

# COMPREHENSIVE STUDY OF AUSTRALIAN ROSÉ WINES: CHARACTERISATION OF CHEMICAL AND SENSORY PROFILES

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# Thesis Summary

Rosé wine is a versatile and diverse style which is increasing in popularity in Australia and elsewhere, and the development of new markets such as China offers great potential to the Australian wine industry. In terms of consumer appeal, aroma and flavour attributes make a wine attractive, however, there is an absence of research related to the volatile compounds that are important to rosé wines produced in Australia. This thesis comprises a number of studies involving rosé wine that have been drafted as manuscripts and published. After an introduction chapter, manuscripts are presented in chapters as outlined in the following summary.

Firstly, insight into the sensory attributes and volatile profiles of Australian rosé wines was obtained. An HS-SPME–GC–MS method was developed and used in conjunction with a new application of a recently developed HPLC–MS/MS method to quantify 51 volatile compounds, including 4 potent sulfur compounds, in more than 2 dozen commercial rosé wines. Sensory descriptive analysis (DA) was undertaken and the corresponding results were correlated with quantitative chemical data to explore relationships between wine composition and sensory profiles. Based on the results, esters were prominent aroma volatiles, and  $\beta$ -damascenone, 3-methylbutyl acetate, ethyl hexanoate and 3-MHA were deemed to be important, in accord with other studies. Wines were described into three different styles with terms ranging from developed, spicy and savoury to fresh green, citrus, tropical fruit, floral and confectionery. This work has been published in Food Chemistry (Wang, J.; Capone, D. L.; Wilkinson, K. L.; Jeffery, D. W. Chemical and Sensory Profiles of Rosé Wines from Australia. Food Chem., 2016, 196, 682-693.)

Secondly, Australian rosé wines characterised in the previous study were selected and shipped to China for a blind tasting, which included several wines from China and France. Rosé wine tends to match well with a range of Asian cuisines, yet little was known about the factors driving the desirability of rosé wines in emerging markets such as China. To gain the first insight, rosé wine blind tastings were conducted in three major cities of China by 62 Chinese wine professionals. In total, 23 rosé wines that originated from Australia, China and France were evaluated by judges. Basic wine chemical parameters and 47 volatile compounds (included 5 potent thiols) were determined for the wines, and a novel use of network analysis (NA) provided good visualisation of the correlations between chemical and sensory components. The levels of residual sugar or developed characters were not related with preference, quality or expected price and acetate esters were related to red fruit characters and preferences. This work has been published in Food Chemistry (Wang, J.; Capone, D. L.; Wilkinson, K. L.; Jeffery, D. W. Rosé Wine Volatile Composition and the Preferences of Chinese Wine Professionals. Food Chem., 2016, 202, 507–517).

Thirdly, two representative rosé wines (tropical sample and fruity/floral sample) were selected for a gas chromatography-olfactometry (GC-O) study and volatiles were also quantified in order to evaluate in detail the compounds that were important to these particular styles. Two volatile extraction methods were compared to obtain extracts for aroma extraction dilution analysis (AEDA): liquid-liquid extraction (LLE) followed by solvent assisted flavor evaporation (SAFE), and a recently developed headspace (HS) sampling method. A HS-SPME-GC-MS with method selected ion monitoring (SIM) was developed, which enabled the quantification of 35 volatile compounds. In total, 51 odourants were detected by AEDA with FD factors  $\geq 3$ , and 92 volatiles were quantified.

For the different samples, compounds like 2-phenylethanol,  $\beta$ -damascenone and a range of esters were more correlated with fruity and floral characters, while some volatile acids and 3-SHA were more associated with the tropical rosé wine. The HS method was as efficient as LLE to extract volatiles with lower boiling point and polarity, which were mostly esters and higher alcohols associated with fruity and floral characters. On the other hand, LLE was better able to capture compounds that were not very volatile. It was suggested that the application of both HS and LLE extraction methods would be necessary to obtain the most representative extracts of wine for AEDA when evaluating the impact of different volatiles on sensory profiles. This work has been published in *Journal of Agricultural and Food Chemistry* (Wang, J.; Gambetta J. M.; Jeffery, D. W., Comprehensive study of volatile compounds in two Australian rosé wines: Aroma extract dilution analysis (AEDA) of extracts prepared using solvent-assisted flavor evaporation (SAFE) or headspace solid-phase extraction (HS-SPE). *J. Agric. Food Chem.*, 2016, 64 (19), 3838–3848).

In conclusion, this work has contributed new knowledge regarding the chemical and sensory compositions of Australian rosé wines, and important aroma volatiles have been determined. It has also greatly enhanced understanding of the preferences towards rosé wine from industry professionals in China, which is an important market for the Australian wine industry. Ultimately, this body of work can assist rosé wine producers to create their desired wine styles through greater knowledge of compositional and sensory characteristics, and preferences in a target market.

## **Declaration**

I declare that this thesis is a record of original work and contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference has been made in the text. The publications included in this thesis have not been previously submitted for the award of any degree at the University of Adelaide or other University.

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Jiaming Wang

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Date

## Publications

This thesis is a collection of manuscripts that were published in Food Chemistry and Journal of Agricultural Food Chemistry (JAFC) during candidature. Two of three manuscripts were published in Food Chemistry, which in 2014 had an impact factor of Food Chemistry according to Thomson Reuters Journal Citation Reports of 3.391, and a 5-year impact factor of 3.901. The impact factor of JAFC was 2.912 in 2014 and the 5-year impact factor was 3.27.

The text and figures in Chapter 2 to 4 appear in different formats due to each journal's specific requirements. A statement of authorship, signed by all of the authors and listing individual contributions to the work, is included at the beginning of each chapter.

The thesis is based on the following refereed publications.

- Chapter 2 Wang, J., Capone, D. L., Wilkinson, K. L., & Jeffery, D. W. (2016). Chemical and sensory profiles of rosé wines from Australia. Food Chemistry, 196, 682-693.
- Chapter 3 Wang, J., Capone, D. L., Wilkinson, K. L., & Jeffery, D. W. (2016). Rosé Wine Volatile Composition and the Preferences of Chinese Wine Professionals. Food Chemistry, 202, 507–517.
- Chapter 4 Wang, J., Gambetta, J. M., & Jeffery, D. W. (2016). Comprehensive study of volatile compounds in two Australian rosé wines: Aroma extract dilution analysis (AEDA) of extracts prepared using solvent-assisted flavor evaporation (SAFE) or headspace solid-phase extraction (HS-SPE). Journal of Agricultural and Food Chemistry, 64 (19), 3838–3848.



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