Characterization of pigments in red grapes

Problem:

The quality of wine and grape juice is greatly affected by the complex interactions of many components of grapes. Many indicators such as taste, sugar content, and acidity are inadequate measures of the optimal time to harvest grapes, and there currently is no simple and reliable test to determine grape quality and optimal harvest time.

Historic means of answering it:

Taste and appearance have been used for thousands of years to determine grape quality and ripeness. Only recently have more scientific methods been used. Anthocyanin concentration offers an alternative to measuring sugar content (usually measured using polarimetry) or acidity. The absorbance spectrum of anthocyanin exhibits a distinctive peak at 540 nm. An absorbance spectrum can be collected on an extract or a reflection spectrum taken of an intact grape using a spectrophotometer equipped with an integrating sphere. The anthocyanin concentration is often expressed as a difference in the absorbance between 540 nm and the non-absorbing wavelength 635 nm.

What information is yielded by this method?

The anthocyanin concentration is an indicator of the ripeness of the grapes. Information on other components such as tannins, total phenolics, and color components can be obtained from spectroscopy on extracts.

Shortcomings of historical method:

The extraction process, while yielding an abundant amount of specific information, is time-consuming and prone to artifacts, such as the effects of solvents on the extracted compounds and the absorbance spectra. Variability due to sample prep by different technicians is also a problem. Reflectance spectra of whole grapes can be informative, but is limited in the ability to quantitate anthocyanin concentration.

How CLARiTY addresses this question:

The CLARiTY method offers the ability to collect a quantitative spectrum of an intact grape. This method is more immune to effects of scatter than the integrating sphere because the measuring beam is isotropic. Because it is already scattered, any further scatter introduced by the sample will not affect the calculated intensity. Thus, one can obtain an absorbance spectrum from a grape quickly and easily.

Materials and Methods:

Absorbance measurements of the grapes were collected on a CLARiTY 1000 rapid scanning spectrophotometer containing 8 mL DeSa Suspension Presentation Cavities (DSPC) as the sample and reference tube holders. One small green grape was quartered and placed into an 8 mm diameter glass test tube. One small red grape was quartered and placed in a separate test tube of the same. Data were collected using an empty reference holder (air) or using the green grapes as a reference. Spectra consisted of repeated scans collected at 100 scans per second and averaged for an integration time of 5 seconds. Spectra were viewed and analyzed using Olis GlobalWorks.

Results:

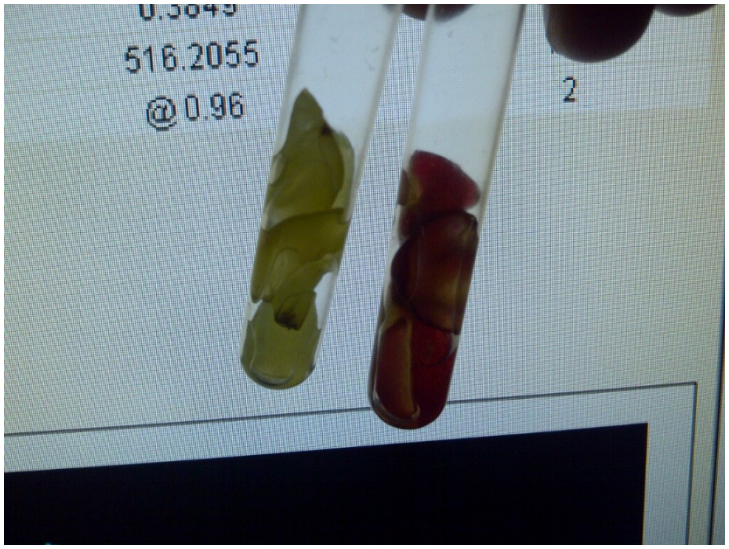

Figure 1. Green and red grape samples

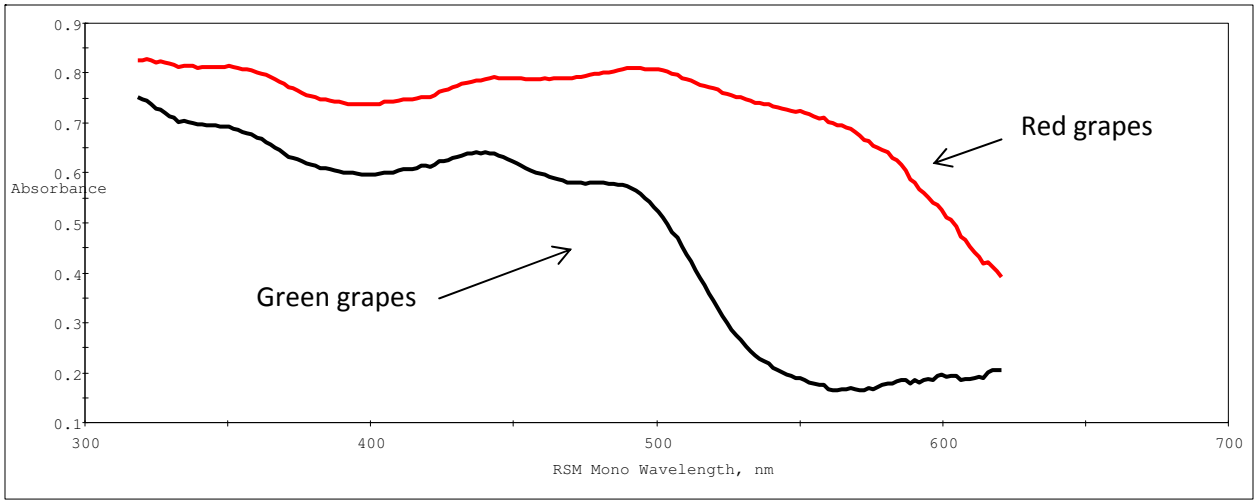

Figure 2. Absorbance spectra of red and green grape samples.

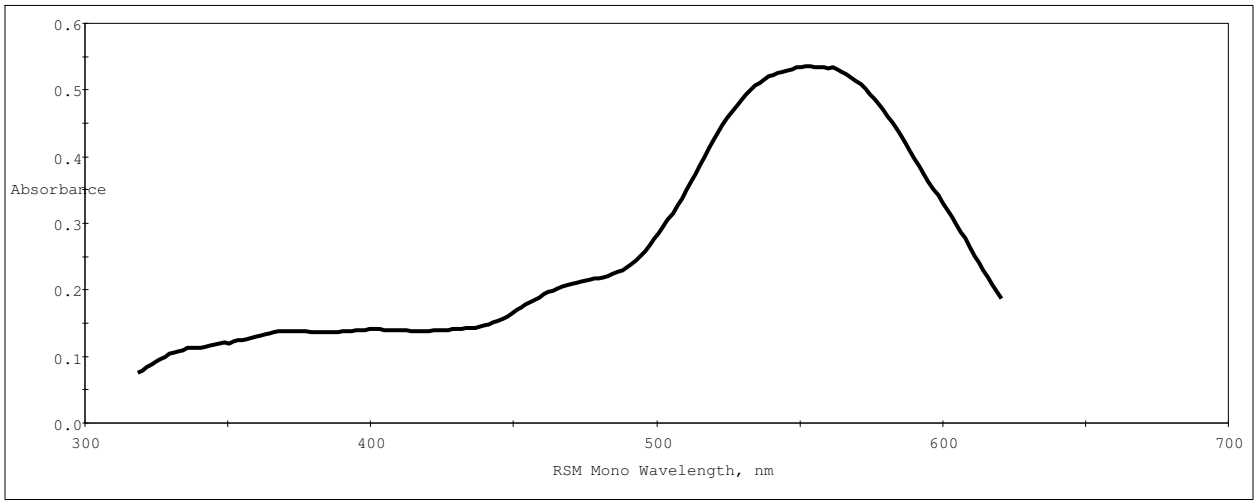

Figure 3. Difference spectrum of red versus green grape samples

Advantages of the CLARiTY method:

The CLARiTY technique completely eliminates the adverse effect of light scatter caused by particulate suspensions and solids when measuring absorbance spectra. The CLARiTY technology is an advance on integrating sphere and diffuse reflectance techniques because of the increased sensitivity it offers in addition to the 100% immunity to light scattering. The extraction process can be completely eliminated when using a CLARiTY spectrophotometer saving time and reducing variability in grape measurements.

Juice and wine samples can be pipetted by hand or automatically titrated into the CLARiTY cuvette holder for quantifiable absorbance spectral measurements.

Future Research Efforts:

- A specialized DSPC cuvette holder will be developed for presenting an intact grape in the CLARiTY spectrophotometer so dissection of the grape samples is not required.
- Calibration titration tests will be performed in an effort to better quantitate absorbance measurements of solids in the new DSPC holder.
- A new software feature will be developed to mathematically separate known spectral components from a mixed spectrum.

For information on the CLARiTY and other Olis optical spectrophotometers, please contact us at:

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