



WHITEPAPER

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**BHO vs. CO2:
THE DEFINITIVE EXTRACTION
COMPARISON**



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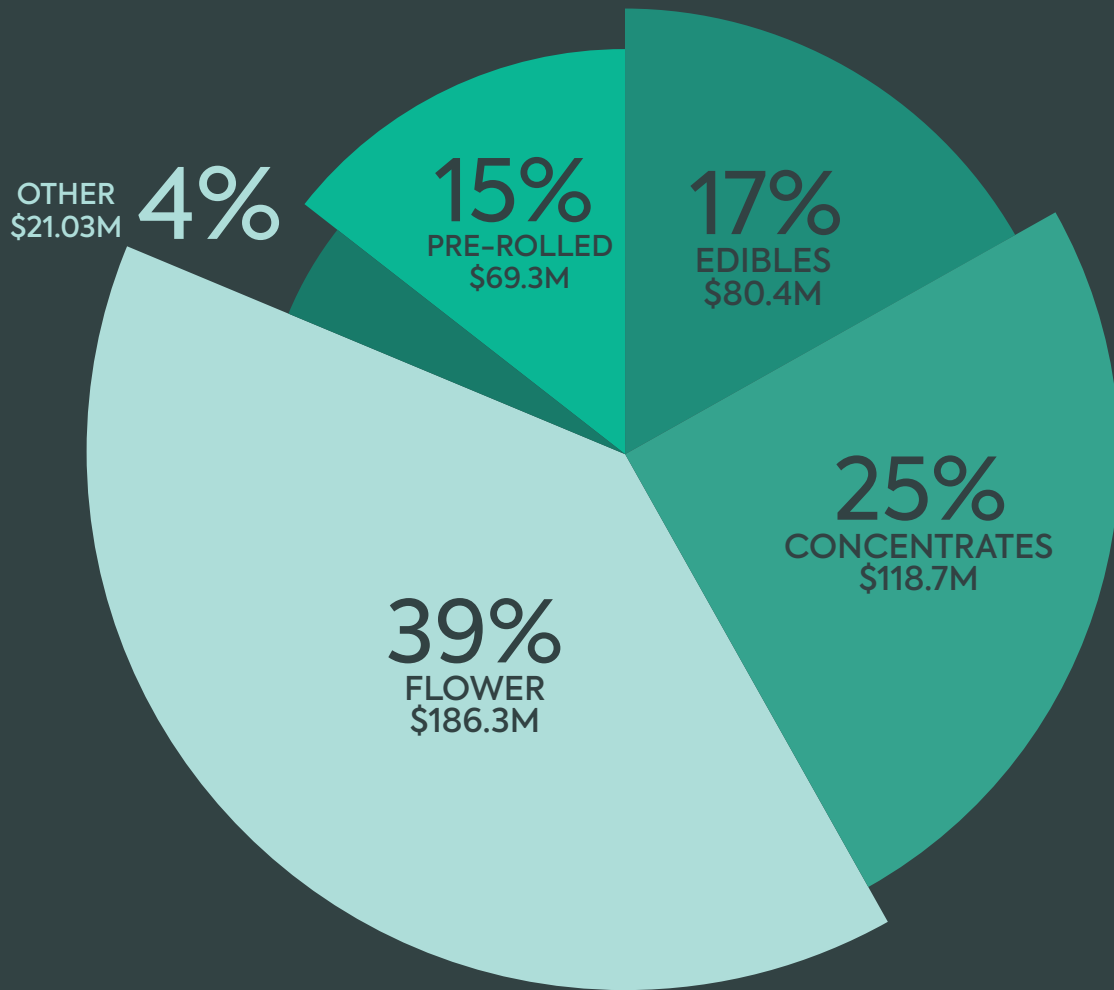


CO2 vs. BHO: The Definitive Extraction Comparison

Cannabis concentrates are a must-have product offering for brands looking to reach a growing cannabis consumer base. Concentrated cannabis compounds can be used to make a wide range of medical and recreational products, such as topical ointments, edibles, capsules, transdermal patches, suppositories, and small-batch extracts.

Concentrates make up more than 25% of the retail cannabis category, and it is the fastest growing segment; concentrates alone are expected to grow more than 17% per year, reaching \$6B by 2026.

DOLLAR SALES BY SUB CATEGORY



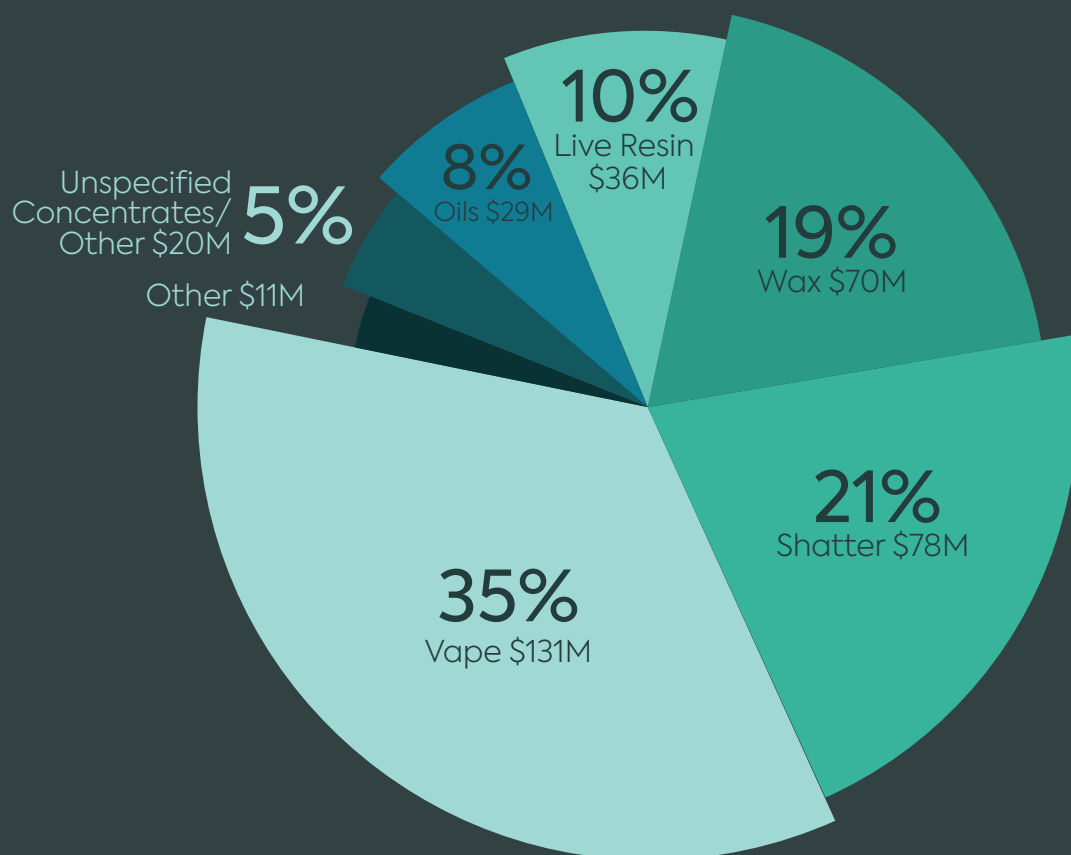
Manufacturers looking to compete in the growing cannabis space need a scalable extraction solution that considers their input material, estimated throughput, equipment capacity, state regulations, and product type to gain an edge in the highly competitive, highly profitable “green rush” environment.

Solvent Is King: SOLVENT-BASED EXTRACTION

Solvent-based extraction is the most viable, scalable, and efficient method for commercial production of cannabis concentrates. While there are a litany of options for those looking to scale production, there are three main categories:

- Butane or Propane Extraction (BHO/Hydrocarbon)
- Supercritical CO2 Oil Extraction
- Ethanol Extraction

SALES BY SUPER CLASS



Both butane and propane are considered “hydrocarbons” and the encompassing extraction method associated with them is called Hydrocarbon Extraction (HCE). For the purposes of this paper, we use the terms BHO and HCE interchangeably to describe any extraction method that utilizes butane or propane as the primary solvent.

CO2 Extraction: HISTORY & PERFORMANCE

Overview

CO2 extraction, also known as supercritical CO2 extraction, is a historically popular method used to extract cannabis compounds from raw cannabis material or trim. The extraction process is also used in pharmacology, cosmetology, and many other industries. Closed-loop CO2 equipment uses the naturally occurring, odorless, and colorless CO2 compound that is capable of dissolving cannabis resin from the plant. Using critical temperatures and pressures, the CO2 compound converts into a supercritical state and adopts gas and liquid-like characteristics.

How It Works

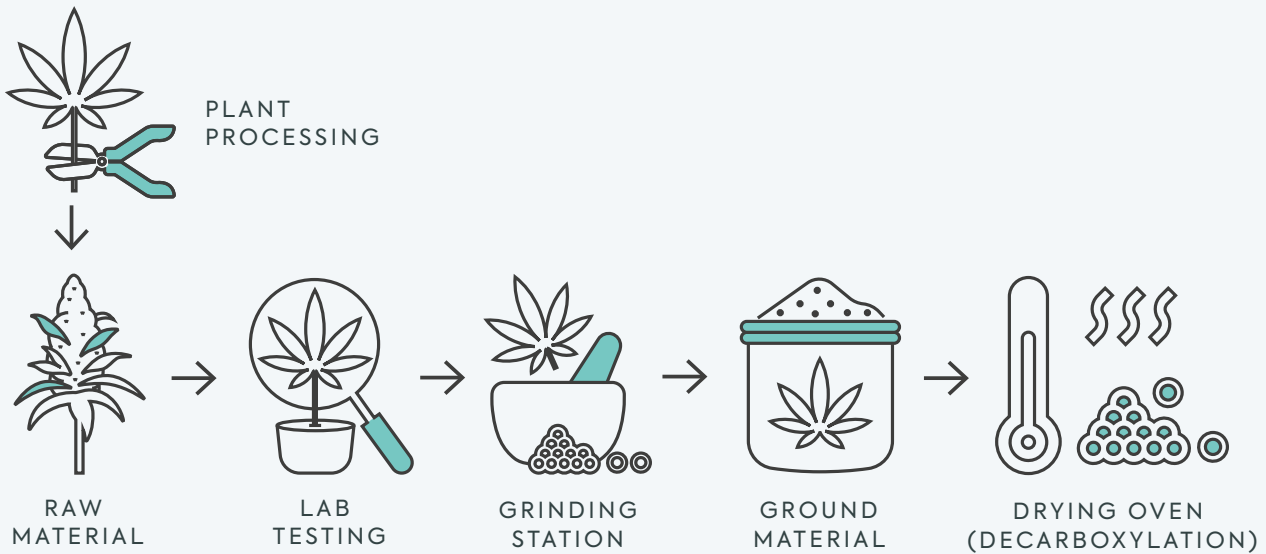
The unique properties of supercritical CO2 allow it to act like a gas by filling in every nook and cranny of an extraction tube while also retaining a liquid-like density that is powerful enough to wash away cannabinoids and terpene compounds. The supercritical CO2 fluid can be passed over the raw material to strip away the valuable resinous trichomes. The compound is “tunable” so that much of the waxes and lipids aren’t extracted with cannabis oil. Unfortunately, the high temperatures and pressures used with this method can degrade many terpenes, thereby significantly altering a cultivar’s unique chemical profile.

High temperatures and pressures used with CO2 can degrade many terpenes, which can significantly alter a cultivar’s unique chemical profile.

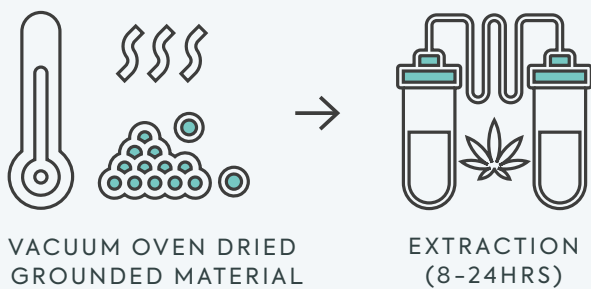
In the highly competitive cannabis concentrates market, producers are looking for any possible advantage. Supercritical CO2 extractions are often perceived as safer, a talking point that many CO2 extractors lean on heavily to differentiate their product. As those arguments are debunked, however, producers who can demonstrate product quality and diversity will stand out in a crowded field.

MAKING CO2

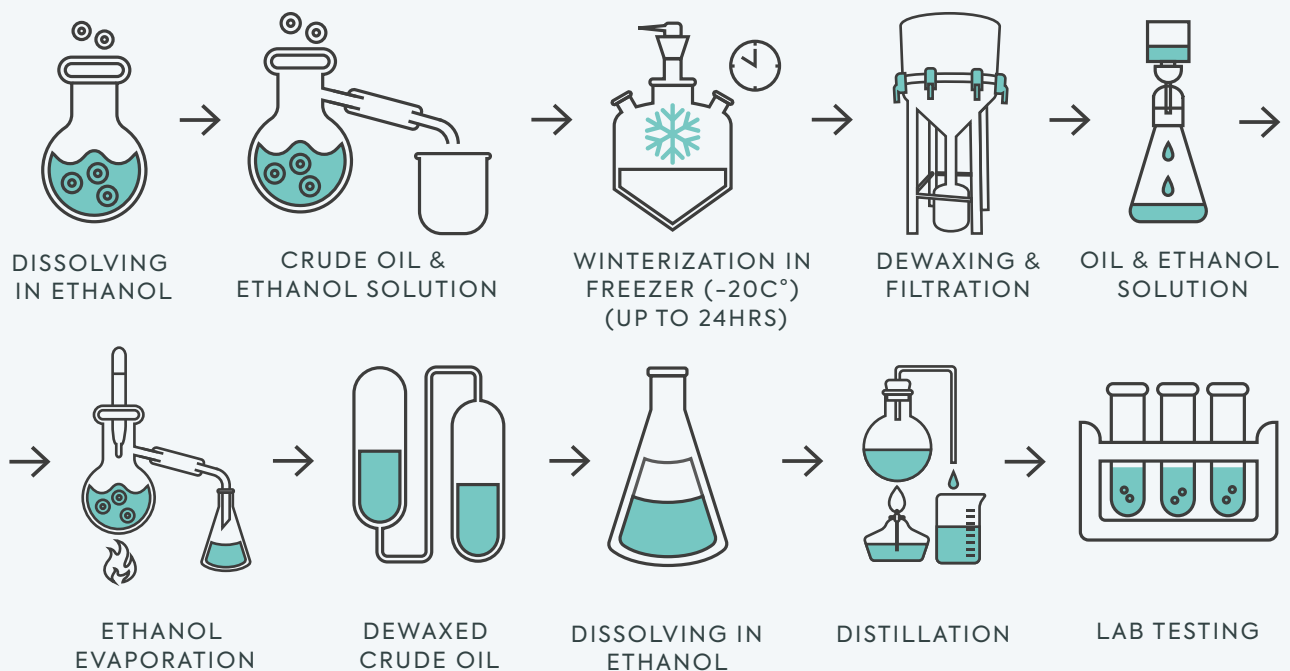
PRE-PROCESSING



CO2 EXTRACTION



POST-PROCESSING



END PRODUCTS:
DISTILLATE FOR VAPES, TINCTURES, EDIBLES, AND OTHER PRODUCTS

Pros and Cons of CO2 Extraction

The CO2 extraction method is often favored by some for its general affordability, non-toxicity, and eco-friendliness. Despite these selling points, CO2 extraction requires time-intensive post-processing like winterization and fractional distillation to create a pure product. Additionally, for many manufacturers, the high startup cost for CO2 extraction equipment — compared to throughput — can be a dealbreaker.

PROS

Automated equipment

“Tunable” solvent

Ability to perform (rudimentary) fractionation in the extraction process

CONS

High capital cost & low throughput in comparison

Long extraction process (up to 24 hours for a single batch)

Requires significant purification post-extraction to create a consumer-ready product

Product must be winterized using a secondary solvent (generally ethanol)

Product has to be dried (terpene loss of 30-80%)

Often requires post-production flavor additives (BHO sauce or others)

BHO/HCE Extraction: HISTORY & PERFORMANCE

Overview

Hydrocarbon extraction uses butane or propane to dissolve trichomes. This method is one of the most frequently used and effective extraction methods, and not just for hemp or cannabis.

Hydrocarbon extraction (HCE), a.k.a. BHO extraction, has its roots in a connoisseur class of experimenters looking for the highest-quality concentrate. Today's extraction machines use peer-reviewed equipment in a C1D1 environment that meets rigorous standards from the American Society of Mechanical Engineers and The American Petroleum Institute.

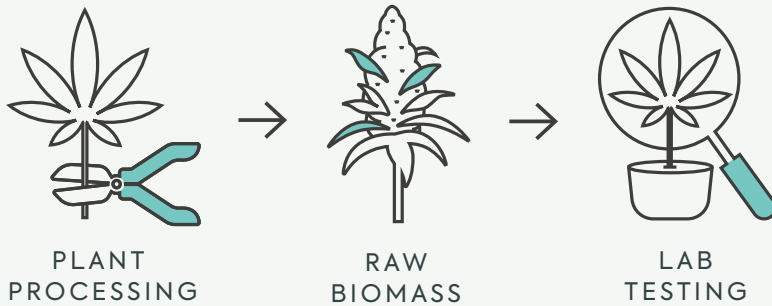
How It Works

The hydrocarbon extraction process involves placing the hemp material into a pressure vessel. Butane or propane is introduced to the vessel to extract the cannabis oils in a quick and efficient manner. The cannabinoid-rich solution is then moved to another vessel where butane and propane are separated from the oil at low temperatures. After the butane has been recovered back to the supply tanks, a final purge can leave behind a pure and potent product. Unique refinement techniques can produce a wide range of textures, such as vape pen oil, live resin, and shatter.

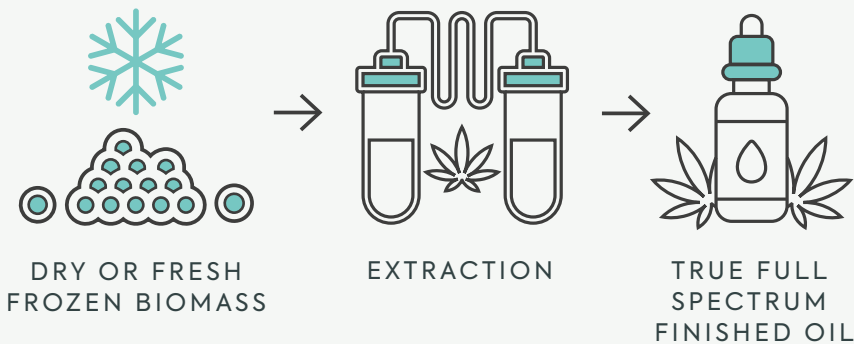


MAKING BHO/HCE

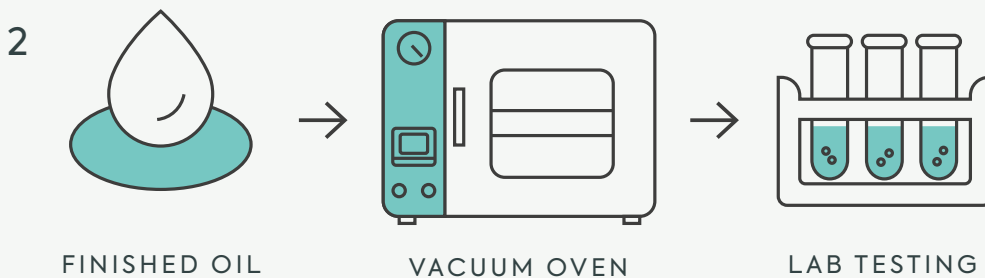
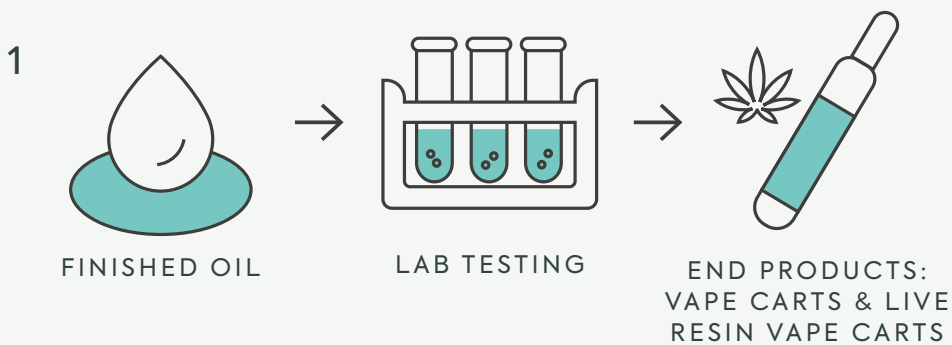
PRE-PROCESSING



BHO EXTRACTION



POST-PROCESSING



END PRODUCTS:

DABS, SAUCE, SHATTER, CRUDE, LIVE RESIN, DIAMONDS,
TINCTURES, TOPICALS, AND OTHER PRODUCTS

Pros and Cons of BHO Extraction

BHO can create a wide range of cannabis concentrates, including shatter, wax, crude oil, hash, crumble, live resin, terp sauce, and more. Consumers that are looking for distillates or cannabinoid isolates can find premium BHO-extracted concentrates. Cannabis connoisseurs looking for a robust flavor profile can also find their desired product with BHO-extracted terp sauce comprised of crystallized cannabinoids and syrupy terpenes.

PROS

Full spectrum

Zero leftover solvent

Terpene retention

Lowest risk of solvent pollution in consumer products

High diversity of end products

Throughput (process a batch in less than an hour)

No need to replicate the grower's original intention with additives

CONS

Facility infrastructure cost

Regulatory compliance

CAPTURING THE ESSENCE

Consumers are increasingly searching for products that capture the essence and complete chemical lineup of a strain. As they become more educated about cannabis and hemp, their product search goes beyond CBD into minor cannabinoids, terpenes, and flavonoid territory. For example, products such as vape cartridges or sublingual tinctures often preserve the strain's original terpenes to provide users with a synergistic and flavorful experience. This allows consumers to feel the full effects of a specific strain.

If I extract a strain - Ruutz, for example - with another solvent, I have to replicate the grower's original intention with additives. HCE is the only way to honor the intent of the grower... Whenever you talk about individual strains of cannabis and you want to translate that into a finished product. When you maintain the terpenes at the level that only BHO can provide, it means that the plant can perform as it was engineered to (entourage effect, strain-specific benefits, etc.).

Kyler Buck,
CO-FOUNDER OF LUNA TECHNOLOGIES

BHO/HCE equipment completely eliminates the risk of leaving behind residual solvents in the finished product — and in a shorter amount of time than CO2 extraction. It has been established as the leader across use of inputs, diversity of outputs, ease of post-processing, taste, smell, and resulting price point.



**10 EXTRACTOR
INCREASES
CAPACITY BY 800%**



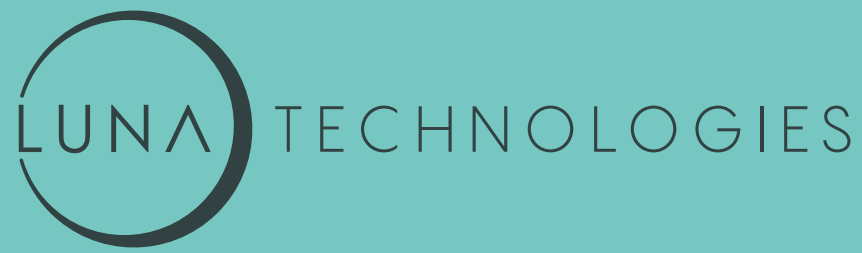
READ THE CASE STUDY

Conclusion: **THROUGHPUT + QUALITY = BHO**

CO2 extraction is fine. It is a generally safe and effective solvent that can more or less do the job of extracting cannabis-derived concentrates at scale. But as the market becomes more competitive, only state-of-the-art BHO and HCE extraction systems like Luna Technologies' IO Extractor are capable of meeting the competing demands of throughput, product quality, product diversity, process efficiency, and safety. If you are ready to take your manufacturing capabilities to the next level, reach out to Luna Technologies to find the right BHO solutions for your hemp extraction needs.

As the demand for clean and potent extracts grows, so, too, does the need for efficient, automated processes. Luna Technologies is proud to be a leader in the field of high-throughput, fully automated BHO and hydrocarbon extraction equipment.

GET IN TOUCH



www.lunatechequipment.com