

Measuring residual ash using Near Infrared analysis

AWTA Ltd has recently commenced measuring the residual ash content of scoured core samples by Near Infrared (NIR) analysis. NIR instruments are already used to measure residual grease content and adding ash measurement will lead to further productivity and cost benefits.

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The first step in Yield testing involves scouring, or washing, greasy core samples. AWTA Ltd's scouring process is much more vigorous than a commercial wool scour and utilises far higher ratios of water and detergent to wool to ensure cleaning is thorough. Nevertheless small amounts of lanolin (residual grease) and mineral matter (residual ash) remain on the washed wool and the quantities of these residuals must be determined in order to correctly calculate Yield.

In recent years, residual grease content has been measured using the near infrared (NIR) analysis technique, which is rapid and highly efficient. However by contrast, ash measurement was slow, taking 2 – 3 hours and involving the incineration of a 10g sample of scoured wool in a furnace at 800°C.

The recent introduction of Automatic Residual Cutter machines to all AWTA Ltd laboratories, together with metrology improvements, has enabled extension of the NIR technique to measurement of residual ash. Consequently, significant productivity and energy consumption benefits are now being realised. The system also reduces occupational health and safety risk, as it replaces a highly repetitive manual task.

The NIR technique involves shining light onto wool samples and then linking the spectral responses of reflected light to the quantity of grease and ash in the sample. Calibration development involved testing thousands of samples, firstly by the standard test method and then by the new NIR technique. While initial investigations were promising, problems were encountered accommodating the wide range of ash found in Australian wool. A research project was initiated to examine the sampling fundamentals that affected both the furnace and NIR methods. In light of this work, changes to the IWTO test method for Yield measurement were recommended and accepted. The ultimate success of ash by NIR measurement was achieved through improvements to sample presentation, equipment specification, calibration methodology and instrument standardisation.

Automatic Residual Cutter Machine

AWTA Ltd has developed a machine that automates the preparation of sub-samples for residual content analysis. The Residual Cutter system was developed over a period of five years with the close collaboration of researchers, engineers, and laboratory staff.

The development of the Residual Cutter involved the use of innovative mechanical design & computer controls, resulting in a sophisticated yet simple and robust machine. The key feature of the device is that it rapidly and accurately cuts predetermined masses of wool from a larger sample of scoured and dried wool. The system was a finalist in the national 2007 Engineering Excellence Awards and was awarded a section prize in the NSW division award.





Ashing furnaces burning wool samples at 800°C

"The furnaces consumed large quantities of gas..."



Weighing ash samples

"The tedious and often arduous task of preparing and weighing samples is removed."

Ash by NIR provides significant benefits:

- It is rapid. Each measurement takes approximately 10 seconds whereas the furnace technique took 2–3 hours.
- It is cost effective and environmentally friendly. The furnaces consumed large quantities of gas and were a source of pollutants. They will be replaced by small electric muffle furnaces for Quality Control monitoring.
- The occupational health and safety risk inherent in operating a large gas appliance within the laboratory is removed.
- The tedious and often arduous task of preparing and weighing samples is removed.



Measuring the ash content of a slice of scoured wool using NIR.

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