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INSTRUMENTS

Liquid Waveguide Capillary Cells

Absorbance measurements with up to 500-fold increase in sensitivity

Microliter sample volumes — exceptional sensitivity

WPI's **Liquid Waveguide Capillary Cell** (LWCC) is a flow cell for absorbance measurements in the ultraviolet, visible and near infra-red ranges. Pathlengths range from 50–500cm, with increasing measurement sensitivity from 50 to 500-fold. The flow cells are fiber coupled and have a very small sample volume ranging from 125µL (50cm pathlength) to 1,250µL (500cm pathlength).

How does it work?

The sample solution is introduced into the LWCC at the liquid input. Light is coupled into the LWCC from a light source via a fiber optic cable. After passing through the LWCC, light is collected with an optical fiber and guided to a detector. The concentration of the sample is determined by measuring its absorbance in the LWCC, similar to a standard UV/VIS spectrometer.

Advantages of LWCC over standard cuvettes

Ultra-sensitive absorbance measurements can be performed in the UV, VIS, and NIR portion of the light spectrum. Compared with a standard 1cm cuvette, a 1mAU signal is enhanced 100-fold to 100mAU when using an LWCC-3100. LWCC units can be directly connected to a pump, a fluid injection analysis system, or even filled with a syringe.

Detector requirements

The LWCC couples with the TIDAS high performance fiber optic photodiode array based spectrophotometer systems, like the WPI #**505067** (Tidas S300, UV/VIS 190-720 nm with deuterium and halogen lamps).

The LWCC can also couple to any CCD, PDA or scanning type optical spectrometer or photodiode detector with fiber optic input capabilities. WPI also offers a range of light sources, such as **FO-6000** (VIS/NIR studies) and **D4H** (UV/VIS) .

Wavelength range

Designed to work in the UV, VIS and NIR, the LWCC's optical performance is strongly dependent on the solvent used in the wavelength of interest. Please note that in aqueous solutions the wavelength performance is limited (see Efficiency Curves).

LWCC Key Features

Pathlength, internal volume, and wavelength range (measured with ultrapure water and a Tidas spectrophotometer

	Pathlength [cm]	Internal Volume [µL]	Wavelength Range [nm]
LWCC-3050	50	125	230-800
LWCC-3100	100	250	230-730
LWCC-3250	250	625	250-730
LWCC-3500	500	1250	280-730

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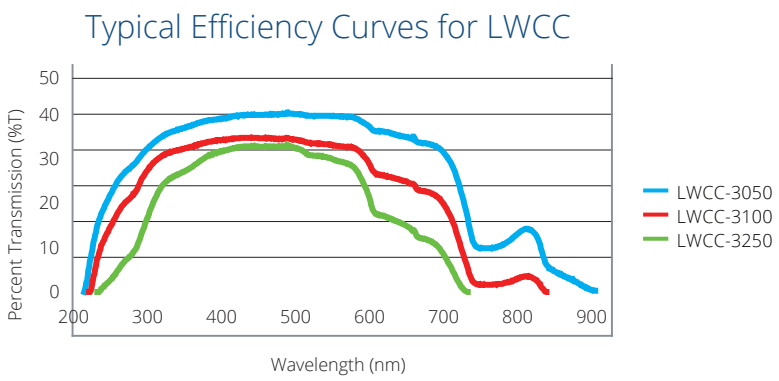

These spectra show the optimal detection limits for LWCCs of varying pathlength.

Linearity

By Beer's Law, the absorption of a liquid sample in LWCC bears a linear relationship to the concentration of an analyte. A linear relationship is observed between 0.01–2AU and is limited only by stray light and noise from the spectrometer.

Chemical resistance

Any chemicals that could react with PEEK, Polyimide and fused silica should not be used in LWCC. (If in doubt, please contact WPI for details.)

Applications

Applications include liquid chromatography detection, stopped-flow injection, flow-injection analysis, gas-segmented continuous flow analysis and water monitoring (environmental, oceanic, and drinking water). Please contact WPI to discuss your needs.

References

M.Belz, "Simple and Sensitive Protein Detection System using UV LEDs and Liquid Core Waveguides", Advanced Environmental, Chemical, and Biological Sensing Technologies V, Optics East, Oct 2007, Proc SPIE, Vol. 6755, 675505.

J.Z. Zhang, "Enhanced Sensitivity in Flow Injection using a Long Pathlength Liquid Waveguide Capillary Flowcell for Spectrophotometric Detection", Analytical Sciences, Jan 2006, Vol. 22, 57.

J.Z. Zhang, "Shipboard Automated Determination of Trace Concentrations of Nitrite and Nitrate in Oligotrophic Water by Gas-Segmented Continuous Flow Analysis with a Liquid Waveguide Capillary Flow Cell", Deep Sea Research I, 2000, Vol. 47, 1157.

M. Belz, P. Dress, A. Sukhitskiy, S. Liu, "Linearity and Effective Optical Pathlength of Liquid Waveguide Capillary Cells", Part of the SPIE Conference on Internal Standardization and Calibration; Architectures for Chemical Sensors, Boston Mass., Sept 1999, SPIE Vol. 3856, 271.

SPECIFICATIONS

WAVEGUIDE MATERIAL	Fused silica tubing coated with a low refractive index polymer
OPTICAL PATHLENGTH	50-500 cm
INNER DIAMETER	550 µm
INTERNAL VOLUME	≈ 125 - 1250 µL
SAMPLE INLET/OUTLET COMPRESSION FITTING	1/16", 1/32"
FIBER INPUT	SMA, ID = 600 µm
MINIMUM PRESSURE*	1.5 - 3 PSI
SOLVENT RESISTANCE	Most organic & inorganic solvents
SHIPPING WEIGHT	1.4 kg (3 lb)

*A one-meter Type II waveguide of 550 µm ID requires about 1.5 PSI for water flow of 1 mL/min.

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