fraction of this was bound in a complexed form.
- Enzyme treatment had no effect on tannin concentration but molecular mass was increased, with larger tannins bound in a complexed form.
- Extended maceration most strongly increased tannin concentration, with the maximum tannin achievable (1,310 mg/L) being 52% higher than that predicted from grapes using the EGT assay (860 mg/L).
- Extending maceration primarily extracted seed tannins, and therefore reduced tannin molecular mass, increasing tannin galloylation.

Wine polysaccharide composition:
- Extended maceration had higher levels of total polysaccharide.
- Enzyme reduced polysaccharide but the effect was lost at 30 days maceration.
- Polysaccharide differences between yeast strains were minor, but 2323 + enzyme had lowered polysaccharide concentration at 30 days maceration.
- Enzyme affected polysaccharide composition, size and complex formation.
- Future research will aim to determine the implications for wine texture.

Complex formation:
- Extracted polysaccharide protein
- Tannin
- Monosaccharide sugar composition of polysaccharides, as mol % (excluding yeast effects)
- Macromolecular complexes?
- Enzyme affected polysaccharide composition independent of yeast/maceration.
- Enzyme treatment reduced arabinose-rich polysaccharides and had enhanced rhamnogalacturonan II (increased rhamnose:galacturonic acid ratio).
- Polysaccharide size (molecular mass) was reduced in enzyme-treated wines due to the contribution of RGII (< 6,000 g/mol).

Conclusions:
- Predicted extractable grape tannin (EGT) reduced 34% using low-tannin yeast.
- Extending maceration removed yeast influence and saw a 52% increase in tannin from predicted. The increase was due to seed tannin extraction.
- Polysaccharide concentration was differentially affected by winemaking, with extended maceration increasing total concentration.
- Enzyme affected polysaccharide composition, size and complex formation.

Reference

The AWRI is a member of the Wine Innovation Cluster