Contribution of phenolic compounds to the total antioxidant capacity of Pinotage wine

Dalene de Beer[1], Elizabeth Joubert[2], Johann Marais[2], Marena Manley[1]

1) Department of Food Science, Stellenbosch University, Private Bag X1, Matieland, 7602, South Africa; dalene@infruit.agric.za
2) Post-Harvest and Wine Technology, ARC Infruitec-Nietvoorbij, Private Bag X5026, Stellenbosch, 7599, South Africa; joubertl@arc.agric.za, maraisj@arc.agric.za

The South African wine industry is taking an interest in the enhancement of red wine total antioxidant capacity (TAC) with retention of sensory quality to satisfy the demands of increasingly discerning consumers. The focus is especially on the unique South African red wine cultivar, Pinotage. Pinotage has a unique phenolic composition and commercial Pinotage wines (1998 vintage) has an average TAC of 15.3 mM Trolox equivalents which compares well with that of Cabernet Sauvignon. Knowledge of wine phenolic composition, the antioxidant activity of individual phenolic compounds and their respective contribution to the TAC of wines are needed to evaluate the importance of individual phenolic compounds. The TAC of wines could then be manipulated optimally by using viticultural and enological practices to enhance the content of compounds contributing significantly to the TAC. The aim of the study was to determine the antioxidant activity of individual phenolic compounds in Pinotage wines and their contribution to TAC.

A series of 20 young Pinotage wines were analysed to determine their phenolic composition (reversed-phase HPLC) and TAC (ABTS radical cation scavenging assay). Compounds identified include gallic acid, caftaric acid, caffeic acid, coutaric acid, catechin, procyanidin B1, myricetin-3-glucoside (glc), quercetin-3-glc, kaempferol-3-glc, quercetin-3-rhamnoside, myricetin, quercetin, kaempferol, isorhamnetin, delphinidin-3-glc, peonidin-3-glc, petunidin-3-glc, malvidin-3-glc, delphinidin-3-glc-acetate, vitisinA, petunidin-3-glc-acetate, peonidin-3-glc-acetate, malvidin-3-glc-acetate and malvidin-3-glc-coumarate. The polymeric content of each wine was also estimated as mg catechin equivalents/L. Individual phenolic compounds, available as pure standards (gallic acid, caffeic acid, catechin, procyanidin B1, myricetin-3-glc, quercetin-3-glc, kaempferol-3-glc, quercetin-3-rhamnoside, myricetin, quercetin, kaempferol, isorhamnetin, delphinidin-3-glc, peonidin-3-glc, petunidin-3-glc, malvidin-3-glc), were tested at a range of concentrations and their Trolox equivalent antioxidant capacity (TEAC) values calculated.

Taking the concentration and TEAC values of 24 monomeric phenolic compounds which could be quantified, into account, only 14% of the TAC of the wines could be explained. Possible synergism was ruled out, as the measured and calculated TAC of a mixture of phenolic standards was within the experimental error. Sulphur dioxide additions to the phenolic mixtures at two concentrations had no effect on their TAC. To estimate the contribution of polymeric compounds ultrafiltration was performed in an attempt to separate monomers and polymers in 3 wines. The polymeric compounds, and possibly proteins, isolated using ultrafiltration (50000 dalton nominal molecular weight cut-off), contribute about 30% of their TAC values. A large fraction (59%) of the TAC of a wine is due to unknown compounds which may or may not be phenolic.