Application Note 70: Calibration of Pyrethrin Levels in solution using a NIT-38 Alcohol Analyser.

Introduction:

Pyrethrum is a botanical insecticide derived from the white chrysanthemum daisy. The oils from this flower are comprised of six chemical esters known as pyrethrins. It is these collected pyrethrins that are being examined. The pyrethrins are collected and stored in an oil solution.

This study was undertaken to demonstrate the feasibility of measuring pyrethrin levels in production solutions. The NIT-38 Alcohol Analyser was used for the purpose of this study.

Procedure:

12 samples of pyrethrin solutions were supplied. The liquid solutions were then placed in a standard liquid cell and scanned over the wavelength range of 720nm to 1100nm at a pathlength of 30mm. A total of 5 scans were collected and each sampling was repeated and presented to the instrument twice. The spectra was collected and then uploaded into NTAS (NIR Technology Australia Software) and Partial Least Squares Regression (PLS) was used to develop a calibration for Pyrethrin concentration levels.

Results:

Figure 1, below, shows the NIT spectra of the 12 samples of pyrethrin solutions.

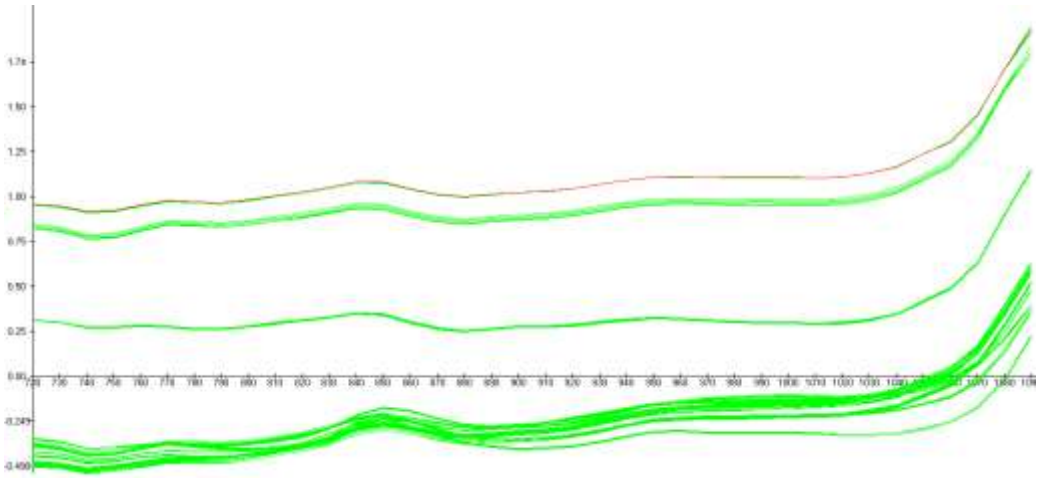

Figure 1: Plot of NIR Spectra for scanned pyrethrin concentrate solutions.

Figure 2 shows the calibration statistics for the NIR pyrethrin values versus the reference pyrethrin value. The Standard Error of Calibration is 0.77% with a correlation (R^2) of 0.99.

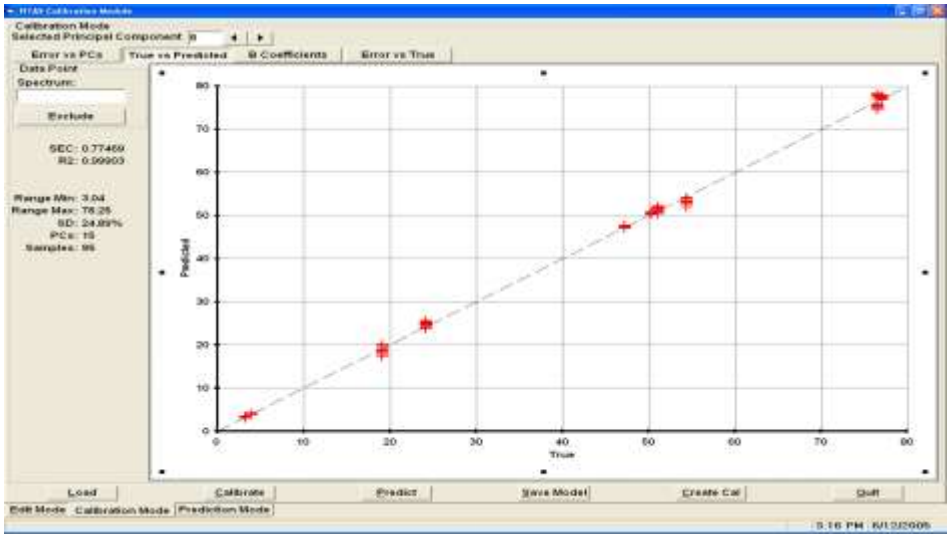

Figure 2: Plot NIR Pyrethrin value vs. Reference Pyrethrin value.

After creating the calibration, 9 samples were retested and plotted. Figure 3, below, show the results of this testing giving a Standard Error of Prediction 0.50% and a correlation (R^2) of 0.99.

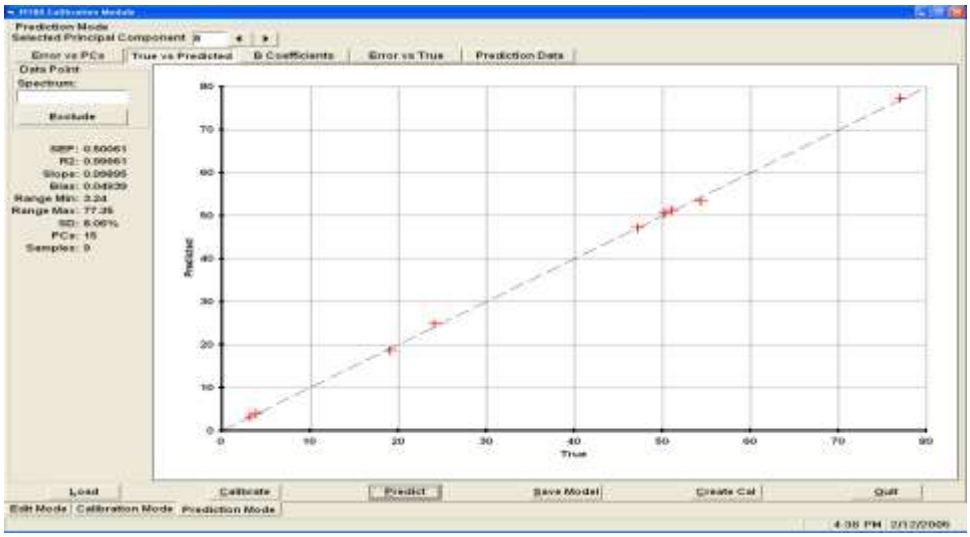

Figure 3: Plot NIR Predicted Pyrethrin value vs. Reference Pyrethrin value.

Conclusion:

It can be seen in figure 2 that the NIT-38 Alcohol Analyser can be calibrated to measure the pyrethrin levels. However, the sample set is to small for a truly robust calibration even with the wide range of available samples. The Standard Error of Calibration for the trial set was 0.77% with additional samples this error could potentially be reduced to half of the existing error or better. The correlation of 0.99 clearly shows the high level of potential with in this application. However, when using the trial calibration to predict against samples it was shown that the true error was actually 0.50%. The trail set also included two sample of Oleoresin. Due to the dark, thick syrup like nature of this product it was not possible to measure using the same sampling methods as the standard solutions. For this product a cell with a 5mm pathlength was used successfully. A separate calibration, however, would be required for this product.

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