Rapid methods of phenolic extraction in reds

Dr Anna Carew (TIA)
Dr Bob Dambergs (WineTQ & TIA)
Acknowledgements

- Australian Grape and Wine Authority (AGWA)
- Australian Wine Research Institute (AWRI)
- Wine TQ (Dr Bob Dambergs)
- Metabolomics Australia

- Josef Chromy Wines, Moorilla Estate, Brown Brothers
- Glaetzer-Dixon Family Winemakers
- Domain Chandon, Seville Estates, Hoddles Creek
- Curly Flat – Phil Moraghan
- Moorooduc Estate – Richard McIntyre
- Dromana Estate – Duncan Buchanan
- Lethbridge Winery – Ray Nadeson
- Paradigm Hill – George Mihaly
- Ten Minutes by Tractor – Jeremy Magyar
- Yalumba

- Tasmanian Wine Show committee
Why rapid extraction?

**EFFICIENCY** - time on skins constrains winery capacity

**CONTROL** – extract desired compounds, craft desired styles

**AIM = EFFICIENCY + CONTROL**
Wine shows: the phenolic sweetspot

Quadratic discriminant analysis: 2014 Tas Wineshow

<table>
<thead>
<tr>
<th>PREDICTED</th>
<th>ACTUAL</th>
<th>GOLD</th>
<th>SILVER</th>
<th>BRONZE</th>
<th>NO MEDAL</th>
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<td>GOLD</td>
<td>4</td>
<td>0</td>
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<tr>
<td>SILVER</td>
<td>0</td>
<td>9</td>
<td>6</td>
<td>4</td>
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<tr>
<td>BRONZE</td>
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<td>1</td>
<td>9</td>
<td>7</td>
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</tr>
<tr>
<td>NO MEDAL</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

2014 Gold Medal wines = high pigment, purple hue, moderate tannin

The Tasmanian Wine Show Society is gratefully acknowledged for allowing access to wines for sampling.

Maceration

Eight days on skins

Twelve days on skins

Microwave maceration

Microwave maceration (70°C) + Hold time (10 min – 6 hours)


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<table>
<thead>
<tr>
<th></th>
<th>CTL</th>
<th>MWV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthocyanins (mg/L)</td>
<td>230 a</td>
<td>350 b</td>
</tr>
<tr>
<td>Non-bleachable pigment (AU)</td>
<td>0.43 a</td>
<td>0.65 b</td>
</tr>
<tr>
<td>Total tannin (g/L)</td>
<td>0.25 a</td>
<td>0.94 b</td>
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</tbody>
</table>


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‘Controlled Phenolic Release’ (CPR)
AGWA-funded research 2014-2017

2014 - 400kg must, solids through 15 kW pentagonal microwave unit,
~100kg/hr, into juice chilled in Cleveland kettle (4°C)
(with Dr Kai Knoerzer, CSIRO Animal, Food and Health Sciences, VIC)
CPR INDUSTRY TRIAL (Yarra, 2014)

- Winemakers volunteered & protocol negotiated
- Six 400kg lots of Pinot noir must
  - CPR x three lots (CSIRO Werribee)
  - Control x three lots
- Fermentation on skins ~8 days
- Press to barrel, inoculate for malo
- Analysis & (industry) tastings
Eiganvector shows consistent separation between ctl and mwv wines at ~ 2 weeks barrel age.
But, how does it taste?

‘...tasted the microwave batch in barrel. Looks good, more plump than the control but still structured. Fruit spectrum is darker with a firmer palate...’

Winemaker X
CPR with Early Pressing


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On skins vs. early press off wine

PCA phenolics

On skins vs. early press off wine
Skin- and seed-tannin indicators

%tri-OH catechin

% galloylated tannin

Acknowledging: Dr Paul Smith and Dr Keren Bindon (AWRI), and Dr Fiona Kerslake (TIA)

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Process Control
peak temperature & hold time

Anthocyanin

Tannin

‘Dial up’ Phenolics

Non-bleachable Pigment

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But, is the aroma ok?

**Ethyl acetate**  ctl & msk ~1.4  mpr 2.3

![Graph showing aroma profiles](image)

**Ethyl octanoate**  ctl & msk ~1.7  mpr 3.7

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What contribution does **lid permeability (open, closed)** and presence/absence of **pomace** make to aroma concentration?
Ethyl octanoate (response ratio)

Early Press-off

closed-pomace  open-pomace  closed+pomace  open+pomace

‘Dial up’ aroma?

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Summary

‘sweet spot’

Thank you! Questions?

• Dr Anna Carew anna.carew@utas.edu.au 0411 894997
• Dr Bob Dambergs bob@winetq.com.au 0408 895858
Rapid methods of phenolic extraction in reds

Dr Anna L Carew (TIA)
Dr Robert G Dambergs (WineTQ and TIA)

A key challenge of red wine making is coaxing a balanced profile of phenolic compounds from grape solids, into the juice phase. Time on skins constrains winery capacity and approximately 50% of phenolics may remain in grape solids by the end of alcoholic fermentation, and hence be disposed of in marc. This paper reports on research into pre- and post-fermentation treatments for improving the rate and efficacy of phenolic extraction. A small-scale vinification trial examined five treatments (control, cold soak, microwave, freeze and thaw, extended maceration) and demonstrated significant difference in wine phenolic profile at six months bottle age. For example, wines from the extended maceration treatment were three-fold higher in non-bleachable pigment than cold soak treatment wines, although each treatment involved 12 days skin contact time. The freeze and thaw treatment was associated with the highest tannin concentration in wines, two-fold that of control wines. The paper will describe development of Controlled Phenolic Release (CPR) which involves thermal maceration of grape solids by microwave and managed hold time for rapid phenolics extraction in red wine making. CPR wines were significantly higher in concentration for anthocyanin, tannin and non-bleachable pigment examined by UV-visible spectrophotometry and chemometrics, compared with control wines, when both treatments were fermented on skins for 8 days. CPR offers an array of potential collateral benefits and options for variation in winemaking, including faster fermentation kinetics, ‘dial up’ tannin concentration, must sanitation and the option of early pressing. Benefits and options will be described.