

The chemistry of red wine colour

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Anthocyanins are water soluble pigments presents in many plants and foods. These red pigments are relatively unstable and can undergo several chemical transformations yielding new compounds with different physico-chemical properties. In red wines, these transformations result in the colour change and could also affect their taste.

Over the last century, the structures of several groups of anthocyanin-derived pigments have been described in wines. One of the first reactions described in wines was the polymerization reaction between anthocyanins and flavanols mediated by acetaldehyde arising from ethanol oxidation. With the increasing knowledge of wine chemistry, acetaldehyde was found to be more and more important as an intermediary in chemical transformations that occur in wine during ageing. Its participation was suggested in the formation of vinylflavanol adducts (described to result from the decomposition of the flavanol acetaldehyde-mediated adducts) that will further react with anthocyanins by a cycloaddition reaction yielding the red-orange pyranoanthocyanin-flavanol pigments.

During the last years, wine yeast metabolites have been shown to contribute importantly to the formation of some anthocyanin-derived pigments. Effectively, among the vast number of compounds released by yeast during wine fermentation, pyruvate (as pyruvic acid), ketones, glyoxilic acid, acetaldehyde and other higher aldehydes (propionaldehyde, isovaleraldehyde, etc.) and acetoacetate acid react with some flavonoids. Many of these compounds were shown to react with anthocyanins yielding pyranoanthocyanins having orange, blue or turquoise colours at acid pH.

During wine ageing, all these chemical transformations occur concomitantly with others, such as the direct condensation between catechins and anthocyanins, being responsible for some of the colour changes observed.