Application Note 09: NIT-38 Alcohol Analyser
Rapid NIR Alcohol Analysis.

Introduction

The NIT-38 Near Infrared Transmission Analyser is designed to measure alcohol between the range of .1-30% alcohol in clear and turbid solutions. It was the aim of this study to determine accuracy and precision of the NIT-38 Alcohol Analyser for measuring alcohol in red and white Australian wines.

Description

The NIT-38 Alcohol Analyser scans the near infrared region between 720-1100nm at a resolution of 10nm. Approximately 70 red and white wine samples were selected covering a broad alcohol range. Another 20 samples were selected and were measured for alcohol content using the densitometry method. This reference set was used for two purposes. Firstly, it was used to calibrate the reference NIR instrument in order to determine the errors associated with the analyses and secondly, the densitometry samples were used as a validation set for the calibration developed on the 70 samples.

The NIT-38 was allowed to warm up for two hours prior to use and left on for the entirety of the experiment. The wine samples were allowed to equilibrate to 20°C where they were scanned firstly on the reference NIR instrument and then on the NIT-38. Temperature stabilisation of the calibration was achieved by measuring 5 samples at 15, 20 and 25°C as this was proven earlier to be the best method of stabilisation (see Application Note 07).

Results

The statistics for the NIR reference method vs. Densitometry are presented in table 1.

Reference Method	Reproducibility (%)		SEP (%)
	SDD	AAD	
Densitometry	0.01	0.01	
NIR Reference	0.08	0.06	0.10

Table1: Relevant statistics associated with the reference methods

Table 2 shows the effect of the number of principal components on the predictive ability of the model produced. This also contains an analysis of the effect of principal components on reproducibility and repeatability.

Principal Components	5	6	7	8	9
SEP (CSV) (%)	0.27	0.17	0.15	0.13	0.10
SEP (Validation Set) (%)	0.29	0.13	0.12	0.09	0.09
Repeatability (SDD) (%)	0.21	0.07	0.06	0.07	0.11
Reproducibility (SDD) (%)	0.22	0.07	0.08	0.06	0.06

Table 2: Prediction statistics and the effect of principal components on sampling accuracy.

From the data presented in table 2, the optimal number of principal components was determined to be 8 as this produced the least sampling errors and the best standard error of prediction (SEP).

Figure 1 graphically shows the predictive ability of the model produced when the model was applied to samples, not contained in the calibration set, which had their alcohol content measured by densitometry.

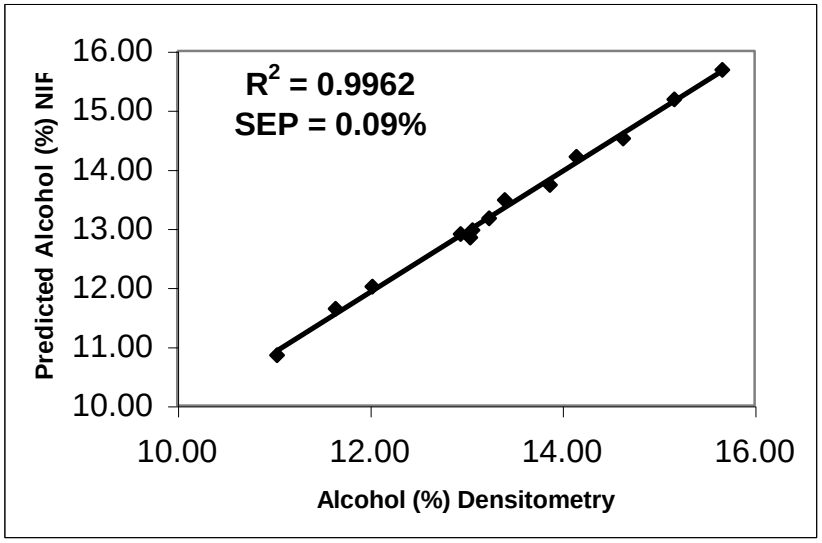

Figure 1: Predictive ability of the alcohol calibration on samples measured by densitometry.

Conclusion

The NIT-38 Alcohol Analsyer is capable of being calibrated for the prediction of alcohol in Australian wine samples in the alcohol range 9-16%. Future work will be done on incorporating fortified wines and samples with high sugar content, as such samples have been difficult to determine previously by NIR analysis.

NIR Technology Systems
366 Edgar Street, Condell Park, NSW, 2200, Australia
Tel: 612 9708 5068, Fax: 612 9708 5537
Email: nirtech@nirtech.net, Web: www.nirtech.net