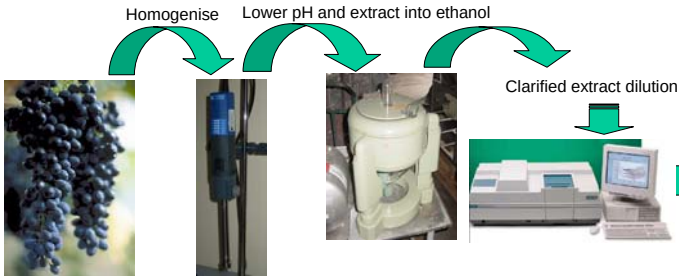
COOPERATIVE RESEARCH CENTRE FOR VITICULTURE

Optical fibre evanescent field absorbance (FEFA) as a new method for the measurement of red winegrape colour and total phenolics

P. G. Lye, R. Bradbury and D.W. Lamb
Precision Viticulture Research Group, School of Biological, Biomedical and Molecular Sciences, University of New England, Armidale NSW 2351, plye@une.edu.au

1. Current Spectrophotometric Method

Measurement of colour or total phenolics using standard reference techniques (Iland et al., 2000*) is a time-consuming technique involving maceration of whole grapes, chemical extraction with ethanol, dilution, centrifugation to separate solid material (including fine suspended material) from the liquid and a subsequent absorption measurement at either a wavelength of 520 nm (colour) or 280 nm (total phenolics).



At a cost of approximately $30 per sample and a minimum 72-hour turnaround (not including sample delivery time and receipt of final report at the vineyard gate), such measurements are generally completed by larger and/or committed growers.

2. The Challenge:

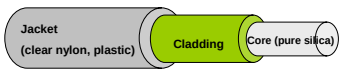
To make the measurement of *red winegrape colour* and *total phenolics* cheaper, faster and field-portable.

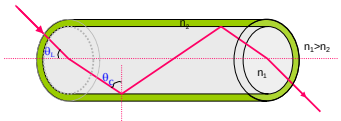
3. Proposed FEFA Method

A novel optical fibre evanescent field absorption (*FEFA*) technique is capable of measuring the optical absorbance of **strongly-absorbing** AND **turbid** liquids, thereby avoiding the need for sample centrifugation or dilution. It has the potential to be a field-based method.

4. What is FEFA?

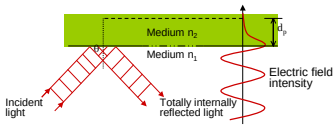
An optical fibre consisting of a silica core, cladding and outer protective jacket is used.

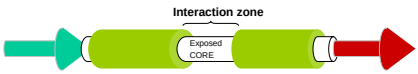




Light travels through the silica core, reflecting from the surface. In doing so the light penetrates a small depth into the outside medium. When immersed in the sample liquid, light is absorbed according to the colour of the liquid.

Light travels through the silica core, reflecting from the interface with the cladding.

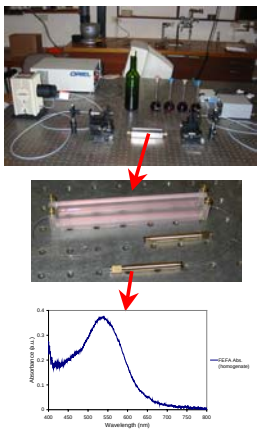




A section of the silica core is exposed by removing the cladding and jacket.

The measured spectrum of the output light is related to the colour (and hence the chemical composition) of the liquid.

5. Experimental set up

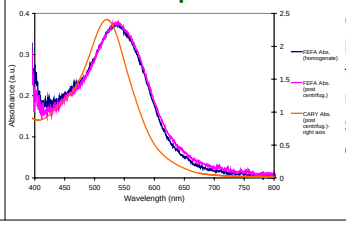


The experimental setup consists of a regulated white light source (tungsten lamp) with the light passing through the FEFA cell using optical fibres and focusing optics. The resulting light output is currently analysed using a diode array spectrometer with an effective range of 400 – 800 nm (Ocean Optics S2000).

Homogenised grape samples (10ml) are poured into the FEFA cell (shown opposite) which immerses a 100 mm section of exposed optical fibre core.

A typical spectrum obtained from the setup is shown opposite.

6. Comparison of Standard Spectrometer and FEFA Absorbance Spectra



Comparative measurements have been made on homogenised merlot fruit, with or without centrifugation, using the FEFA cell and a standard spectrometer (CARY 1E, 0.1 cm cuvette) with dilution.

7. Ongoing and Future work

- Analyse 180 grape samples (shiraz, merlot and cabernet sauvignon; from 2 vineyards) collected at harvest using both the conventional spectrophotometric method and the FEFA method
- Determine correlation between standard and FEFA methods
- Evaluate methods of homogenate preparation
- Identify the influence of surface interactions
- Develop a calibration algorithm - including extraneous factors such as temperature
- Investigate rapid sample presentation, including flow-through configurations

* Techniques for chemical analysis and quality monitoring during winemaking, P. Iland, A. Ewart, J. Sitters, A. Markides and N. Bruer, Patrick Iland Wine Promotions, 2000.

The CRC for Viticulture is a joint venture between the following core participants, working with a wide range of supporting participants.