

Tannins: from grape to wine

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This paper is dedicated to the memory of Yves Glories.

Tannins are polyphenols that are widespread in the vegetal kingdom and are present in various plants and food products (wine, tea, cocoa). Tannins are generally divided into two subgroups: condensed tannins and hydrolysable tannins. In wine, both types of tannins are present. The grape seeds and skins are a major source of condensed tannins, whereas the use of oak barrels or oak additive adds hydrolysable tannins to the wine. While the chemical structures of these two types of polyphenols differ, they are both called tannins because of their ability to precipitate proteins. This is particularly important for the winemaker and the consumer as this property can result in an astringent sensation while wine tasting. There is then considerable interest to better understand the chemistry and physical chemistry of this phenomenon. Polymeric flavan-3-ols i.e. condensed tannins (proanthocyanidins) are also important in wine for their colour stability (Somers 1971) and their contribution to human health (Santos-Buelga and Scalbert 2000, Dixon et al. 2005).

Two important parameters that will influence tannin perception are their concentration and their chemical structure. There are differences in grape skin and seed tannin composition which may confer different astringent qualities in wine. Skin differs from seed tannin in that it has a higher mean degree of polymerization (mDP). Skin tannins also possess trihydroxylated flavan-3-ol units i.e. (–)-epigallocatechin, and less galloylation i.e. (–)-epicatechin gallate units (Prieur et al. 1994, Souquet et al 1996, Pastor del Rio and Kennedy 2006). As molecular weight increases with polymerization, astringency becomes dominant over bitterness (Noble 1994, Peleg et al. 1999). There is a “grape tannin paradox” because skin tannins should always be more astringent than seed tannins. However, the winemaker generally observes that the opposite is true. While this paradox remains a mystery, it is clear that other compounds in grapes or wine modify the intensity of astringency and mouthfeel in general. Increasing the ethanol content increases the intensity of bitterness and decreases astringency (Fontoin et al. 2008). Lowering the pH of wines increases the sourness (Fischer and Noble 1994) and the astringency of tannins (Fontoin et al. 2008).

The concentration of tannin is an important parameter and several methods exist to determine its amount. Some methods evaluate the total amount of tannin present by acid hydrolysis and spectrophotometry (Ribereau-gayon and Stonestreet 1966) or HPLC (Kennedy and Jones 2001). Other methods are based on protein or polysaccharide precipitation (Fia et al. 2008, Mercurio and Smith 2008). In these cases, it is more the “reactive” or astringent tannins that are quantified rather than the total amount. Nevertheless, these assays are very useful for the winemaker because the data can be correlated to perceived astringency. The future of research in this field is to have high throughput methods. Protein-based assays could still be enhanced to be available at a low cost to the wineries. More expensive but efficient techniques could also involve infrared spectroscopy or sensor array. The nature of tannin-protein interaction inhibitors in the grape skin also remains a major challenge in explaining the phenolic ripening phenomenon. Since the introduction of the concept of phenolic maturity by Yves Glories (Glories and Augustin 1993), there is still a need for practical and improved methods to assess red grape qualities.

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