

# Homogenization Best Practices in the Cannabis Industry

OMNI International, a PerkinElmer company



Global standards for cannabis quality have not yet been established, but many US states impose testing regulations to ensure cannabis-related products are ready for recreational consumption and medicinal use. Consequently, cannabis producers increasingly face stringent testing requirements of their products.

Testing requirements typically fall under these two categories: **potency** and **standard testing**.

**Potency** testing analyzes the concentration of the naturally occurring compounds within the plant. This process is critical for understanding the chemical profile of the product, primarily the concentration of the main psychoactive compound Delta-9-tetrahydrocannabinol ( $\Delta$ 9-THC), better known as THC. In addition to THC measurement, other compounds such as cannabidiol (CBD) and terpenes are quantified.

**Standard** testing checks levels of heavy metals, pesticide residues, mycotoxins and more. Through these tests, laboratories can ensure that finished goods are free of potentially harmful substances and are ready for consumption.

For reliable results, all cannabis samples must be representative of the total crop and ground prior to extraction. Reducing the sample size to a homogenous, fine consistency is critical to accurately measuring the chemical makeup of the plant.

This whitepaper describes the various methods for producing sample homogenates suitable for downstream laboratory analysis.

## HIGHLIGHTS OF THIS WHITEPAPER

- The role that homogenization can play in cannabis testing
- Best practices for the homogenization of cannabis samples
- The value of automated homogenization
- Common misconceptions around homogenization of cannabis samples
- Types of homogenizers

For research use only. Not for use in diagnostic procedures.



## HOMOGENIZATION FOR CANNABIS TESTING

Homogenization is the process of utilizing a physical or chemical treatment so that the structure of a substrate (solid or liquid) or a mixture of substances is made uniform, generally resulting in a smaller, narrower, and uniform particle size distribution.

Ensuring this uniformity is beneficial in two ways. Firstly, it ensures that compounds to be analyzed are equally distributed throughout the sample and the sample is considered “homogenous”. Secondly, the process of homogenization may serve to release analytes of interest from within the sample matrix ensuring they are available for subsequent extraction and measurement.

Recent state-wide measures to prevent bribery of labs includes random audits in which the state, already knowing the chemical makeup of a sample, sends it to a third-party laboratory to test and compare the results. In some cases, the sample has already been spiked with a substance; if the laboratory fails to detect it, the state could shut down all operations.

Another somewhat unscrupulous practice is “lab shopping”. A cannabis product is “shopped” around different labs until one provides the cannabis manufacturer with the test results it’s after. When people are able to test compliance samples at multiple labs and pick the most favorable result for sale, then it makes it very difficult for labs with integrity to survive.

Different cannabis regulations exist depending on the state. For laboratories testing samples from a variety of states, it’s critical to ensure that potency stays within legal limits and that no cross-contamination or carryover of testing equipment occurs. While many methods of homogenizing exist, only some meet the strict need for contamination prevention.

For both laboratories and cannabis producers, a reliable homogenization process is critical to the consistency of the end product. Knowing that a product is more potent than originally thought can also increase its selling price.

## BEST PRACTICES FOR HOMOGENIZATION

From CBD cartridges for vaping, to salves, lotions, edibles, and more, the cannabis market offers a wide selection of products to consumers. Without proper testing, consistency of product standards and potency can vary widely. The type of crop, age of the plant material, production process, and more can change the chemical makeup from one batch to another of a single product. Because of this variability, homogenization is crucial to developing – and replicating – a shelf-stable product.

Coffee grinders, mortar and pestles, milling machines, cryo-grinders, and more are all methods that have been utilized for cannabis sample homogenization; however, these methods are not consistent in their results and can pose a high risk of cross-contamination and carryover.

For the best results, laboratories should utilize a high speed, single use, disposable tube [homogenizer](#) to break down the sample in a matter of seconds. Disposable vessels with grinding media provide a contamination-free alternative to other, less homogenous methods of grinding or milling.

[High speed and automated homogenizers](#) fully process material within single-use tubes in less than 90 seconds, providing a pure and consistent sample for testing. While longer homogenizing is possible, research [here](#) has shown that past 90 seconds, no significant difference in homogenization is evident (Zachary P. Morehouse 2021).



With proper homogenization, laboratories have seen a 25% increase in their limits of detection. Automated homogenizers use active grinding media to break down a cannabis product into a fine, uniform sample in just 15-90 seconds (Zachary P. Morehouse 2021). And with separate, automated homogenizing vessels, laboratories can process multiple samples at the same time without risk of cross contamination. High pressure homogenizers and sonicators are also useful for creating nano emulsions by homogenizing the CBD and oil blend that goes into edibles, capsules and vape cartridges.

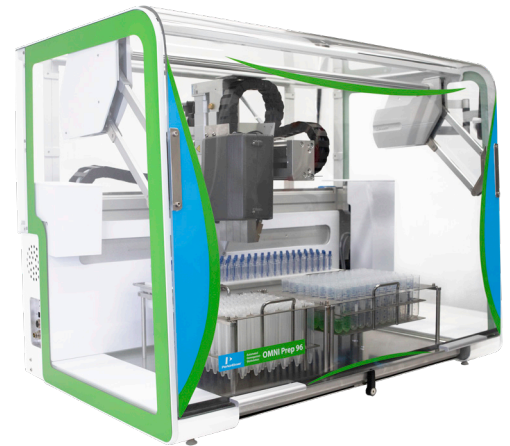
## BEST PRACTICES CHECKLIST

- ✓ Use single-use vessels to grind material
- ✓ Use – or employ a lab that uses – a high speed homogenizer
- ✓ Ensure material is homogenized for 90 seconds prior to testing
- ✓ Frequently test product for consistency
- ✓ Never use coffee grinders or milling machines that can cross-contaminate samples
- ✓ For best results, use an automated homogenizer

## WHY AUTOMATION?

[Automated homogenizers](#) provide more consistent, superior results in less time. Specifically designed to provide the same generator probe movement as a manual, handheld homogenizer, automated homogenizers incorporate [motor heads capable of both vertical and horizontal intra-tube movement](#).

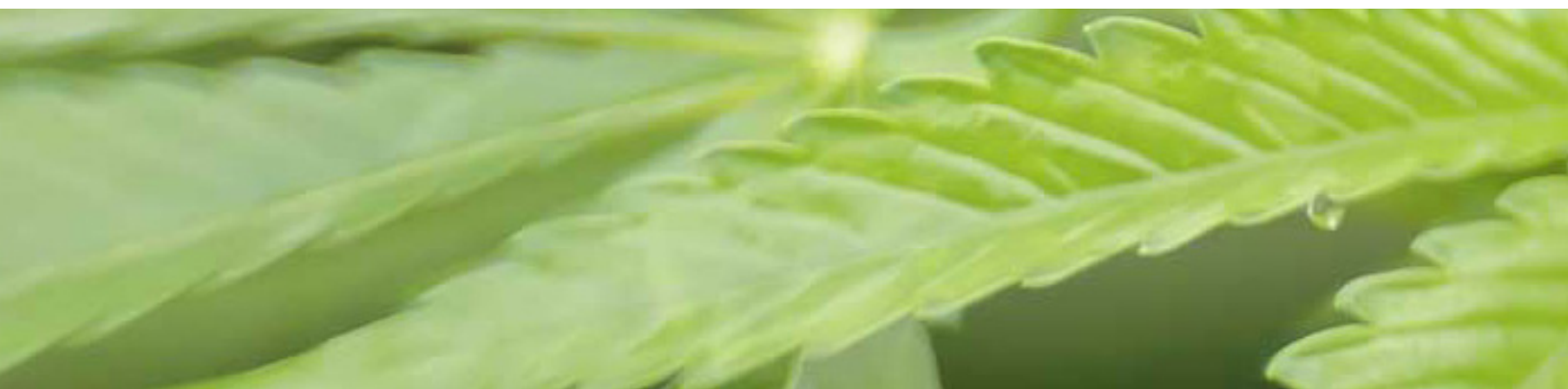
This technology is equipped with brush-less motors for nearly maintenance free (and ultra-quiet) operation and ensures reproducibility and consistency across all samples.



## COMMON HOMOGENIZATION MISCONCEPTIONS

The psychoactive components of cannabis, namely THC, are released with heat. A common misconception is that homogenization produces heat that can decarboxylate the sample, leading some cannabis producers to avoid this method of testing (O'Driscoll 2019). However, homogenization creates no significant thermal reaction and will not degrade the psychoactive chemicals within a cannabis sample.

While some devices designed to mill or grind can produce heat, no homogenizer manufactured by OMNI International will reduce the THC content of the sample if operated appropriately (Zachary P. Morehouse 2021). On the contrary, many cannabis-related products are made more stable with homogenization. A combination of sonicating and high pressure will homogenize many CBD products and oil blends used with edibles and capsules, allowing the product to reach the bloodstream faster due to the in reduction in particle size. However, OMNI does sell an [optional cryo cooling unit](#) for the Bead Ruptor homogenizer series should there be any decarboxylation concerns though it's intended more for cryomilling gummies, other edibles and other samples that are difficult to homogenize.





## HOMOGENIZER TYPES

There are four main types of homogenizers used in the cannabis industry:

### BEAD MILL HOMOGENIZERS

For the cannabis industry, [bead mills](#) provide rapid grinding of cannabis flowers and edibles for downstream extraction of cannabinoids, terpenes, and flavonoids.

Overall, bead mills provide a fast, easy-to-use, and consistent method for grinding, lysing and homogenizing solid human, animal, and plant samples prior to molecular extraction. [The equipment works by using rapidly accelerating beads of various sizes and composition within a sealed tube to dissociate a sample upon impact.](#)

Because it is a sealed system with no probes, bead mills significantly reduce the risk of samples becoming aerosolized and there is reduced risk of cross-contamination. This makes it a good choice for preparing samples that pose a risk of infection or contain other hazardous materials. Upon repeated impact with the beads, the cellular and connective tissue breaks down to release analytes. Because the tubes are prefilled, however, bead mill homogenizers have less flexibility around sample size.

Front-loading bead mills minimize leak risks and makes it easy to see and access your samples to reduce the risk of missing something, and sealed tubes reduce the risk of samples becoming aerosolized.

### AUTOMATED HOMOGENIZERS

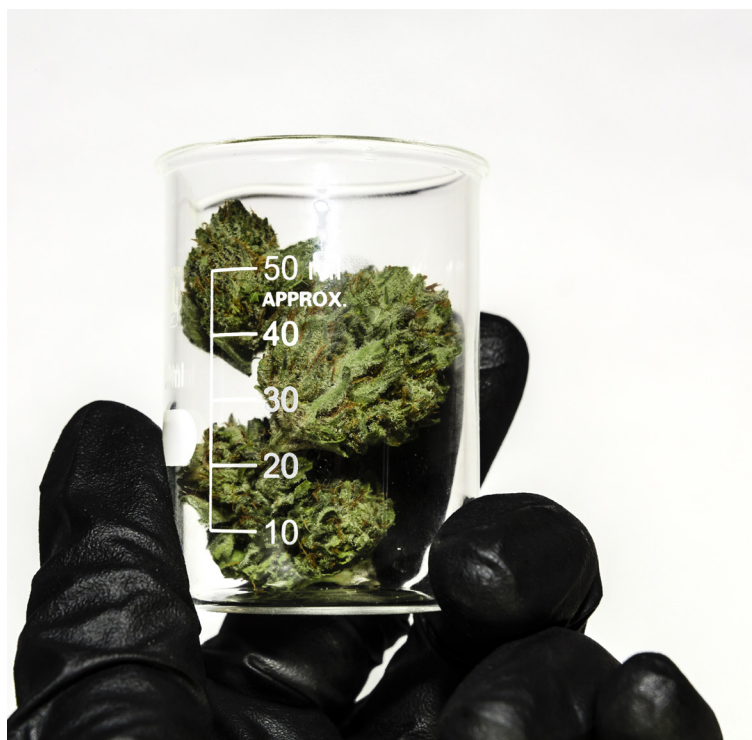
For labs or producers that require automated tools to meet large-scale sample preparation demands, [automated homogenizers](#) simultaneously process dozens of samples with microprocessor controls that can capture and save methods/protocols for repeatability, and the ability to walk away during processing large batches so you can work on something else.

Some automated homogenizer models are also equipped with [workflow software](#) that enables you to create and deploy methods in minutes through an interactive GUI to ensure hands-free sample preparation.

Disposable probes and sealed vessels also reduce the risk of cross-contamination and carryover.

### SONICATORS

Also known as [ultrasonic homogenizers](#), sonicators provide homogenization by creating forceful cavitation and ultrasonic waves to blend, mix, emulsify, disperse, and stir liquid samples. Sonicators impart high-energy over a small area and are ideal for samples with very small particles. Sonicators are well-suited for disintegrating or shearing most cells, such as bacteria, DNA and RNA, and are also useful to create cannabis nano emulsions.



Unlike traditional grinding and cutting techniques, a sonicator uses a tip to rapidly vibrate and generate bubbles in the surrounding solution. This process can generate a significant amount of heat so may not be the right option for temperature-sensitive samples. Due to high-powered sound waves, sound abatement chambers or other acoustic enclosures are highly recommended.

### ROTOR-STATOR MIXER HOMOGENIZERS

These hand-held or free-standing machines are standard equipment in any lab that needs a standard process for breaking open cells and homogenizing tissue with a probe that also may not have the budget for a bead mill. [Rotor-Stator homogenizers](#) are well suited for liquid or soft samples that need to be mixed or emulsified. High shear versions can process tough samples quickly and reduce exposure to heat, which can degrade samples.

Rotor-stator homogenizers also can hold the sample securely in place while spinning the rotor at extremely high speeds, up to 75,000 rpm. Probes with saw-toothed heads help break down fibrous samples and other soft solids. The equipment may produce a moderate amount of heat into the sample, mostly due to frictional forces.

To learn more about finding the right homogenizer for your cannabis testing, [contact the homogenizing experts](#) at OMNI International, a PerkinElmer company – send us a sample, we'll process it at no charge, and provide you with a full report with photographs.

### **About OMNI International, a PerkinElmer company**

OMNI is a leading global manufacturer and distributor of laboratory homogenizers and sets the industry standard with an unmatched commitment to outstanding product design, reliable performance and a uniquely diversified solution-based product line.

Since 1956, the name OMNI has been synonymous with laboratory homogenizers. Referenced in over 10,000 peer reviewed scientific articles, OMNI International homogenizers can be found in laboratories worldwide and are counted on for years of trouble-free operation.

OMNI products are designed and built in the United States under ISO 9001 Quality Management Standards. More: <https://us.omni-inc.com>

### **REFERENCES**

Zachary P. Morehouse, G. L. R., Caleb M. Proctor, Akelachi Okparanta, Will Todd, Derrick Bunting, Taylor White, Steven Perez, Blessida Miller, Veronica Colon, Brandon Easparro, James Atwood, YoungChul Park & Rodney J. Nash (2021). "A proposed method of sample preparation and homogenization of hemp for the molecular analysis of cannabinoids." SN Applied Sciences volume 762(3).

O'Driscoll, A. (2019). "The Forces Involved in Homogenization Explained." Homogenizers.



**PerkinElmer, Inc.**  
940 Winter Street  
Waltham, MA 02451 USA  
P: (800) 762-4000 or  
(+1) 203-925-4602  
[www.perkinelmer.com](http://www.perkinelmer.com)



**OMNI International, a PerkinElmer company**  
935 Cobb Place Blvd NW  
Kennesaw, GA 30144 USA  
P: (800) 766-4431 or  
(+1) 770-421-0058  
[www.omni-inc.com](http://www.omni-inc.com)

---

**For a complete listing of our global offices, visit [www.perkinelmer.com/ContactUS](http://www.perkinelmer.com/ContactUS)**

Copyright ©2022, PerkinElmer, Inc. All rights reserved. PerkinElmer® is a registered trademark of PerkinElmer, Inc. All other trademarks are the property of their respective owners.

08/05/2022