



The effect of interactions between non-volatile and volatile wine components on the sensory properties of wine – preparation of a reconstituted wine-like model wine

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What wine components are most important in determining sensory properties of white and red wine and how do they interact?

It is well known that particular wine component groups and components (total acids and citric acid, for example) have a direct influence on sensory perception. However, due to interactions, the perception of a mixture of multiple components can not always be predicted from the sum of perceptions of individual compounds. Such interactions may be either chemical, physiological (competition for receptors etc.) or cognitive (Frank, 2002; Noble, 1996; Keast and Breslin, 2002). For example, it has been shown that the simultaneous presentation of fruity aromas in sucrose solutions can enhance the perceived sweetness of the solution compared to that of sucrose alone (Sydow *et al.*, 1974).

In the present study, we are interested in assessing the relative importance of major components and component groups that influence the perception of wine sensory properties either directly or through interactions with other components. The chosen initial method involves separating wine component groups, such as phenolic compounds, proteins and polysaccharides, from wine and subjecting combinations of these purified component groups in aqueous solutions to quantitative sensory descriptive analysis.

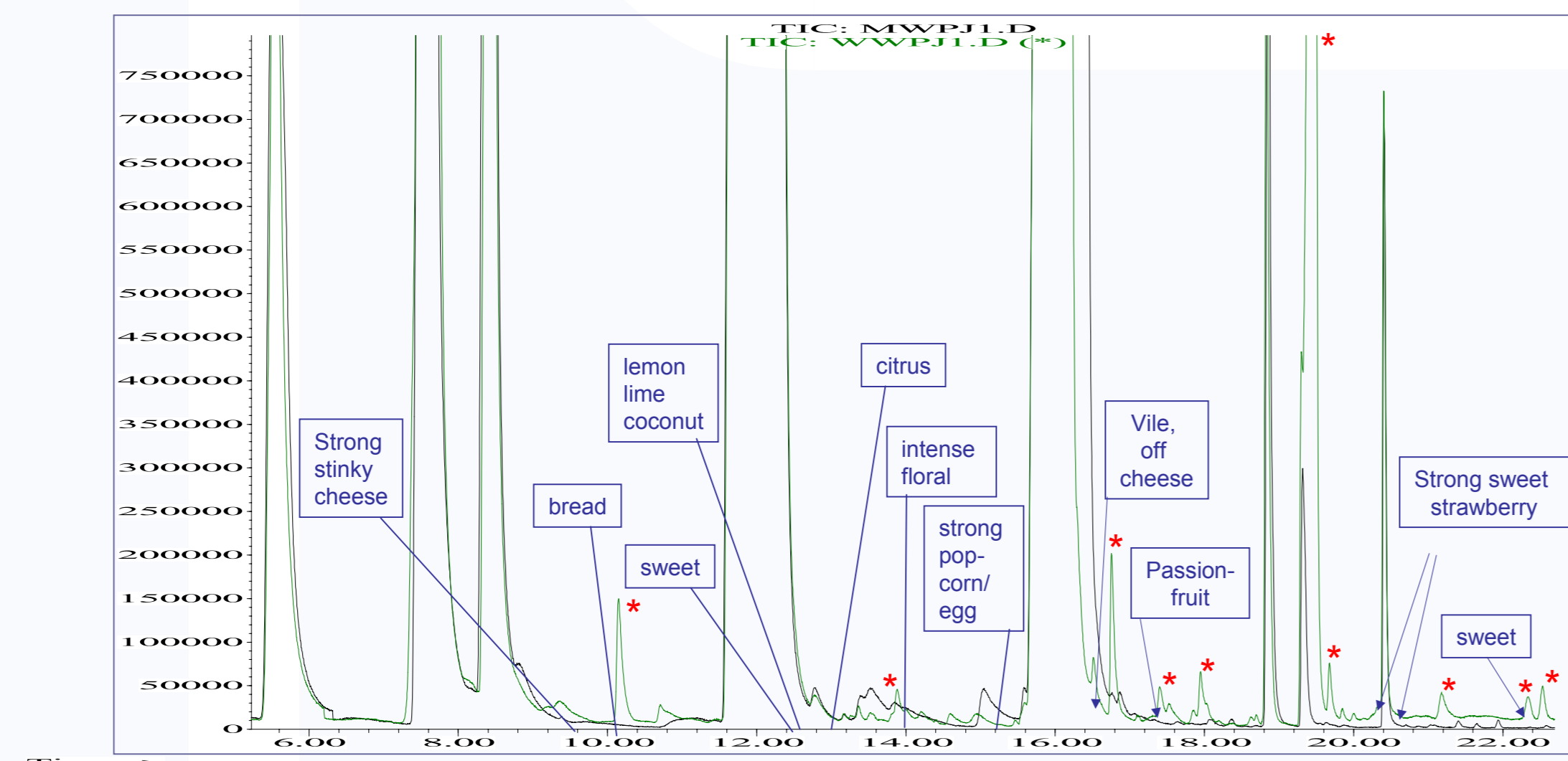
This poster describes the purification and analysis of key wine component groups to allow a 'wine-like' model wine to be prepared for subsequent sensory studies. A white wine model was first attempted given that white wine aroma analysis was already well developed at the AWRI.

Analysis and purification of key wine component groups

A 2003 Adelaide Hills Chardonnay was used in this investigation. The wine was vinified with no oak treatment, no intentional lees contact, and no bentonite nor proteinaceous fining.

Aroma compound analysis

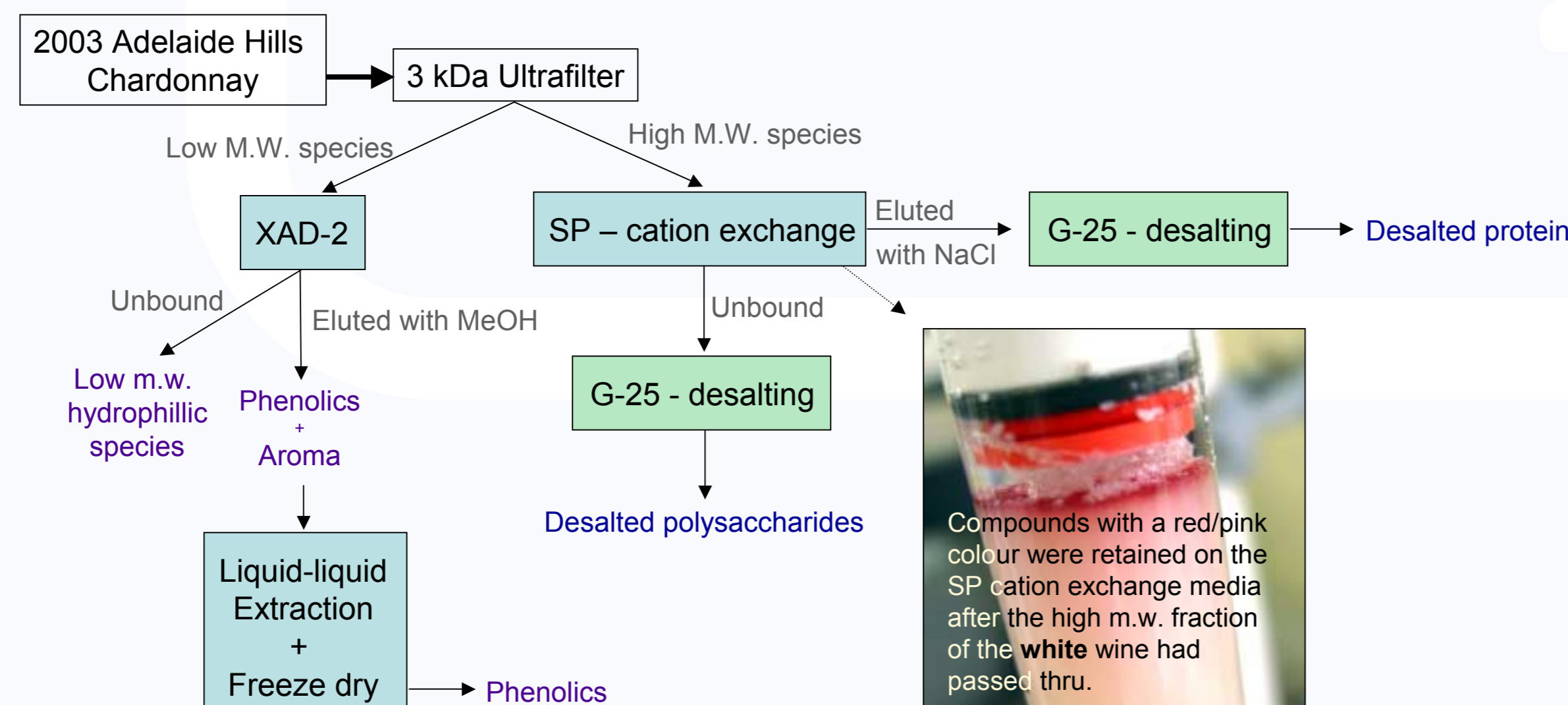
The levels of an extensive range of known aroma compounds was quantified in a small selection of unoaked 2003 Chardonnay wines (Capone *et al.*, unpublished; Siebert *et al.*, in preparation). All compounds at or above published aroma threshold levels were combined in simple model wine solutions and informal sensory evaluation indicated that the aroma was wine-like although less intense and less complex than the original wine.



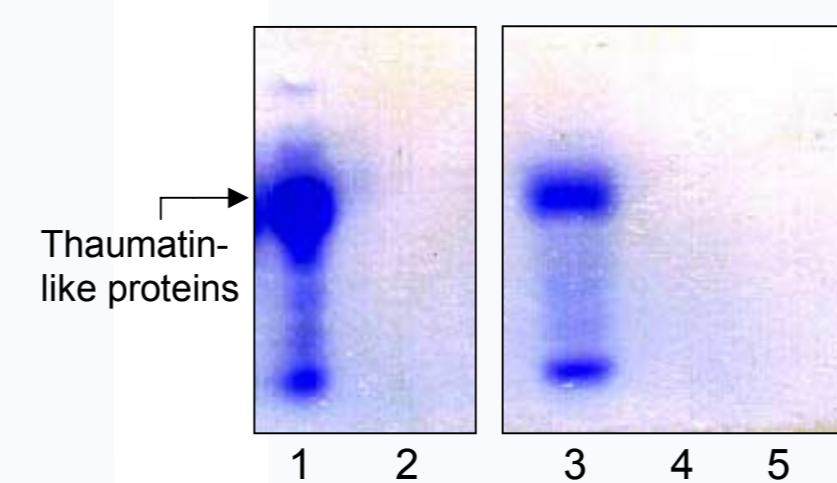
'Twister'-GC-MS-sniff of original wine (black) compared with reconstituted model wine mixture (green) illustrates differences in complexity. Aroma attributes that were identified in the sniff-port of the original wine but not in the reconstituted model wine are highlighted in blue. Likewise, peaks appearing in the original wine but not in the reconstituted model wine are indicated by a red star (*).

Purification of polysaccharides, proteins and phenolics

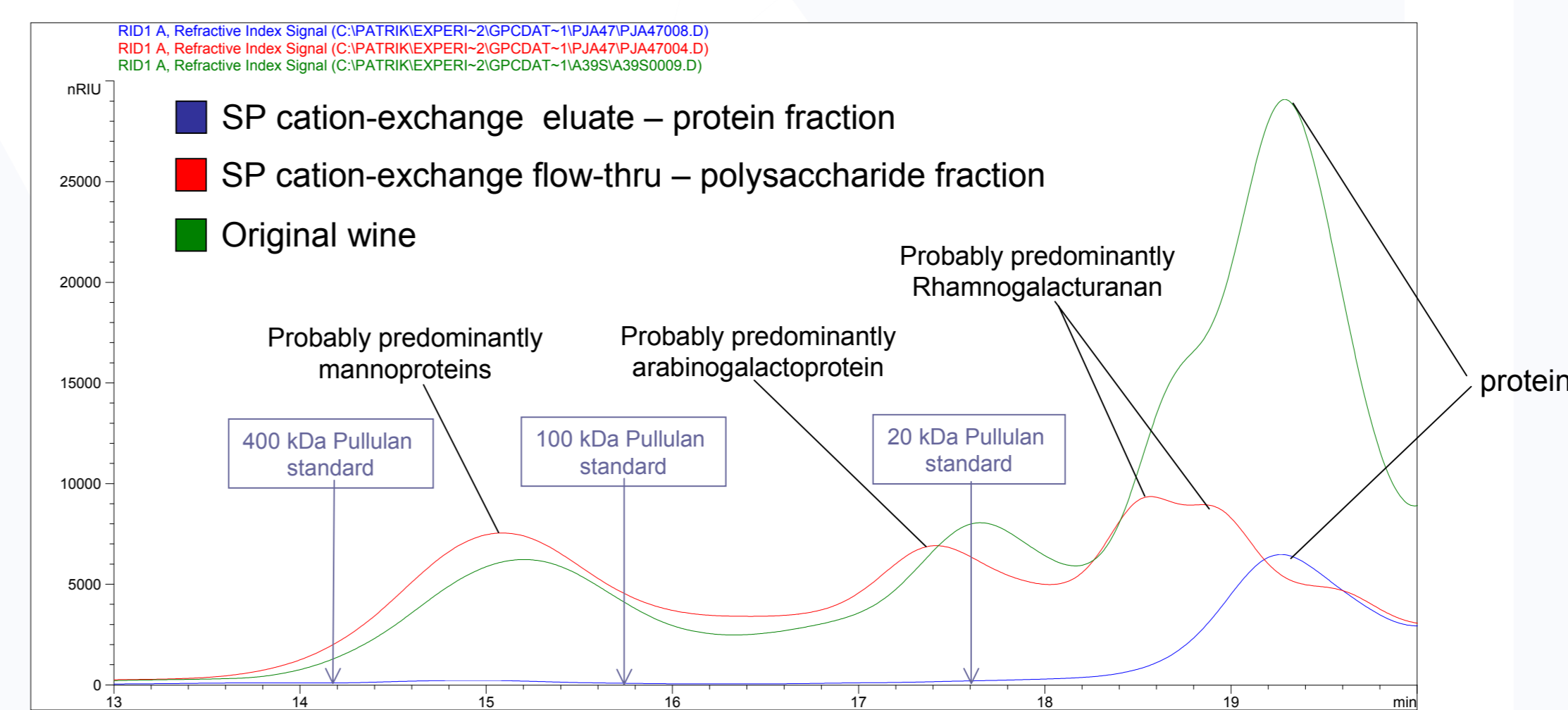
Several mild and gentle purification protocols were designed and tested and a method that resulted in samples with the greatest yield and purity was chosen and is outlined in the figure below:



The purity and yield of the purified components were analysed by a range of methods including SDS-PAGE, C8-HPLC (proteins), gel permeation chromatography and IEC-HPLC of polysaccharide hydrolysates (polysaccharides), and C18-HPLC (phenolic compounds). Informal tasting of the purified fractions indicated that the protein and polysaccharide fractions had no discernible aroma in water or model wine. The purity and yield of protein assessed by SDS-PAGE is shown below:



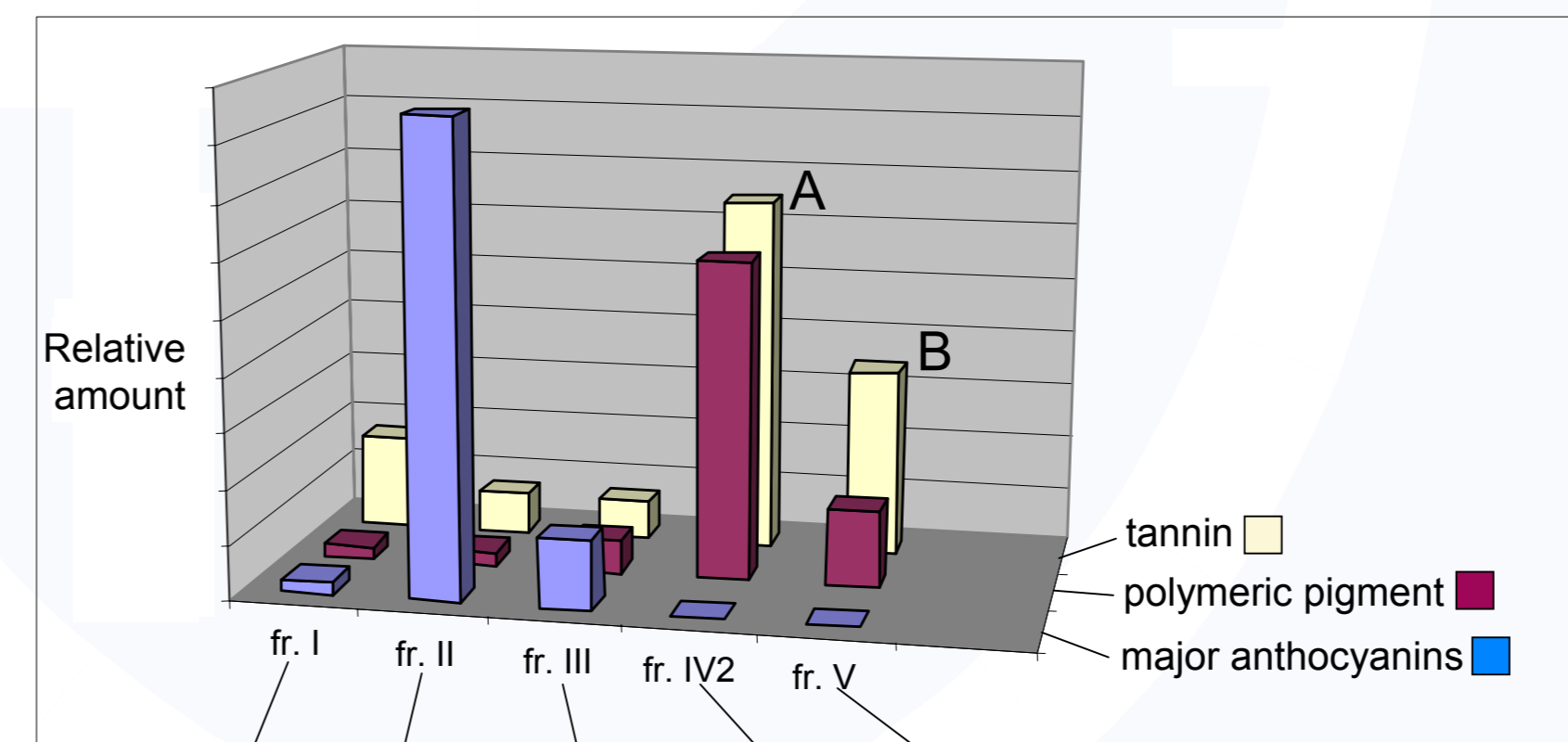
Protein analysis by SDS-PAGE. Analysis of wine protein throughout purification by SDS-PAGE and C8-HPLC indicated reasonable yields (~25-50% thaumatin-like protein, ~10-25% chitinases) and purity. Samples: (1) Original wine, (2) Ultrafilter flow-thru, (3) SP cation exchange eluate (final purified protein pool), (4) SP unbound (polysaccharide fraction), (5) XAD-2 unbound. All samples were analyzed at reconstituted original wine concentration.



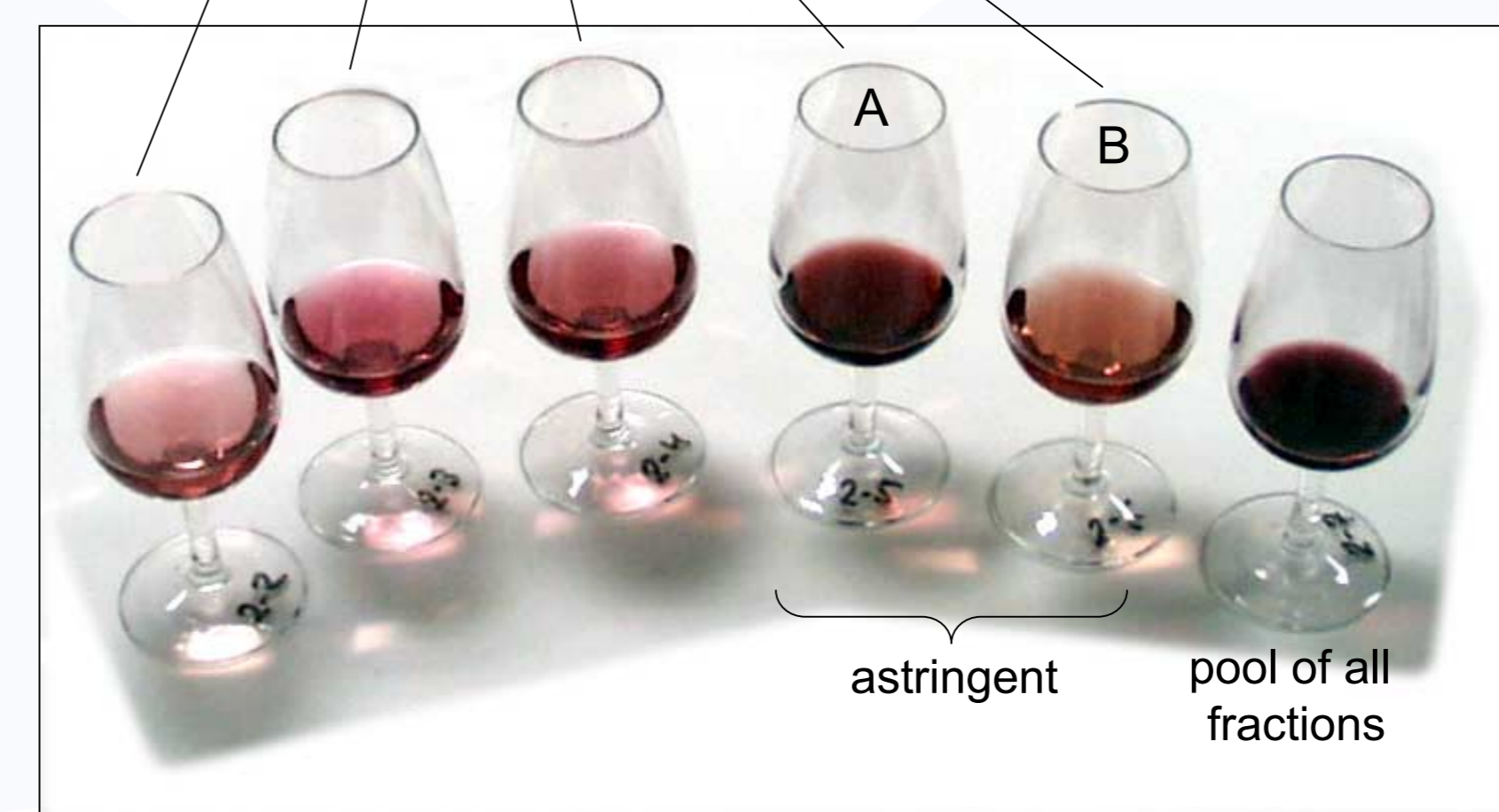
Polysaccharide analysis. The yield and purity was assessed by gel permeation chromatography using refractive index detection.

Purification of red wine tannin

Pigmented wine tannins were purified from a 2001 McLaren Vale Shiraz using Sephadex LH-20. The developed method enabled the separation of tannins into two major groups (A and B, see figure below) by adjustments to the eluant solvent composition. Phloroglucinol analysis (Kennedy and Jones, 2001) indicated that the composition of the two tannin groups was different: A (mean degree of polymerisation (mDP) 6.18, 48.5% yield), B (mDP 9.57, 81.8% yield). Further analysis of such fractions is planned.



A phenolic extract of a 2001 Shiraz wine was separated into multiple fractions by LH-20 chromatography. HPLC analysis (Eglinton *et al.*, 2004) of each fraction at equal dry weight concentration indicated compositional differences with regards to major anthocyanins, polymeric pigment and tannin.



The purified phenolic fractions were reconstituted in basic model wine at original wine concentration. Informal sensory evaluation indicated that only fractions A and B were astringent at original wine concentration and at equal concentration (500 mg/L). The majority of wine colour appeared to be contained within fraction A.

Conclusion

Key wine component groups were purified from white and red wine at a purity, yield and scale sufficient for comprehensive sensory analysis. A 'wine-like' model wine could be assembled using a reconstituted aroma extract based on the analysis of major known wine aroma compounds. Red wine tannins could be purified from a red wine and separated into two major groups with differing composition.

Acknowledgements

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