Cuvette spectrophotometers are for clear samples only.

CLARiTY Integrating Cavity UV/Vis Spectrophotometers

are for **Clear and Not Clear Samples!**

Cuvettes offer convenience. The cuvette is commonly one centimeter on a side, i.e. 1 cm2. Short pathlength models are available for high absorbance studies; masked cuvettes are available for low volume samples. Quartz cuvettes are used for UV spectroscopy; lower cost glass and plastic cuvettes are suitable for visible spectroscopy.

WHAT IF YOUR SAMPLE IS TURBID OR HAZY?

When using traditional cuvette spectrophotometers, accurate results are only possible with perfectly clear samples. If your sample is hazy or turbid, the light scatters and evades detection, and the detector reads only a portion of the sample. Your results will be inaccurate and flawed.

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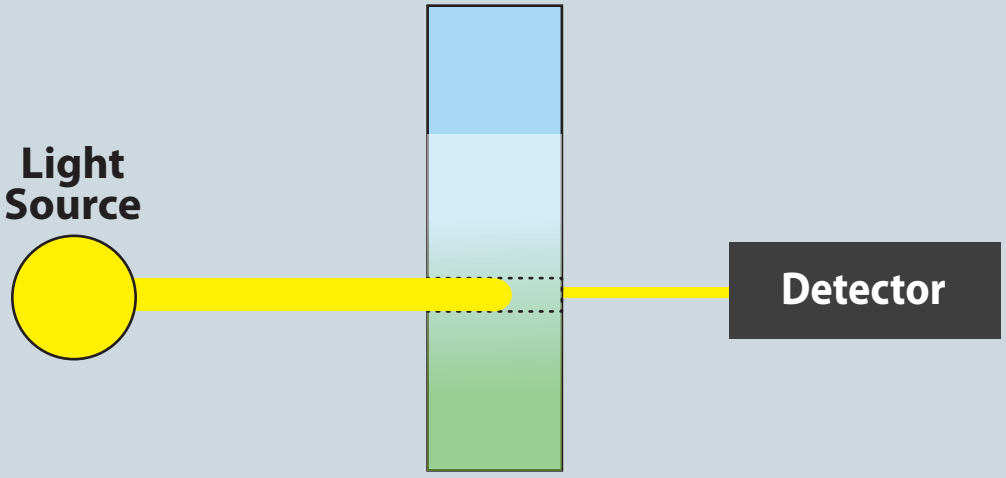
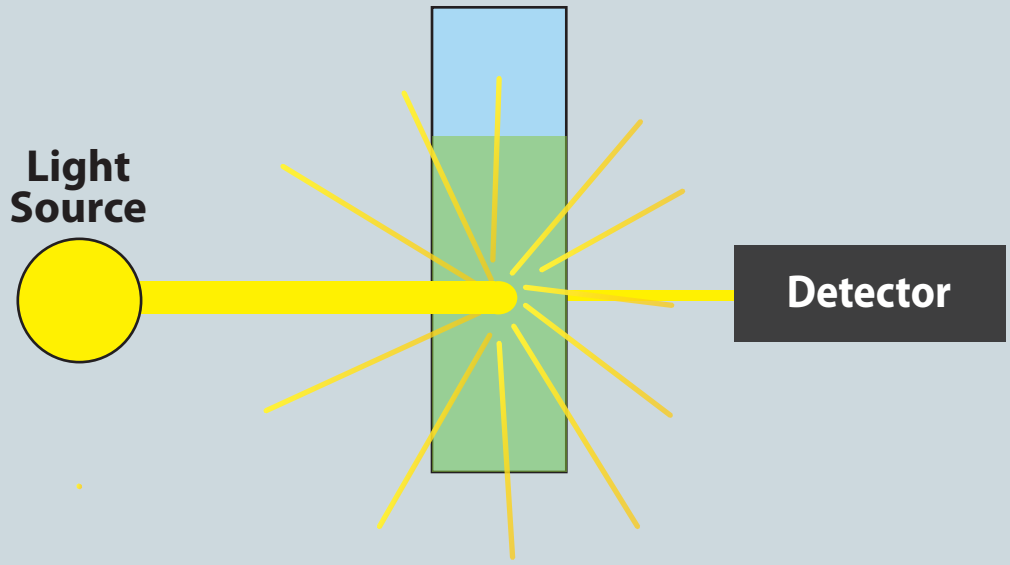
Limitations of cuvettes



The measurement light from the spectrophotometer passes through a small section of the cuvette, so that:

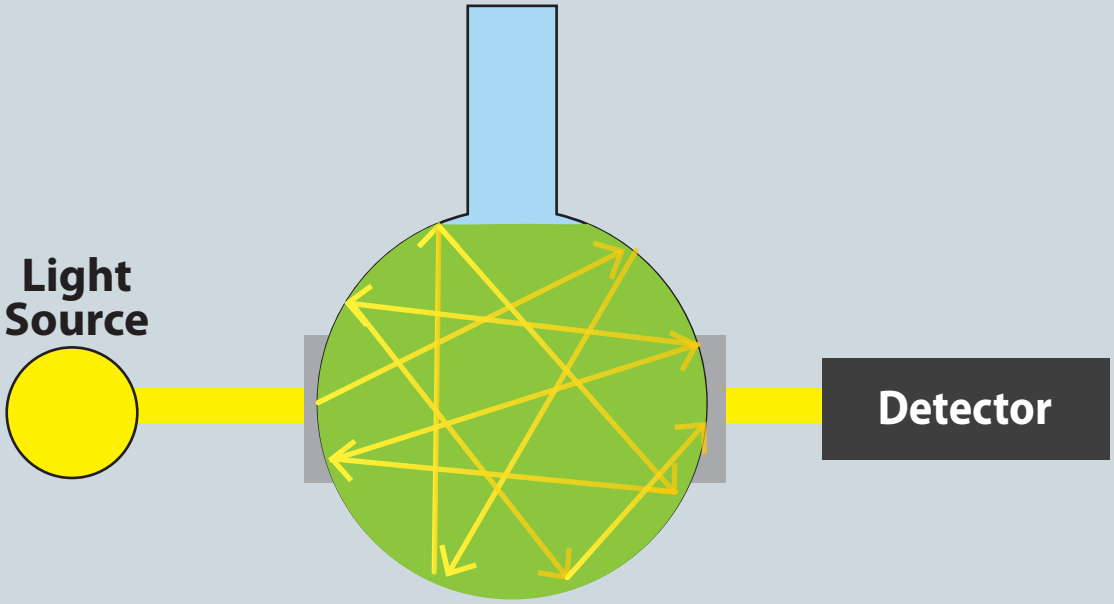
(1) the sample volume must be to at least this Z-axis level, and

(2) only the portion of the sample through which the light passes is involved in the measurement and thus in the experimental results.

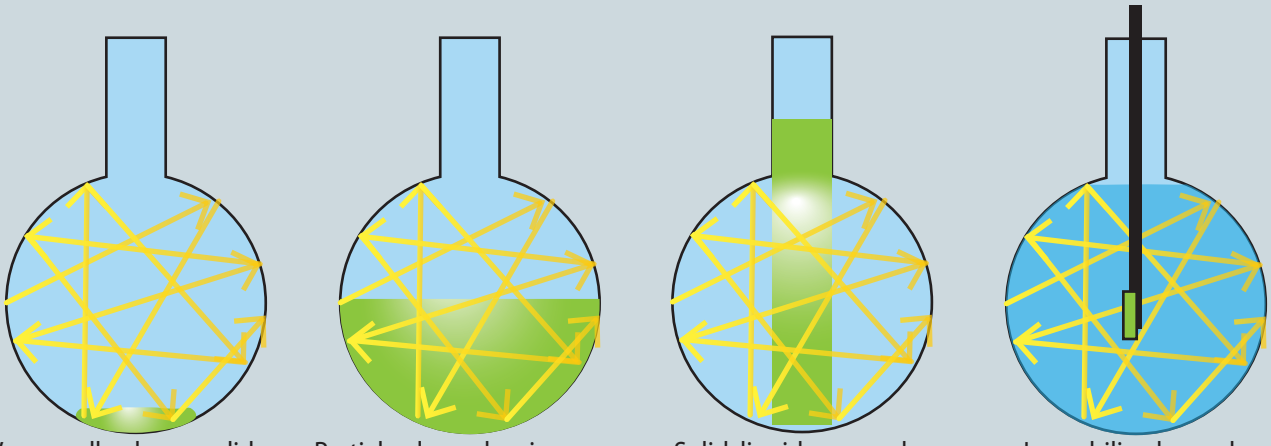


A third limitation occurs when the sample must be perfectly clear. The more hazy the sample, the more flawed the results.

Advantages of the Integrating Cavity



The CLARiTY product line uses integrating cavities instead of cuvettes. The integrating cavity solves the problem of light escaping detection. All light entering the sample holder is available to the detector. Your sample can be perfectly clear or hazy and turbid...the light in the integrating cavity design reflects endlessly off the highly reflective surface surrounding the chamber, until it is either absorbed by the sample or exits by the detector. **Your results are accurate every time.**



Very small volume, solid or drop of suspension.

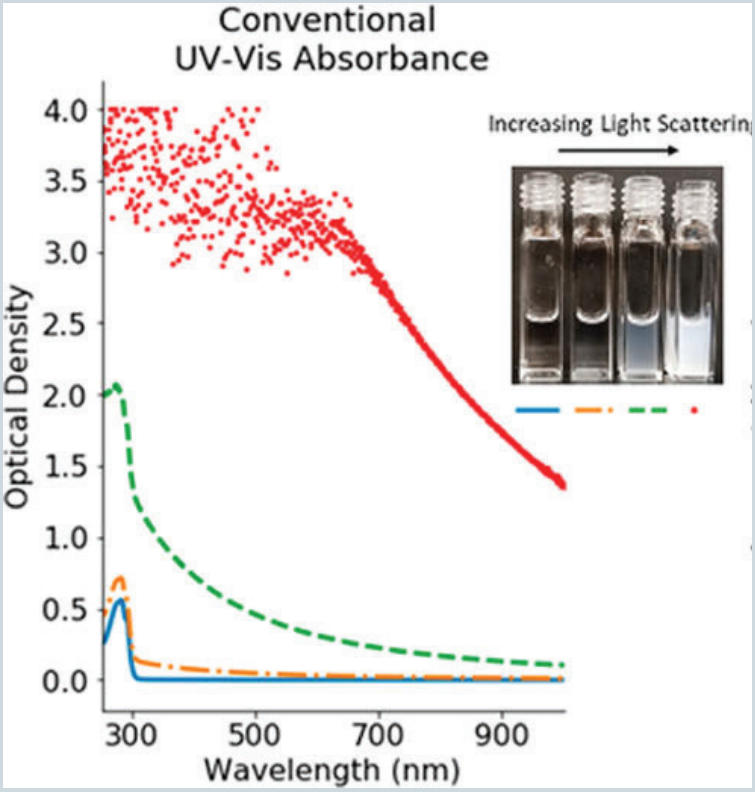
Partial volume, leaving room for addition of reactants

Solid, liquid, or powder sample within test tube.

Immobilized sample in a solution.

Another benefit of the integrating cavity is its versatility. The most popular volume cavity is 8 mL, but you can get accurate results with very small volumes, partially filled cavities, samples within test tubes, and samples immobilized in a solution.

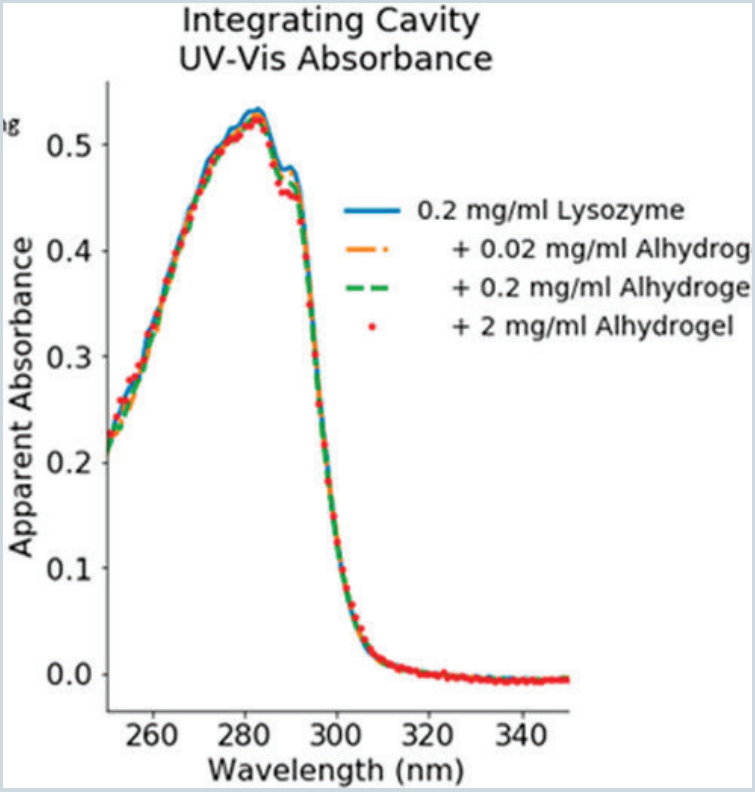
Turbidity does not affect absorbance in a CLARiTY



Results from a cuvette spectrophotometer:

Here, we see one protein concentration in four solvents of increasing turbidity.

The answer changes from accurate to inaccurate to ultimately nonsense in the face of increasing turbidity. The only correct answer is the blue on the far left.



Results from a CLARiTY spectrophotometer:

The same four samples were then run through a spectrophotometer with a CLARiTY integrating cavity.

Turbidity does not change the absorbance measurement. This example, published in Analytical Chem, May 2018, confirms that a given protein concentration is measured exactly the same whether in a clear or opaque medium.

More details about the Integrating Cavity

Our favorite shape is round, but an integrating cavity can take other forms.

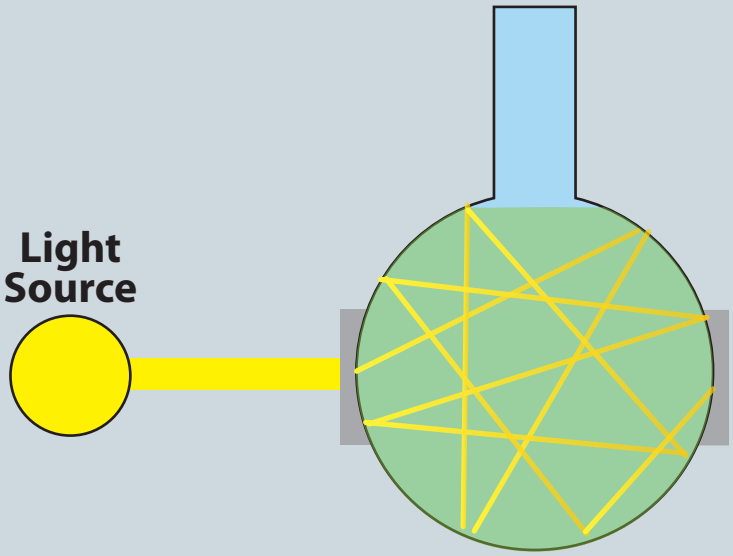
A round-bottom quartz flask was our first design. Round is the perfect shape. And, it leaves the sample nowhere to hide. The flask is blown of high quality quartz, inert to effectively every sample and cleaning agent.

The most popular volume is 8 mL. Example sample preparations are (a) 50 uL of protein in 8 mL of solvent, (b) 10^7 cells/ mL of living cells or bacteria, and (c) a test tube containing 2 mL of nanoparticles.

Highest sensitivity is achieved when the cavity is filled with the sample. The sample can also be:

- **A very small or partial volume in the flask**
- **A lesser volume introduced within a 2 mL test tube**
- **A solid lowered or coiled into the flask**
- **An immobilized solid within a solvent bath**

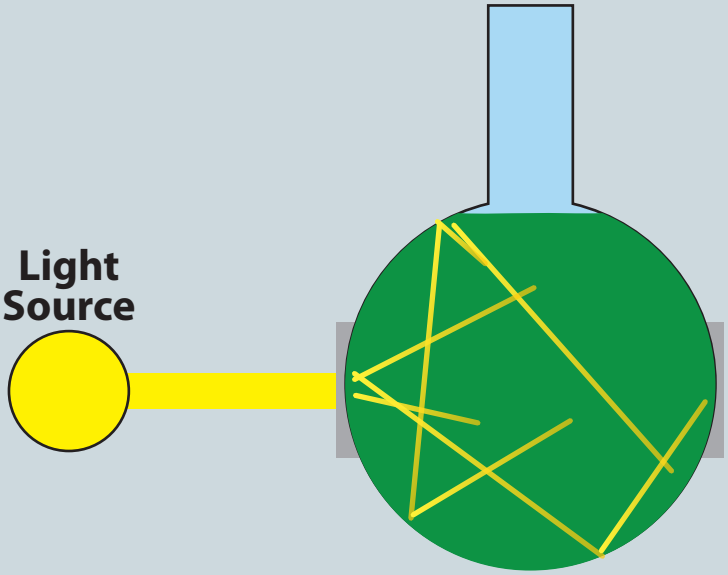
Absorbance and Pathlength



Low absorbance =
Longer pathlength

The standard volume cavity is 8 mL. With a low absorbance sample, the resulting pathlength is 30 cm. Sensitivity is on the nanomolar range.

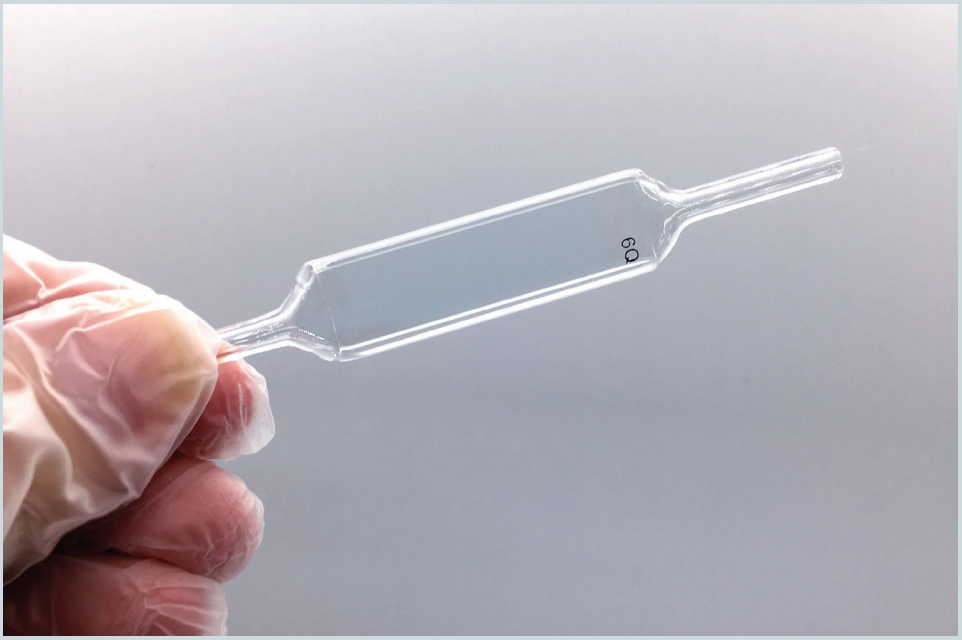
Absorbances from roughly 0.001 AU/cm to 3 AU/cm are successful in the filled cavity.



High absorbance =
Shorter pathlength

Higher absorbing samples which cannot be diluted can be measured in this large flask by using a lesser volume.

Flow-through Cell Options



For ease of handling very high absorbance samples which must be measured in very short pathlength integrating cavities, we opted for flow-through cells.

Such samples include undiluted whole milk, red wine, and highly colored flowable ingredients.

Choose from these five flow-through cavities:.

physical path (mm)	*optical path (mm)*	*upper limit (abs/cm)*	*volume (mL)*
5	2.5	4	2
2	1	10	0.8
1	0.5	20	0.4
0.5	0.25	40	0.2
0.2	0.1	100	0.08

The Integrating Cavity is within the DSPC

The integrating cavity is permanently packed inside a housing, which we call a DSPC, for DeSa Suspension Presentation Chamber.

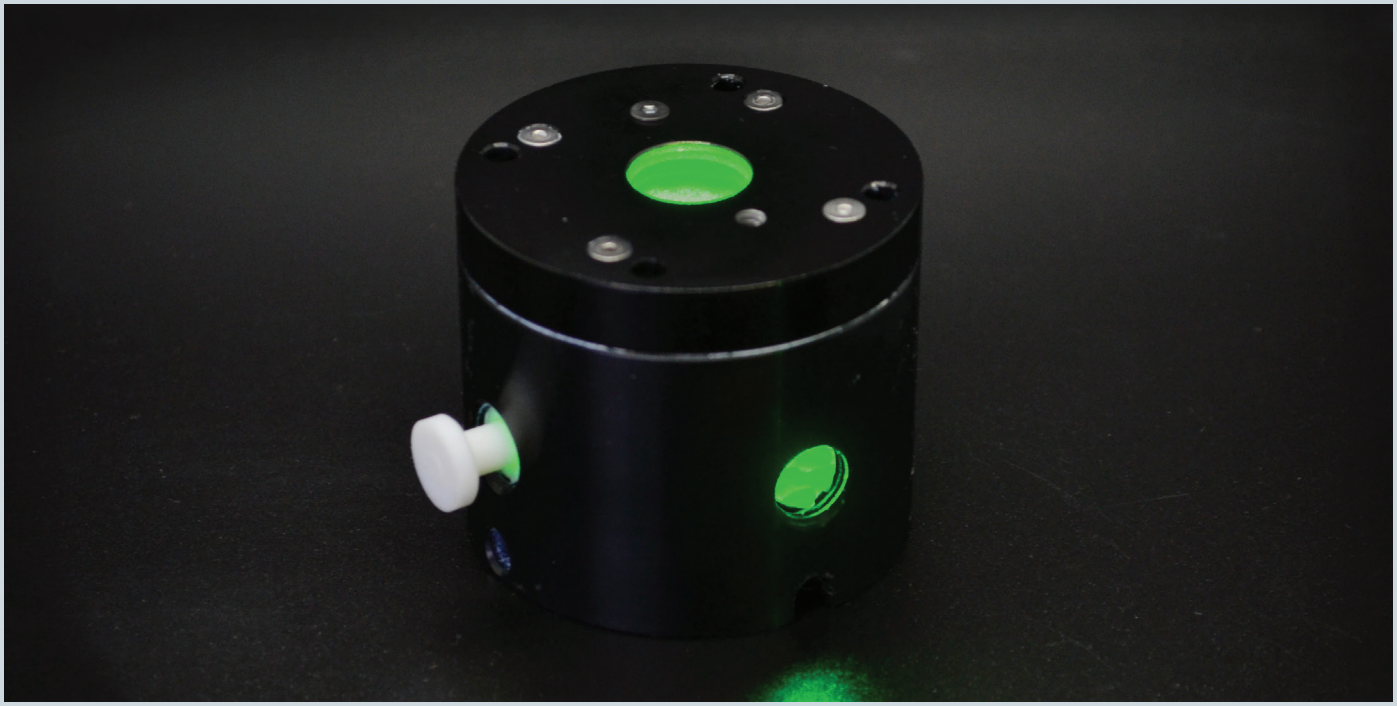
Between the quartz integrating cavity and the high density black housing is a highly reflective material, encasing the integrating cavity and its contents.

The light inside the cavity reflects endlessly off this reflective surface until it is either absorbed by the sample or exits the DSPC to the detector.

Quartz rods -- straight or curved, short or long – can be used to direct light in and out of the DSPC.

A lab might have two or three DSPCs to accommodate different sample types. These sample holders are extremely easy to exchange one for the other. Stirring and Peltier control are available.

The "gas of photons" inside the DSPC



The measurement light is fully diffused as a "gas of photons."

All photons are trapped within DSPC until they pass through a port to the awaiting detector.

Roughly 5% of the light in escapes as detected light.

Roughly 0.1% of the light is absorbed by the reflective surface.

How can OLIS help you achieve CLARiTY?

Fr more information about integrating cavities, or to learn about CLARiTY spectrophotometers, visit OlisClarity.com or call 706-353-6547.

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