# INVESTIGATION OF THE CHEMICAL AND SENSORY PROPERTIES OF RED WINE PIGMENTS

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# ABSTRACT

Phenolic compounds play an important role in red wine colour, bitterness, astringency, as well as a range of other tactile or 'mouth-feel' characteristics. Progressive changes of phenolic compounds, initially extracted from grapes, occur during the storage and aging of red wines. The decrease of astringency occurring during wine aging has been considered as a result of mainly anthocyanin-flavanol condensation either directly or mediated by aldehydes. The contribution of these polymeric pigments formed during wine aging to the unique properties of red wine is an important question still unanswered.

Experiments were conducted to synthesise polymeric pigments in model wine solutions under different conditions in the absence of acetaldehyde to provide material for chemical and sensory studies. Only small amounts of polymeric pigments were formed in these experiments confirming that direct polymerisation is a slow process. The low yield of polymers made it necessary to investigate the isolation of polymeric pigments directly from wine. A preparative fractionation protocol was developed to obtain fractions enriched in different red wine pigment combinations for further investigation. A HPLC method was also developed that separated the pigmented and non-pigmented polymers, as well as the monomeric anthocyanins, flavanols (monomeric to trimeric), flavonols and hydroxycinnamic acids from each other. A 6 month old and a 5 year old Shiraz wine were fractionated and further analysed by acid hydrolysis in the presence of a nucleophile, gel permeation chromatography (GPC) and by different mass spectrometry techniques. The various fractions isolated from the 6 month old wine contained combinations of pentameric to dimeric pigments, while those from the 5 year old wine contained pigments with an average degree of polymerisation (DP) of at least 11 but possibly up to 32.

Experiments were conducted to determine the sensorial contribution of anthocyanins to wine as well as the effect of anthocyanin-flavanol polymerisation reactions taking place during maturation. It was shown that significant changes occur in the polymeric phenol composition and in the mean degree of polymerisation of Shiraz wine during aging. With aging more skin tannin were incorporated in the pigmented polymers and the percentage of galloylation in these polymers decreased.

In order to describe the sensory attributes of the polymeric pigments a refined vocabulary, describing the astringent and other mouth-feel sensations elicited by dry red table wines representing different styles was developed and called the mouth-feel wheel. The developed mouth-feel wheel was used in a study to investigate the contribution of anthocyanins and anthocyanin-proanthocyanidin reaction products to the mouth-feel properties of red wine. Wines were made from both red and white grapes with and without pomace contact, as well as with and without anthocyanin addition to the white grapes. The white wine made like a red wine did not exhibit the same mouth-feel sensory attributes of a red wine: it was lower in viscosity, less particulate in nature and lower in intensity for the astringency descriptors fine emery, dry and grippy. The presence of anthocyanins during fermentation appeared to increase the intensity of astringency related terms. Treatments with added anthocyanins increased the amount of polymeric phenols to twice that when compared to treatments without added anthocyanins.

# DECLARATION

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying.

Anita Oberholster Date

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