**cphnano**

## NanoCuvette™ One

The NanoCuvette™ One expands the capabilities of a UV-Vis spectrophotometer to include quantification of non-absorbing compounds via refractive index. Use cases include label-free kinetics, label-free concentration determinations, and the possibility to measure on 0.5 μL droplets for low-volume samples. In addition, a free cloud-based online software is available as a lab journal system to analyse spectra, automatically extract results and save information.

## 1.     Introduction

Absorbance spectroscopy measures how much light a chemical substance absorbs by measuring the intensity of light as a beam of light passes through a liquid sample solution. It is widely used for quantitative analysis in various areas, e.g., chemistry, physics, biology, biochemistry, material and chemical engineering, clinical applications, and industrial applications. This technique requires a sample that absorbs light, but many chemical substances are non-absorbing and other methods must be used. One option is refractive index that describes how fast light propagates through a sample. It can be used to quantify non-absorbing compounds since all compounds affect the speed of light. The NanoCuvette™ One is a cuvette that can be used for measuring both refractive index and absorbance using a spectrophotometer.

## 2.     Product description

The NanoCuvette™ One is a "Made in Denmark" PMMA plastic cuvette with a path length of 10 mm that embeds an anti-stiction coated (ASC) optical filter based on nanotechnology. Unique identification is engraved for traceability. The cuvette can measure refractive index, using visual light (550 nm to 800 nm), and absorbance in the UV-Vis range (300 nm to 800 nm). The cuvette requires a spectrophotometer with a 12.5 x 12.5 mm cuvette holder, capable of capturing an absorbance spectrum in the visual range (550 nm to 800 nm) with no more than 2 nm between each absorbance value. The beam height of the instrument should be between 8.5 and 15 mm. See the datasheet for more information.



*Figure 1. NanoCuvette™ One.*

The NanoCuvette™ One is reusable. Between uses it should be cleaned by following the cleaning manual.

In order to calculate the refractive index, our free cloud-based online software is needed. An internet connected computer is required to use the software for the data processing. Data processing is performed in the cloud and the customer does not need a powerful computer.

The software is user-friendly and fast. It is hosted by Amazon Web Services (AWS), which ensures that the customers data is handled reliably, privately and securely. The customer has their own account and can access their data through this. Only the customer has access to their data. The software includes quality control controlling the quality of each measurement.

The software presents the results as a complete lab report, where the user can add their own notes, sample parameters, etc. The software can be used to store analysis data in the cloud on the user profile level. The lab report, figures and data

can be exported and printed.

To perform an analysis using NanoCuvette™ One, the first step is to obtain three spectra using the usual absorbance method and a spectrophotometer. The spectra needed are:

1. A reference spectrum through the optical filter using a reference liquid (usually water).

2. A sample spectrum through the optical filter.

3. A sample spectrum through the clear side of the NanoCuvette™ One (not through the optical filter).

The three spectra must be obtained using the same NanoCuvette™ One. See the user guide for more details.

## 3. Use cases

The NanoCuvette™ One offers unique benefits compared to conventional spectrophotometry and refractometry techniques, including:

### 3.1 Label-free enzyme kinetics

• Determine enzyme kinetics without the need of labeling.

• Application note: Enzymes, kinetics and NanoCuvette™ One.

### 3.2 Label-free protein concentration

• Determine protein concentrations without the need of labeling.

• Application note: Protein concentration, refractometry and NanoCuvette™ One.

### 3.3 Label-free DNA concentration

• Determine DNA concentrations without the need of labeling.

• Application note: Under development.

### 3.4 Quality control

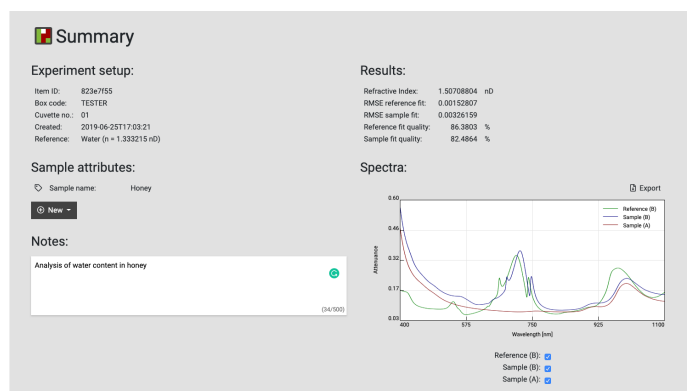• Robust and easy to perform analysis with no need for a complex laboratory setup.



Figure 2. Screenshot from online software with honey measurements. Test examples of spectral data for different samples can be found on the product website.

• No need for calibration as this is built into the software.

• The free NanoCuvette™-series software is a laboratory information management system (LIMS) for quality control, including library and backup for the analysis.

• Application note: Buffers, QC and NanoCuvette™ One, Glycerol concentration, QC and NanoCuvette™ One and Apple juice, QC and NanoCuvette™ One.

### 3.5 Droplet measurements

• Accurate measurements on 0.5 µL droplets.

• Application note: Droplets, low volume samples and NanoCuvette™ One.

## 4. Sectors

Similar to normal cuvettes, the use of NanoCuvette™ One is horizontal in nature spanding different applications and industries. An overview is provided below.

### 4.1 Education

The NanoCuvette™ One is ideal for educational purposes especially in high schools and at higher educational levels. The NanoCuvette™ One allows the students to explore and develop methods within biology, biotechnology, physic and chemistry in a cost-efficient way. This makes the analysis of protein, enzymes, and DNA

accessible for many schools at low cost.

Currently, most laboratory technician schools in Denmark and some high schools uses the NanoCuvette™ One.

A set of teaching materials on analysis of honey is available in Danish on the [website](#).

## 4.2    Research

The NanoCuvette™ One can be used in research in the public and private sectors. It can be used as a quick and inexpensive way to quantify non-absorbing compounds, such as sugar, DNA, enzymes and protein, without the need for expensive and time consuming labeling processes. It can also be used to track reactions, e.g. fermentation reactions.

The NanoCuvette™ One is used to perform research at the Technical University of Denmark, Copenhagen University and Business Academy Aarhus.

## 4.3    Industry

The NanoCuvette™ One and software can be used as a complete quality control (QC) system, including reporting the data in an easily readable format. It is ideal as QC analysis for foods and beverages, such as honey and juice, where quality can be measured by a carbohydrate profile. It can also be used as QC in the fermentation of beer by following the conversion of carbohydrates into alcohol.

A variation of the NanoCuvette™ One is currently being developed as part of a QC system for a customer.

## 4.4    Healthcare/Veterinarian

The NanoCuvette™ One and the algorithms in the software are at the moment not approved for clinical use by any notifying body. However, the NanoCuvette™ One may be still tested in research projects at hospitals or clinics.
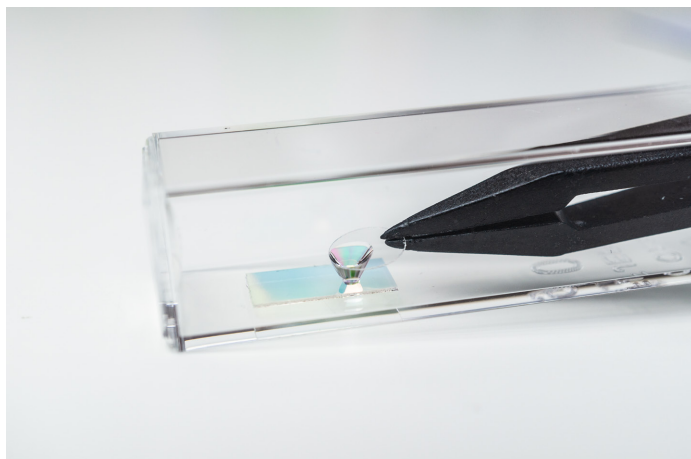


*Figure 3. Droplets can be placed with a pipette inside the cuvette and flattened using a 6 mm coverslide.*

## 6.    Contact information

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