Application Note 100: Near Infrared Transmission Measurement of Onions

Introduction:

The objective of this brief study was to determine the feasibility of the FOP-38 On Line Analyser to measure the presence of rot in whole onions. If this proves feasible then the objective would be to place this instrument onto an onion packaging line so that each onion could be inspected for rot and rejected accordingly.

Description:

The FOP-38 On Line Analyser is a diode array based NIR spectrometer that collects the spectrum from 720-1100nm. The spectrometer is connected to a process stream using a fiber optic cable up to 10 meters in length. A lamp can be used to illuminate the onions as they pass an aperture. The fiber optic cable, positioned above the onion would collect the NIT spectrum and transmit the light back to the spectrometer. The spectrometer would compare the spectrum to a library file consisting of onions that have degrees of rot included. Based on a sophisticated spectral matching algorithm, the spectra can be identified as being good or bad. Where a bad spectrum is detected, ie, indicating the presence of rot, then the onion could be rejected from the line using a mechanical device or an air jet.

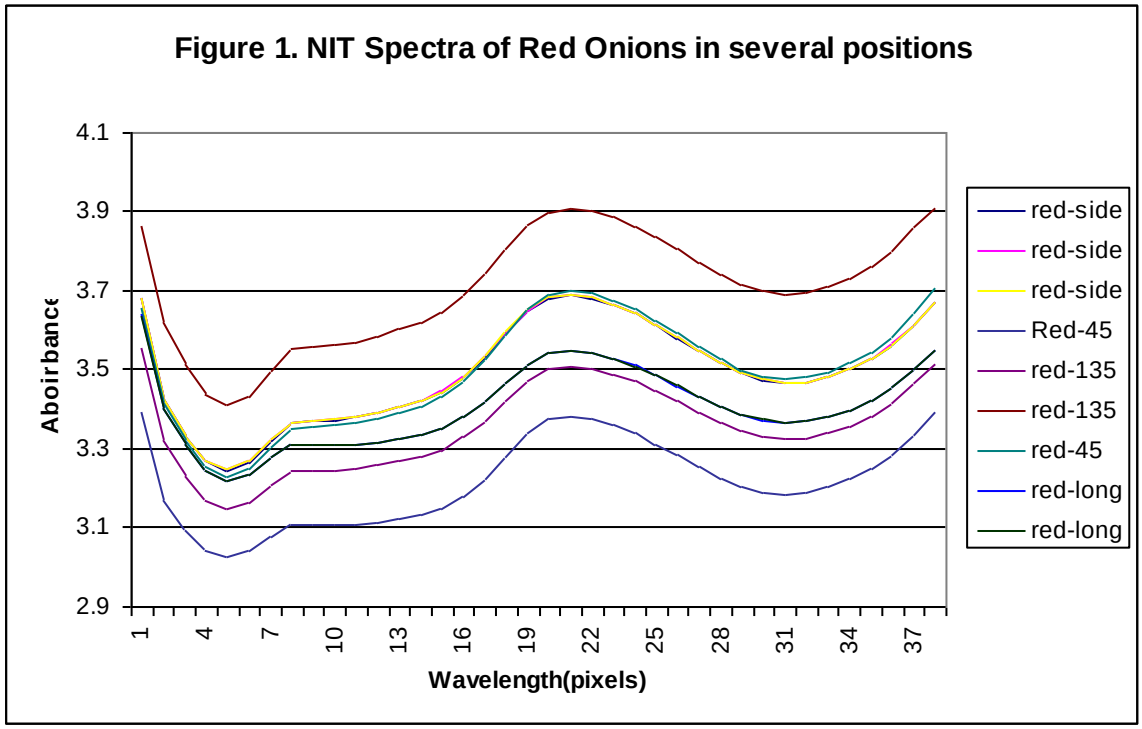
To test the feasibility of NIT to measure through whole onions, two red and two brown onions of approximately 40mm diameter were purchased from a local grocer. The onions were placed in between the lamp and the fiber optic cable in the following positions.

1) Along the axis
2) Side to Side
3) 45 degree angle
4) 135 degree angle
5)

The NIT spectra were collected and stored in a computer.

Results:

Figure 1. shows the spectra of red onions scanned along the axis, from the side and from two angles, 45 and 135 degrees. Figure 2. shows the spectra of brown onions scanned in the same fashion.



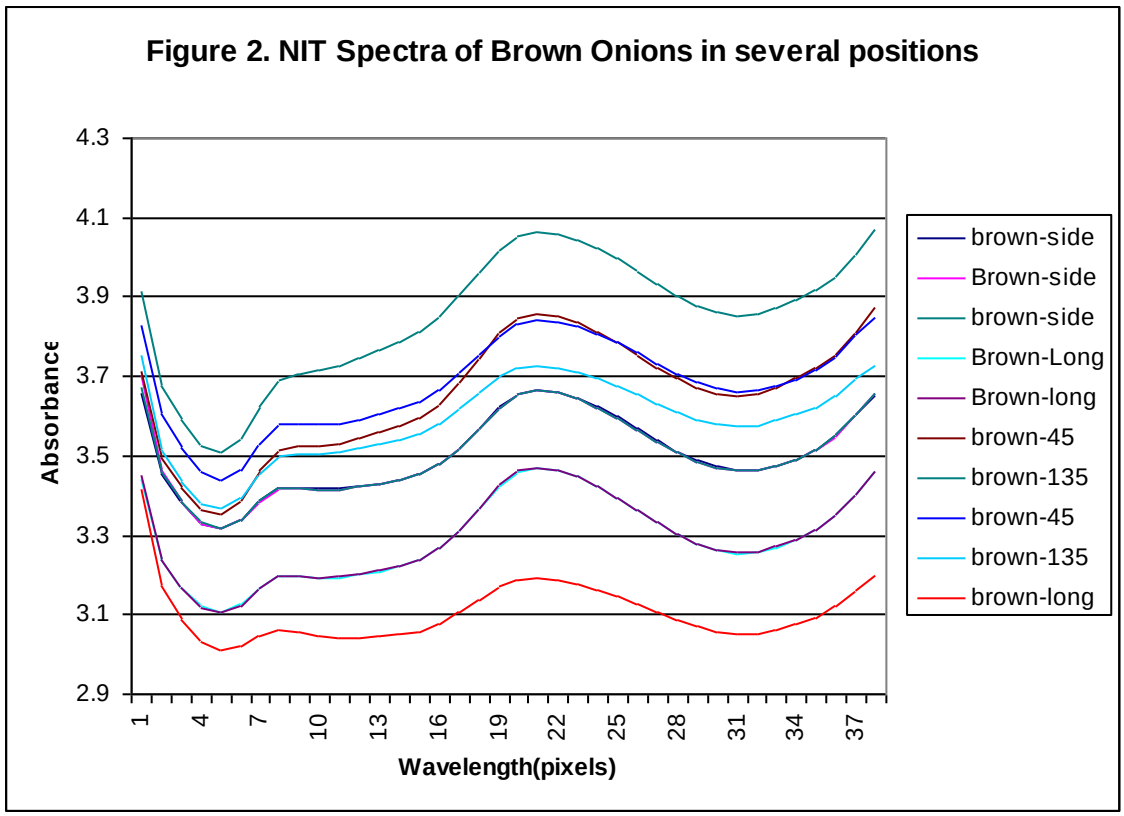


Figure 3. shows the NIT spectra of all the onions in all positions. Figure 4 shows the second derivative spectra of the scans. The second derivative spectra reduce the scatter caused by different thickness of onions and the angular positioning.

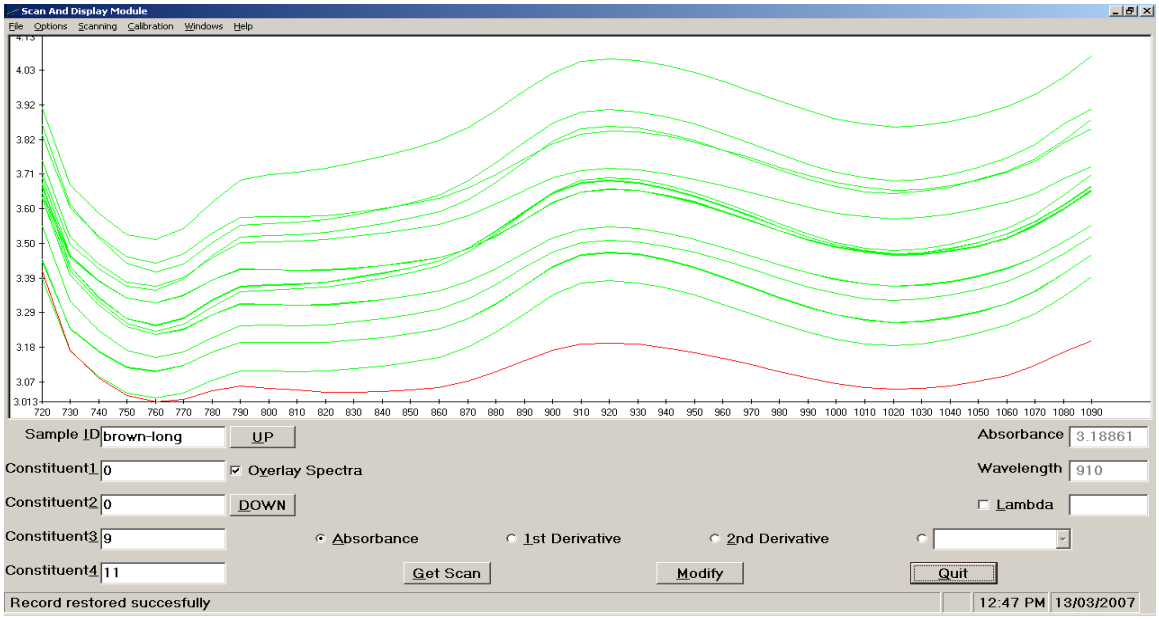


Figure 3. NIT spectra of the Red and Brown Onions.

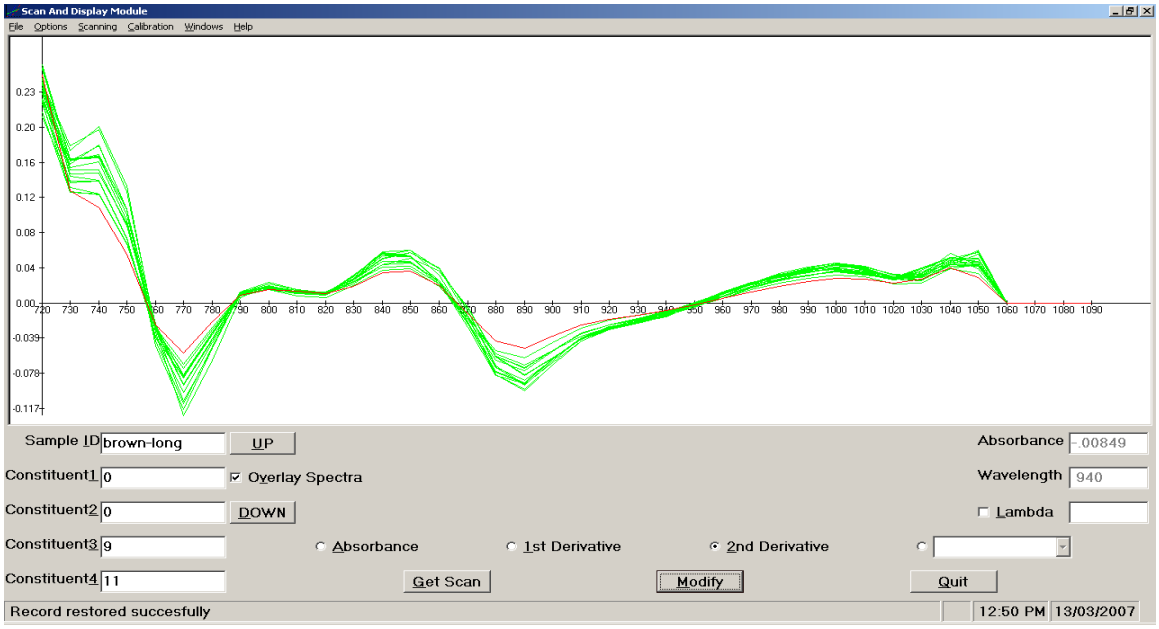


Figure 4. 2nd Derivative Spectra of Red and Brown Onions.

Discussion:

The first comment to be made is that the onions are quite transparent to NIR light in the 720 to 1100nm range. The second comment is that the NIT spectra of both red and brown onions in multiple positions are extremely consistent.

This suggests that identifying good onions is well within the ability of the FOP-38 On Line Analyser. In order to establish whether the proposed system can detect onions with varying degrees of rot, will require testing with such samples.

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