

Introduction:

Research Octane Number (RON) and Motor Octane Number (MON) are determined in the petrochemical industry by use of a knocking engine. This device is a very expensive and large instrument, which cannot be practically used at the gas pump to determine the fuel Octane Number. The NIT-38 Alcohol Analyser is a low cost, easily transportable near infrared transmission spectrometer that can be operated in a mobile laboratory to measure Octane Number at the pump or in a laboratory.

This study was undertaken to demonstrate the feasibility of measuring the Octane Number of fuels using the NIT-38 Alcohol Analyser. It must also be noted that the same analyser can also determine the alcohol content of gasoline.

Procedure:

12 mixtures of gasoline samples were prepared volumetrically to provide a calibration set with a range from 92 to 97 Octane Number. Each sample was scanned on the NIT-38 Alcohol analyser using a 20mm Pathlength and five scans were collected per sample over the wavelength range of 720nm to 1100nm. The spectra were uploaded into NTAS (NIR Technology Australia Software) and Partial Least Squares Regression (PLS) was used to develop a calibration for the Octane Number in gasoline.

Results:

Figure 1 shows the NIR spectra of the 12 samples of gasoline. The peaks correspond to the aliphatic and aromatic hydrocarbons present in the gasoline.

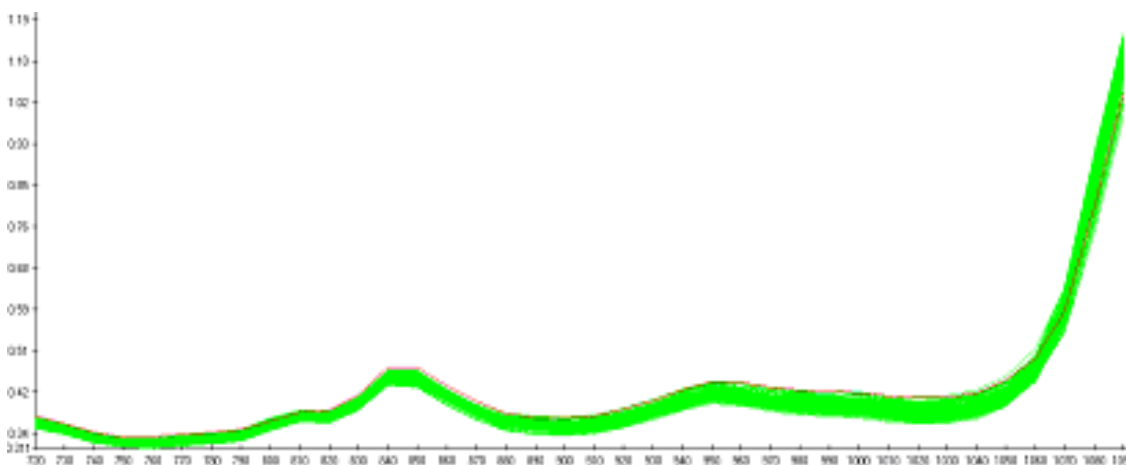


Figure 1: Plot of NIR Spectra for scanned gasoline samples.

Figure 2 shows the calibration statistics for the NIR Octane Number versus the reference Octane Number.

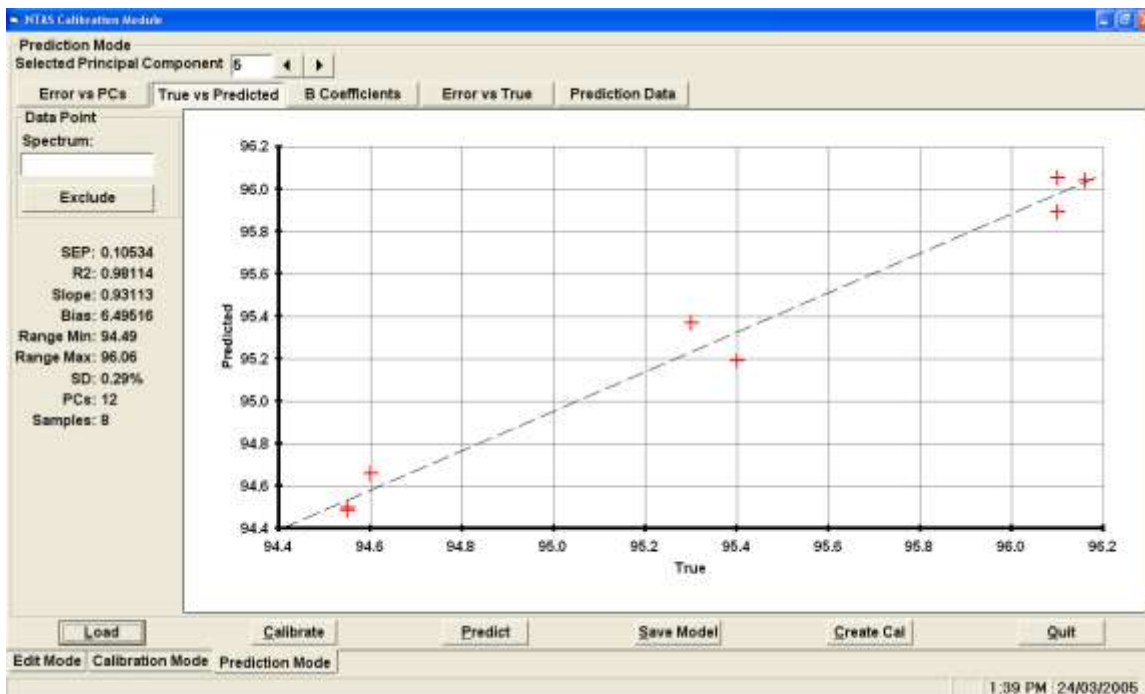


Figure 2: Plot NIR Predicted Octane value vs. Reference Octane value.

The Standard Error of Calibration (SEC) was of 0.1 and the correlation (R^2) was 0.98

Conclusion:

It can be seen in figure 2 the NIT-38 Alcohol Analyser can be calibrated to measure the Octane Number of gasoline. Whilst the sample set is currently too small to develop a robust calibration, it is still sufficient to demonstrate the feasibility of the technique.

It is recommended that additional samples be added to the spectral file to improve the calibration set and prediction models.