C Technologies, Inc.

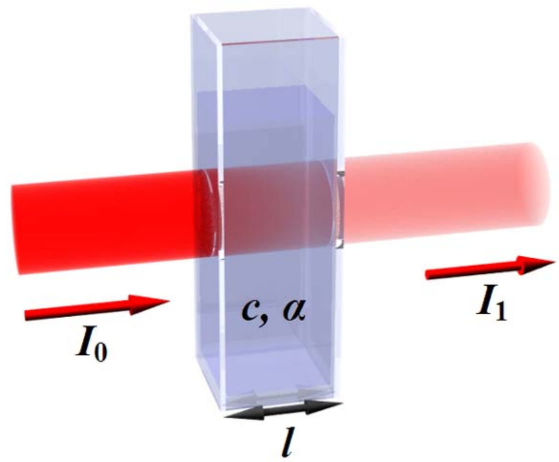
Principle of Operation

Company Confidential

The SoloVPE (pr. sōlō vē-pē-ē) Variable Pathlength Extension from C Technologies, Inc. is a new kind of UV-Vis-NIR spectroscopic instrument that takes advantage of all the terms in the Beer-Lambert Law.

$$A = \alpha\, l\, c$$

$$T = \frac{I_1}{I_0} = 10^{-A} = 10^{-\alpha l c}$$



where,

$$A = \log_{10}\left(\frac{I_0}{I_1}\right)$$

$$\alpha = \frac{4\pi k}{\lambda}$$

where:

- A is the absorbance of the sample
- I_0 is the intensity of the incident light
- I_1 is the intensity after passing through the material
- l is the distance that the light travels through the material (the path length)
- c is the concentration of absorbing species in the material
- α is the absorption coefficient or the molar absorptivity of the absorber
- λ is the wavelength of the light
- k is the extinction coefficient
- T is the transmittance (From Wikipedia)

The power of the SoloVPE is that it takes advantage of the pathlength term (l) which is typically held "constant" through the use of fixed pathlength cuvettes or other measurement devices that have a known value for the pathlength, subject to some tolerance. Methods are typically developed at a specific pathlength (1 cm is common) and dilutions can be performed to make sure the Absorbance readings are within the range of the instrument. Concentration changes require dilutions, which are subject to preparation errors and pathlength options have typically been limited to discrete options in cuvettes, probes, flow cells etc. The SoloVPE gives the user fine control over the pathlength used in their measurements.

The SoloVPE leverages the pathlength term by allowing measurements across a wide range of pathlengths from 0.010 mm (10 micron) up to as high as 20.000 mm (2 cm) with a pathlength resolution of 0.005 mm (5 micron). The system allows measurements of solutions with concentrations orders of magnitude higher than most typical laboratory instruments available. The system accomplishes this by capturing the light from a Varian Cary 50™ spectrophotometer in an optical fiber (called a Fibrette ™) and passing it through the sample solution. The optical fiber can be moved up or down relative to the bottom of the sample vessel holding the solution. The pathlength is defined by the output tip of the optical fiber and the bottom of the sample vessel. The light transmitted through the sample solution is capture by a detector mounted below the sample vessel. See the graphical depiction in Figure 1.

The motion of the Fibrette is precisely and accurately controlled by a computer. The software that controls the system allows detailed method configuration. Users can specify a wavelength scanning range and a pathlength scanning range. Or the system can be used to collect data at discrete wavelengths and discrete pathlengths or any combination of the above. Thresholds can be set and the data can be analyzed.

The sample vessel and Fibrettes™ have been designed to be transmissive across the instrument measurement range of 190 to 1100 nm. Fabricated out of quartz they are highly resistant to chemicals.

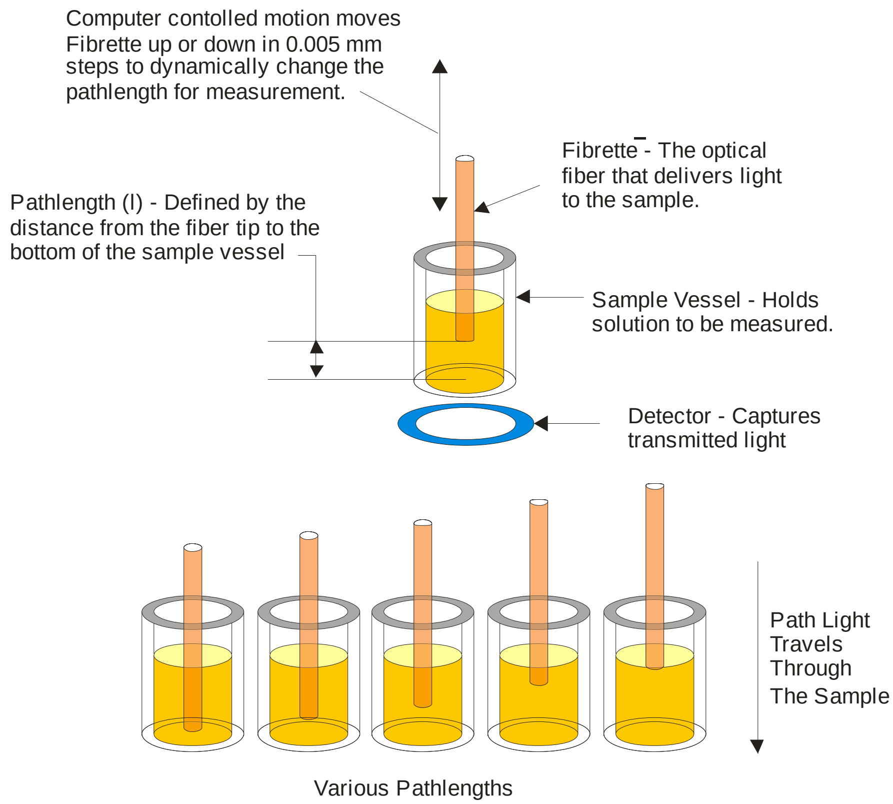
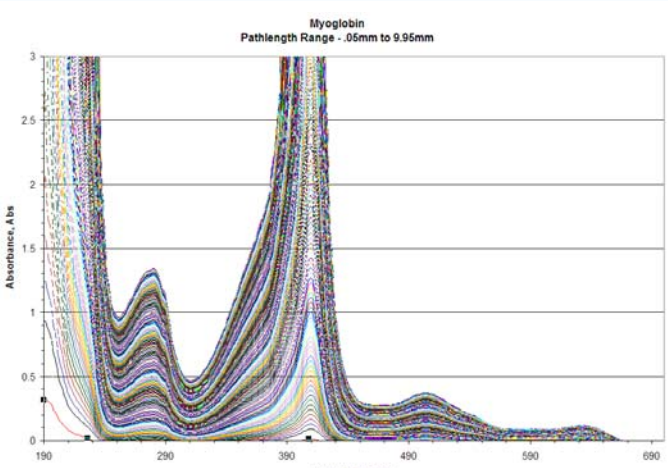
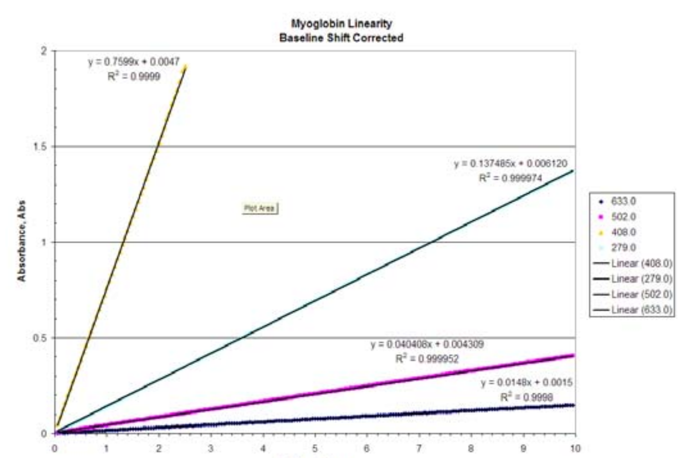


Figure 1: Operation Graphic

The software is capable of substantial data collection and analysis. The example data set below contains wavelength scans from 600 to 190 nm at pathlengths from 0.050 mm to 9.95 mm, nearly 200 curves. Wavelength cross-section plots of Absorbance vs. Pathlength were created at the peaks of interest in the spectra. Linear regression was then performed on that data set resulting in an equation that allows further sample analysis, concentration calculations and predictions of absorbance values at un-measurable pathlengths (when the sample is so highly concentrated). The system can be used on samples such as DNA, RNA, proteins, dyes or any solution where UV-Vis-NIR techniques are typically employed. The ability to dynamically vary pathlength and to measure at pathlengths as small as 0.010 mm also serves to expand the usefulness of the UV-Vis-NIR techniques.





C Technologies, Inc. 757 Route 202/206 Bridgewater, NJ 08807 908-707-1009 www.solovpe.com