



## FREQUENTLY ASKED QUESTIONS

### 1. What does Sage Analytics make?

Sage Analytics develops hardware and software solutions to provide instantaneous, accurate measurements of potency in cannabis products. Importantly, we designed these solutions to be operated by non-technical personnel allowing anyone to make accurate cannabis potency measurements. The two flagship devices recently introduced into the market by Sage are called the **Luminary™ Profiler & the Beacon™**.

### 2. What is potency, and what does it mean?

Potency, in the traditional pharmaceutical sense, means the amount of active ingredient in a product. Cannabis potency, in most strains, is driven by tetrahydrocannabinolic acid, (THCA) and tetrahydrocannabinol (THC), which are its primary and most prevalent psychoactive compounds, respectively. In flowering products, the THCA content is generally around 10 to 25% by weight, but can reach the low 30% region. In hash and extracted oils, THCA/THC content can be much higher, up to 80% or more by weight.

The second main elements of cannabis potency are cannabidiolic acid (CBDA) and cannabidiol (CBD), the latter of which does not provide the psychoactive stimulation of THC but, rather, physiological relaxation associated with therapeutic usage of cannabis (anxiety relief, muscle relaxation, among others). CBDA and CBD in flowers are typically present in much smaller concentrations, less than 10% by weight and usually closer to 1 or 2%, unless the strain has been cultivated to maximize the CBDA/CBD content. A third constituent of potency is cannabinol, CBN, which is a very weak psychoactive compound and, importantly, a natural breakdown product of THC that occurs over time. In extremely fresh product, CBN is typically at or near 0, but this percentage increases as the product slowly degrades over time. As such, CBN can be a useful indicator of the product freshness.

### 3. Why is it important to measure potency?

When you buy a pharmaceutical product, the amount of active ingredient (hence, potency) is required to be on the packaging label, ensuring that the recommended dosage is delivered. The United States Food and Drug Administration (FDA) keeps strict guidelines and procedures in place for all aspects of drug manufacturing, packaging, and dispensing, so patients and physicians can be 100% positive that the prescribed product contains the correct potency. While cannabis legislation is evolving in multiple states, the testing requirements drafted to date are much less stringent than those mandated for pharmaceuticals, and vary among states where either medical or recreational marijuana has been legalized. Thus, consumers cannot be 100% sure of the effect of their cannabis product until after they ingest it, which can have some obvious unintended consequences. It is critical to measure potency in all dispensed products so consumers can be sure of what they are buying, its likely effects, and how much of a dose is necessary to achieve the desired effects.

#### **4. How are the Luminary Profiler and Beacon products different than other cannabis potency testing methods?**

Cannabis testing laboratories typically receive samples to process and measure using standard analytical techniques like liquid chromatography (LC), gas chromatography (GC), and mass spectrometry (MS), among others. Samples are typically dissolved into solvents like methanol or chloroform (LC), or combusted during the measurement (GC), both of which destroy the original sample. The lab compares the measurement of the unknown samples with those of synthetic, commercially available standards. The lab then provides the potency values over several days.

The Sage Analytics potency profiling devices are different because: 1) we provide systems that let anyone accurately measure their own samples on site, without having to send them anywhere, 2) the samples are measured intact using only light, without destroying them or altering them in any way, and 3) the results are provided within seconds. In general, the use of light for evaluating sample characteristics (called spectroscopy) provides a non-destructive, rapid, and environmentally-friendly method for measuring cannabinoid potency, without requiring hazardous solvents, compressed gases, time-consuming sample preparation protocols, or skilled technical researchers to develop methods, troubleshoot problems, or analyze the data, thereby reducing experimental costs and the use of consumables.

#### **5. How do optical measurements compare with analytical techniques like GC or LC?**

GC and LC have been in use for decades as standard analytical measurement techniques. Both techniques can be incredibly accurate, but require skilled, trained operators to add the appropriate art to the method development, troubleshooting, and data analysis. Unfortunately, these techniques can also provide erroneous results when not utilized properly, and there are a number of potential stumbling blocks to their use—even university labs full of PhDs can make consistent missteps that produce the wrong outputs. These techniques also require the sample to be destroyed, tens of minutes to generate a result, and extensive machine calibration and cleaning.

Optical measurement techniques like spectroscopy have advantages and disadvantages compared with GC and LC. The hallmark advantages are convenience, simplicity, and speed, as the measurements literally just require light to be shone onto the sample, where results can be deduced in seconds. And since it is shining light on the intact sample, the sample is not altered in any way and can be used or sold afterwards, as the case may be. When used correctly, these techniques can also be just as accurate as GC and LC. The primary disadvantage of optical measurement techniques is that they cannot measure absolutely everything—some materials and chemicals just don't comply, or are not in high enough concentration to be measured. In the case of cannabis potency, THCA/THC and CBDA/CBD can be accurately measured optically, as well as other relevant parameters such as moisture.

It is important to note that chromatography techniques are considered primary analytical methods, meaning they directly quantify the sample of interest. While some applications of spectroscopy can be considered primary measurement methods, in the case of the Luminary Profiler and Beacon products, data from a standard method is combined with the spectral data to develop models capable of accurately predicting cannabinoid potencies. Since the models rely on diligently produced reference data sets, the Luminary and Beacon products are considered secondary measurement tools.

## **6. What is near-infrared spectroscopy?**

Near-infrared spectroscopy (NIR) is the measurement of light at the very edge of the red spectrum that our eyes can see and slightly beyond. Light in this region of the spectrum interacts with the chemical bonds in molecules. By measuring the light intensity returned from the samples at each point in the spectrum, characteristic fingerprints can be measured quickly and accurately. NIR can be used to monitor both chemical and physical properties.

Diving deeper into the science, the NIR spectral region from approximately 700 to 2500 nm corresponds to overtones and combination bands of molecular vibrational absorption. The functional groups probed by NIR are predominantly those containing hydrogen bonds (O-H, N-H, C-H, S-H). Compared to mid-infrared spectroscopy, where fundamental absorptions arise, NIR can be used to measure thick samples with high water content, and its allowance for diffuse scattering permits its use in both transmission and reflectance geometries, vastly simplifying sample preparation and measurement.

## **7. What do Sage systems measure?**

Currently, we can measure total THC, THCA, total CBD, and CBDA. Although terpenes have evolved into a hot topic in cannabis analysis, Luminary and Beacon products do not currently evaluate terpene concentration.

## **8. Can we measure contaminants?**

Contaminants like mold, pesticides, and fungus cannot be reliably detected via the techniques we currently employ; therefore, at this time, Sage Analytics is focused on measuring the potency of cannabis and related products.

## **9. What cannabis products can the Luminary and Beacon measure, and what are those that it cannot?**

The Sage product line can measure potency in most cannabis products, from the cured buds and leaves, kief, and processed products including concentrates (shatter, wax, oil) and hash. They cannot measure the potency of MIPs (marijuana infused products, a.k.a edibles) since they contain other ingredients that could potentially interfere with the optical measurements and cause inaccurate results. In order to assess whether these types of products can be measured using Luminary Profiler and Beacon technology, Sage scientists would need to have specific knowledge of what the matrix ingredients are, to gauge how well the cannabinoid potencies could be differentiated from the other constituents.

## **10. How do the samples need to be prepared?**

It is strongly recommended that the samples be homogenized via grinding to reduce potential measurement errors. Cannabis trichomes contain the highest proportion of cannabinoids, contrasted with other portions of the plant like the leaf, seed, and stalk. If an area of high trichome concentration on the flower is preferentially evaluated using NIR light, measurement errors can occur. Likewise, errors in the analysis can occur if stems or other regions of the plant are evaluated, that do not contain any, or have distinctly low cannabinoid contents.

### **11. How much sample is required to obtain a potency measurement?**

Although there is not a required fixed mass of sample to measure cannabinoid potencies, users should ensure that the bud holder is completely filled with ground flower. Typically, using about 300 milligrams is enough. Once filled, the lid serves to tamp the plant matter. This compression is key to achieving reproducible analyses. Users should ensure that the measurement window is completely covered by the compressed ground flower, and that no light is seeping through.

Liquid samples and other concentrates should be evaluated using the disposable sample cells. About 100 milligrams of solid concentrates like hash, or 100 microliters of liquid concentrates should be enough sample to fill the small sample well on the inside of the disposable. The silver side of the disposable should be on the outside of the cell. Apply the sample to the small well, and spread using the wooden applicators contained in your Profiler Pack, or another equivalent implement. When measuring liquid samples that may be dark or opaque, it may be necessary to add a thinner disc of sample to the disposable sample cell, as highly darkened samples can prevent the reflected light from passing through the measurement window.

### **12. Can the system be portable for use in the grow house?**

Currently, the Luminary Profiler and Beacon can be used to evaluate cured plant matter in a grow house. Future Sage developments will enable live plants in a grow house to be evaluated directly on the plant, during all stages of the cultivation cycle.

### **13. Do room lights, grow lights, or sunlight interfere with the measurement?**

Since the samples are inserted into a small, dark sample chamber on the device, ambient light is blocked from interfering.

### **14. How much do Luminary Profiler and Beacon products weigh?**

- Luminary Profiler: 5.2 kg / 11.5 lb
- Beacon: 1.9 kg / 4.2 lb

**For more information visit: [www.sageanalytics.com](http://www.sageanalytics.com)**