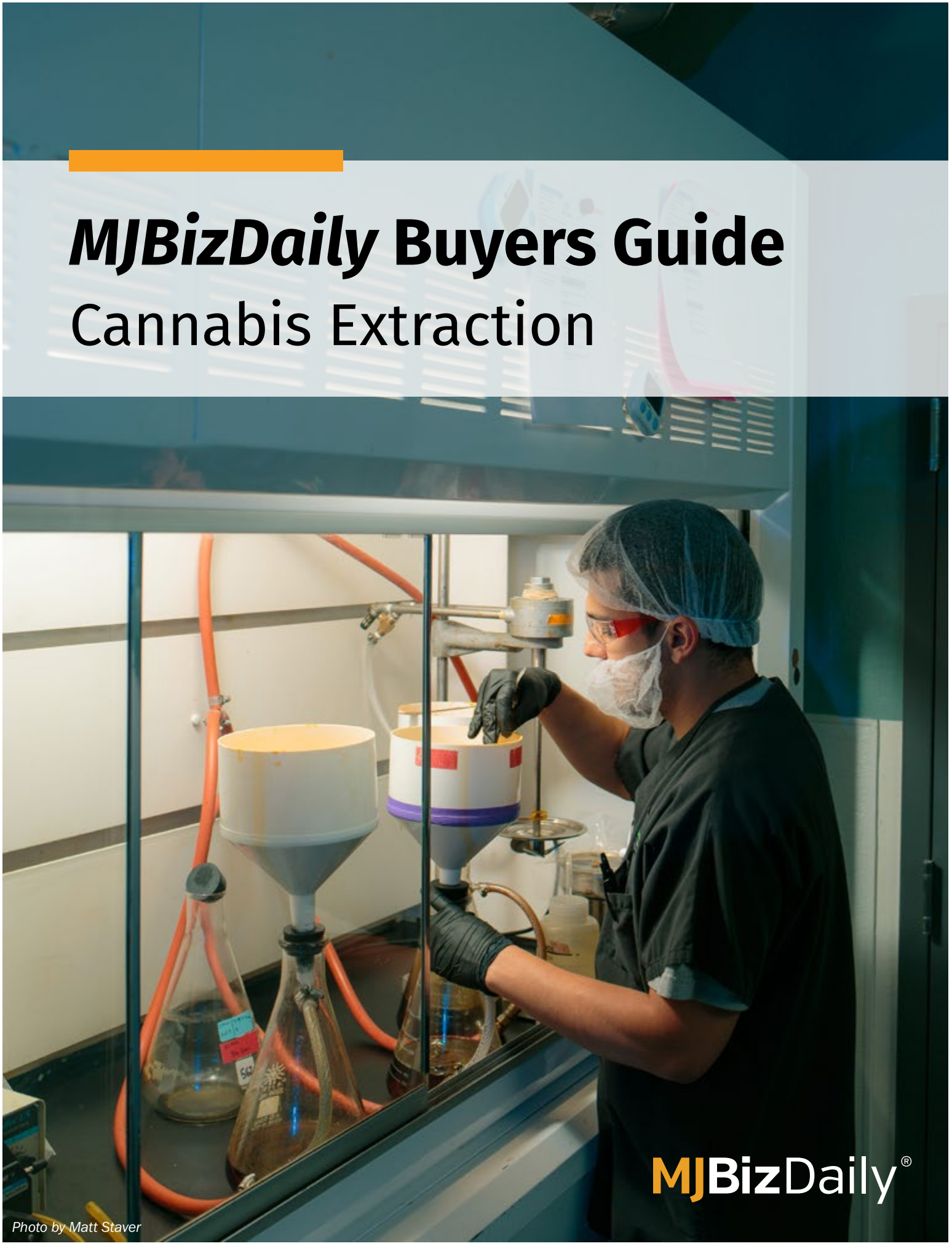
MJBizDaily Buyers Guide

Cannabis Extraction



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INTRODUCTION

Laura Drotleff
MJBizDaily

In cannabis, there aren't a lot of set rules and standards, so many processors and extractors have developed their own as they've gone along.

Because there are several different extraction methods available—both with and without solvent—extractors, along with anyone linked to the all-important extraction process, need to be keen on the terms and equipment involved and the products that result.

That's why we have developed the *MJBizDaily* Cannabis Extraction Buyers Guide, part of a series of resources designed to help connect the buyers who are in the market to purchase cannabis extraction equipment and products with the sellers who offer them and provide the technical know-how and service to help their clients function at the highest level.

While connecting buyers and sellers is a key objective, so is education. The Cannabis Extraction Buyers Guide also includes content from processing experts who have been immersed in the cannabis market and have firsthand knowledge of the ins and outs of the extraction process.

They share insights on:

- Considerations for choosing a cannabis extraction system.
- Choosing between solvents and solventless extraction.
- The most efficient cannabis varieties for extraction.
- Extraction costs.
- Safety precautions.

We hope that the information you find in these pages helps you better understand the complexities of cannabis extraction and enables you to make profitable decisions for your business.

Kudos and thanks to our contributor Georgie Smith for her work on this project.

If you have any questions or want to provide feedback, please contact me at **laura.drotleff@hempindustrydaily.com.**

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CHOOSING A CANNABIS EXTRACTION SYSTEM

Part of the beauty of the cannabis plant is its versatility. There are countless ways to extract, process, press, distill and refine cannabis into wholesale and retail products.

Rapid progress in innovation, scale and quality has marked the last few years of the extraction market, as more U.S. states legalize medical and recreational cannabis and the industry continues to expand. Valued at $7.3 billion in 2019, the global cannabis extraction market—including both marijuana and hemp extraction—is predicted to reach $28.5 billion by 2027, **according to a market analysis by Grand View Research.**

As extraction technology has evolved and matured, extraction processes once relegated to small, home-based processors have scaled up, and methods once considered dangerous have become manageable with appropriate safety precautions.

But versatility doesn't simplify decision-making about which extraction equipment to choose for your business objectives, no matter the scale of your operation or your goals.

The good news is there are many valid approaches to choosing an extraction methodology, according to Casey Flippo, CEO of two Arkansas-based cannabis extraction companies—Natvana LLC, a hemp extraction facility using cryogenic ethanol extraction, and Dark Horse Medicinal, a medical marijuana processor using butane hash oil (BHO) hydrocarbon extraction.

Flippo and other cannabis extraction professionals consulted for the 2021 *MJBizDaily* Cannabis Extraction Buyers Guide recommend that extractors evaluate the following factors as they research extraction processes:

- Types of cannabis extraction methods.
- Brand goals.
- Location and local regulatory constraints.
- Hemp versus marijuana.
- What happens post-extraction.
- Consulting resources.
- Market trends.
- Types of cannabis extraction processes

Four principal methodologies dominate the extraction marketplace, each with pros and cons:

Carbon Dioxide Extraction—A method using cooled and pressurized liquid CO_2 to dissolve oils out of cannabis plant material.

- Pros: A relatively safe method producing a high-quality product that retains most of the desirable compounds in cannabis with no residual contaminants.
- Cons: Slow extraction requiring a lot of processing post-extraction. Requires the most expensive equipment, which is also costly to maintain. Equipment may require a specially trained technician.

Hydrocarbon Extraction—A solvent-based process that uses petroleum-based fuels (most commonly butane) to act as a solvent stripping desired compounds out of plant material.

- Pros: Quick extraction process that produces a highly refined, potent extract suitable for many cannabis products. Less expensive than CO_2 to purchase and maintain.

A cannabis extraction equipment buyer's checklist

What to Know and What to Ask

Ask yourself:

- ☐ What does my brand represent?
- ☐ Does this extraction process support my brand?
- ☐ Is quality or quantity more important to the brand?
- ☐ What market outlet does my product have?
- ☐ How much post-extraction processing is needed?
- ☐ After initial set-up costs, how well financed is my business?
- ☐ Can we afford to pay higher labor costs for trained professionals?
- ☐ What's the ultimate goal for my cannabis extraction business?

Ask extraction equipment manufacturers:

- ☐ What safety elements are required for your equipment?
- ☐ Have you set up a processing/extraction system locally?
- ☐ What rules and regulations govern your equipment?
- ☐ What facility design elements are recommended with your equipment?
- ☐ What post-extraction equipment do you recommend and why?
- ☐ What kind of maintenance is required for your equipment?
- ☐ What parts most commonly break and how do you order and replace those parts?
- ☐ What kind of technical and customer service do you offer with purchase?
- ☐ How much energy does your system require?

Don't be afraid to:

- ☐ Get multiple quotes.
- ☐ Talk to fellow extractors.
- ☐ Hire a consultant.

- Cons: The solvents used are highly flammable, making this the most dangerous process. A safe facility can be expensive to set up and maintain. Hard to scale for larger volumes because of restrictions on how many solvents can be in the facility, although advances in solvent recovery technology are changing that.

Ethanol Extraction—A process that soaks cannabis material in ethanol (grain alcohol) to separate the cannabinoids from the plant material.

- Pros: Quick, easily scalable process that is inexpensive to set up and maintain, and the equipment and solvents are readily available.
- Cons: Destroys many of the desirable secondary compounds in the cannabis plant like terpenes and flavonoids. It is flammable, requiring appropriate safety equipment like fume hoods.

Rosin Extraction—A solventless extraction method that uses high pressure and temperatures to squeeze resin out of cannabis plant material.

- Pros: The safest method of extraction because it doesn't use solvents, which is desirable to many consumers in the high-end boutique market.
- Cons: Traditionally not considered scalable for volume production, although new equipment advances allow for much larger-scale rosin extraction facilities.

There are a few lesser-known extraction processes in cannabis, such as cold-pressed extraction, a natural method used to make essential oils and even olive oil. But these tend to be relegated to small-scale boutique or organic markets because of low throughput efficiencies.

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There are also multiple filtration, distillation and formulation processes used after (and in some cases before) extraction that play into decision-making and ultimately into a processing setup, as a processor moves past extraction and into making products. In many cases, the extraction method helps determine what other processes are needed or possible and, ultimately, what cannabis products can be made.

UNDERSTAND YOUR BRAND GOALS WHEN PICKING AN EXTRACTION METHODOLOGY

The first thing a potential processor must think about is what their brand represents and what kind of volume they hope to achieve, said Liz Geisleman, chief brand officer at 710 Spirits Extraction Products, a Colorado company providing solvents and supplies to extraction labs.

"Are you making Smirnoff or are you making Belvedere?" Geisleman asks.

Nick Tanem, the founder of Essential Extracts, a California-based solventless extraction company selling extract and consulting on new solventless extract installations, agrees that considering the extraction process in your branding is key.

There is room in the market for even a small, niche farmer or extractor, assuming they put work into branding and marketing, Tanem said.

"Branding and recognition are huge. If you haven't been working on that for the last 10 years, get on it now. You don't have to blow up your Instagram, but start thinking about your specific technology, your specific SOPs tied into a brand that you can package."

Geisleman recommends butane hash oil (BHO) or hydrocarbon extraction for smaller artisanal producers because it gives a cleaner taste profile, or rosin extraction for organic production or high-end solventless products.

Different Cannabis Varieties for Different Extraction Systems

Not all cannabis varieties are created equal when it comes to the type of extraction system used.

Nick Tanem is the founder of a well-known solventless extraction company, California-based Essential Extracts. Yet he also runs a butane hash oil (BHO) extraction process in his facility along with his rosin extraction system.

"There are some strains that just aren't the best suited for solventless processing, but after purchasing them and doing some trial runs, I didn't want to lose money. So now we cycle all the material that is not good for solventless into our hydrocarbon rooms," Tanem said.

Solventless products command a premium at the retail level but yields still make a difference in profitability. Tanem's breakeven is at least 3.5% cannabinoid yield for solventless extraction.

The determining factors for cultivars appropriate for solventless extraction seem to be the oil-to-wax ratio within the trichome structure and what's called the "weak neck trait," Tanem said.

In some cultivars, the trichome head and material come off easily in the agitation process. In other cultivars, they "just don't want to release the head."

A variety like Blue Dream, for instance, "doesn't wash at all," Tanem said. He'll get 1% to 2% cannabinoid yields in the solventless process, but if he runs it through his BHO extractor, he sees 22% yields.

With other varieties, he might see as high as 7% to 8% yields in solventless extraction.

For volume production, Geisleman suggests ethanol processing or BHO. CO_2 extraction, which initially took off as a safe extraction process for creating a versatile oil useful in many product applications, is becoming less popular, Geisleman said, because of the equipment's initial setup and maintenance costs.

WHAT ARE YOUR LOCAL REGULATORY CONSTRAINTS?

If you're processing marijuana, check to make sure marijuana is legal in your state, Geisleman said, but your second question should be, "How can I process safely and legally?"

Different states and municipalities have varying regulations and familiarity with extraction methods. Most fire departments are familiar with ethanol extraction because of breweries, but may not have seen more potentially dangerous processes like hydrocarbon extraction, Geisleman said.

"When you see some of these big operations, it's pretty scary, especially from a fire department standpoint," she said.

Solventless Versus Solvent-free Cannabis Products

Solventless and solvent-free are not the same thing in cannabis extraction.

Consumers are becoming better educated about the differences in extraction, and it is important that manufacturers communicate clearly about how their products are made, said JD Garrick, managing partner of Illuminated Extractors, a Colorado company selling hydrocarbon extraction equipment.

"Even if a process uses solvent, it should still be a solvent-free product once it's sold to the consumer," Garrick said.

The 2019 vaping crisis caused dozens of deaths and over 2,600 hospitalizations that were blamed on additives in flavorless THC distillates with added artificial flavors. Since then, consumers have placed more emphasis on the chemicals used in the extraction process. This has increased demand for cannabis products made without solvents, or evidence that the final product for consumption is free of any solvents used in the manufacturing process.

Solventless products are extracted manually, without the use of a chemical solvent.

Rosin extraction, which uses heat and pressure, is the most commonly used solventless extraction method.

Solvent-free products, on the other hand, are made using extraction processes that include some sort of chemical solvent—ethanol, butane or propane are some of the more common. After extraction, the chemical solvent is distilled out.

Carbon dioxide is technically a solventless product through the extraction process. But because it creates a crude oil thick with leftover plant material, which is typically winterized in ethanol as part of post-extraction processing, a solvent is used on the product.

CO_2 extractors that market their products as solventless but went through a winterization process are lying to the consumer, Garrick said.

"They're telling the consumer this is solvent-free, but they are still winterizing in ethanol," Garrick added.

"If somebody wants to have a solventless product, they should have all the facts."

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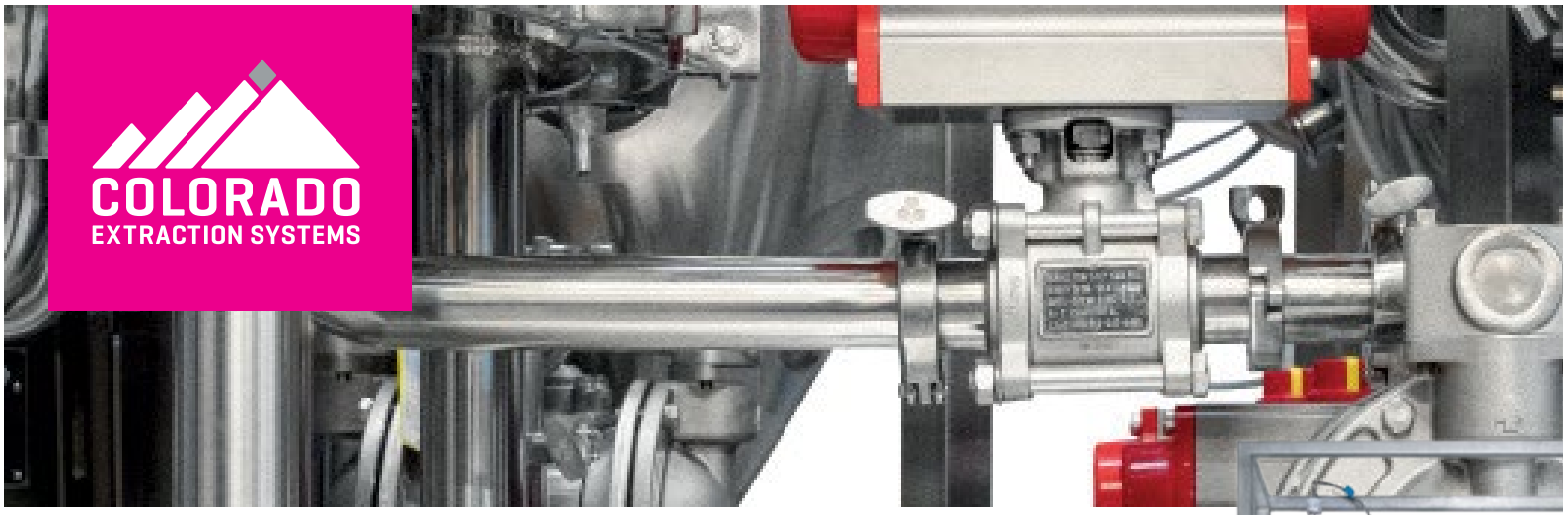

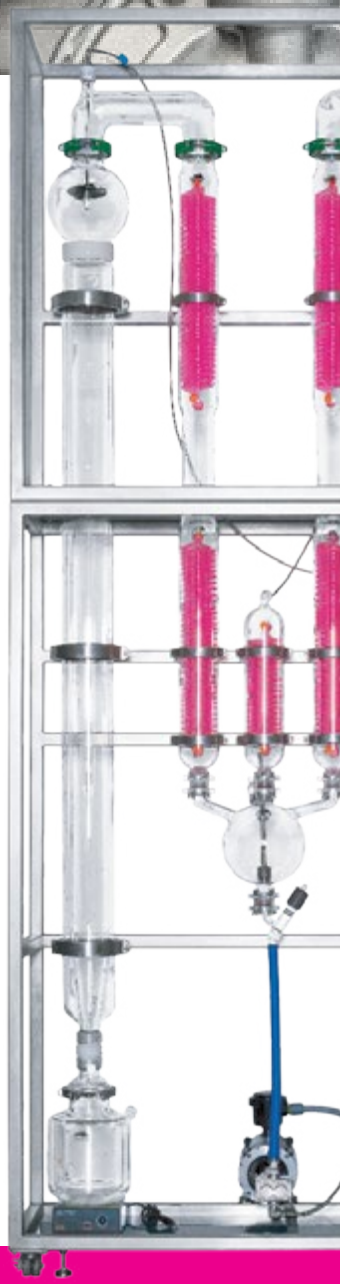

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There are countless ways to extract, process, press, distill and refine cannabis into wholesale and retail products. *Courtesy Photo*

Also, ask how many solvents you will be allowed to hold in your facility. Some municipalities are particular about the volume of solvent a facility can have on-site.

“If you have a 500-gallon extractor, but you can have only 100 gallons (of solvent) in your facility based on local regulations, you’re already outside of that,” Geisleman said.

Typically, labs in urban areas will have stricter regulations while rural, agricultural areas will be more permissive, often with fire departments that are more familiar with large-scale operations through other agricultural businesses.

EXTRACTION FOR HEMP VERSUS MARIJUANA

Hemp and marijuana may come from the same plant, but extraction methods need to be considered for each individually.

Because of overproduction in the hemp market after federal legalization and the subsequent price crash, hemp is a “volume business,” Flippo said. Hemp doesn’t allow the same standard of quality biomass as marijuana, which means it’s harder to get high percentages of terpenes and flavonoids, he said.

Flippo recommends cryogenic ethanol extraction for hemp processing.

“There is nothing else you can do that gives you a throughput and efficiency that, in this volatile market, will allow you to remain competitive,” Flippo said.

On the other hand, marijuana has more processing options, although he prefers BHO extraction because it favors the whole plant process desirable in the medical marijuana market.

"Marijuana is a more high-quality feedstock. It's almost a shame to run it through the ethanol process," Flippo said.

WHAT HAPPENS POST-EXTRACTION?

Once extraction is finished, consider what happens next.

There's a lot involved in the "cleanup chemistry," Geisleman said.

Extractors need filtration media to remove pesticides and heavy metals if that is a concern. For some hemp products, THC must be removed. Remember to consider the costs and space requirements for all of this equipment.

"What kind of filtration media are you going to need? Are you going to winterize, and what does that look like? You'll need large freezers and all of that," Geisleman said. "Are you going to extract just oil? What's your next step? Where's that space going to go?"

Geisleman also recommends completing the first round of your compliance testing in-house before you go to third-party verification, to better control the timeliness of the process.

"If you're going to rely on a third-party, that could be a week —or 12 weeks —for results," she said.

CONSIDER HIRING A CONSULTANT

The sticker price of hiring a consultant to set up the extraction process may be high, but it will more than pay for itself.

"We just built on an expansion and the amount of work my chemical engineer did for it was almost a Ph.D.-level thesis for our fire department," Geiselman said.

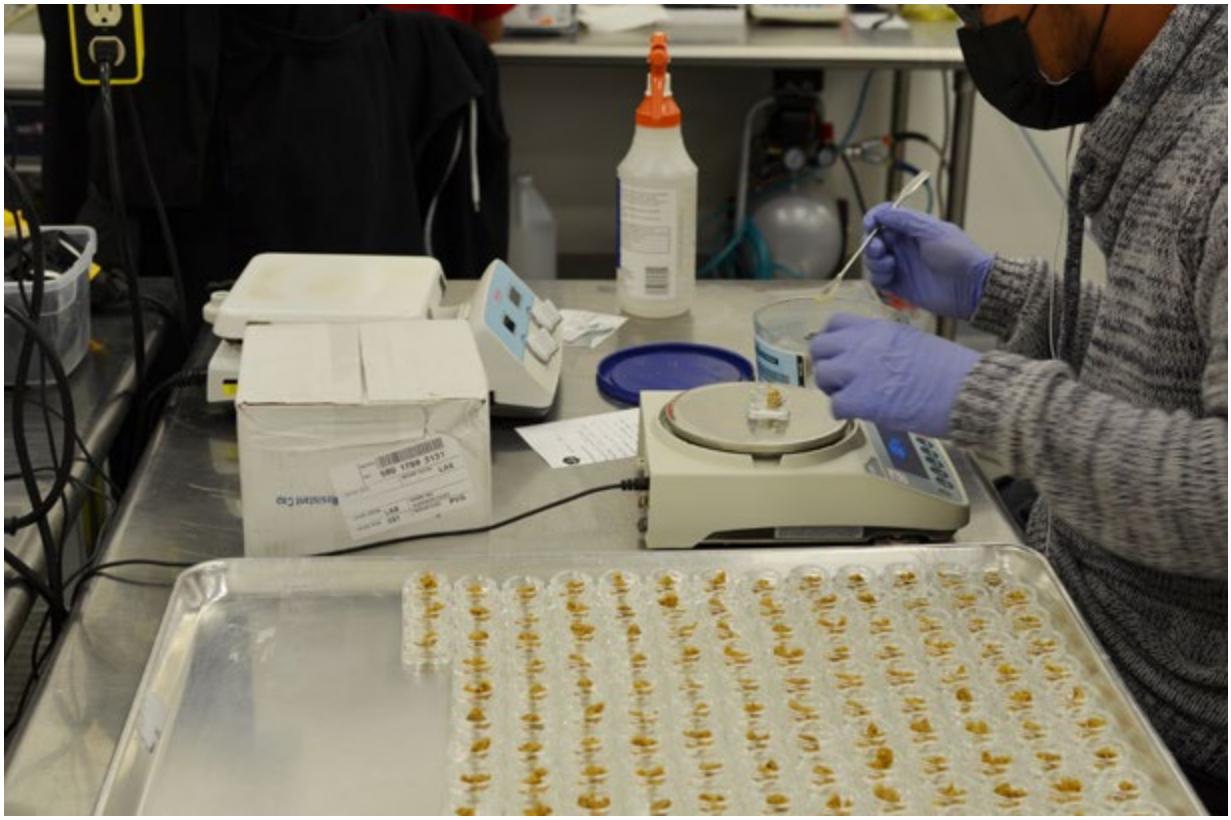
"All these organizations (that regulate extraction) when you start reading these regulations—they get real subjective, fast. The money you spend on a consultant will save you thousands, if not tens of thousands of dollars."

Consultants can help with everything from figuring out which equipment to buy and negotiating with manufacturers to dealing with regulatory agencies, to helping set up an efficient facility that meets all laws, keeps employees safe and produces a safe, quality product.

Consultants shouldn't just talk to you a few times, but really immerse themselves in your system and be there "every step of the way," Flippo said.

Geisleman recommends checking in with a consultant at least annually, even after you're up and running.

Regulations can change. Checking in helps the lab avoid becoming non-compliant and receiving an unanticipated stop-work order.



Processors need to think about what their brand represents and what kind of volume they hope to achieve when choosing an extraction method. *Photo by Lindsey Bartlett*

MARKET TRENDS IN CANNABIS EXTRACTION

One thing is certain: Innovation in the extraction market is happening quickly, Tanem said.

Automation, higher efficiencies, better equipment and lower energy technology are all coming to the forefront.

"This is an emerging market. If you're trying to get into this space, take the initiative because there's room for everybody right now," Tanem said. Even for the small brands, there's "always room for new ideas and creativity in the space."

And with equipment innovations, it is no longer true that processes like rosin extraction are challenging to scale, Tanem said.

"When I'm selling quarter-million-dollar pieces of equipment that can process 90,000 grams of fresh frozen in a day, we're scaling this process."

JD Garrick, managing partner of Illuminated Extractors, a Colorado company selling hydrocarbon extraction equipment, agrees.

"There was this whole first wave of technology that came out in the industry, but it's all about efficiency now," Garrick said.

"Operating faster with less, saving money on your electricity. You're going to see a whole new evolution of people trying to make these products without consuming so many solvents or so much energy."

Garrick foresees large regional facilities processing plant material from multiple states for a growing export market. Even in boutique settings, efficiencies matter, Garrick said.

Starting with high-quality flower can help create a consistent product such as this distillate. *Photo courtesy of The Clear*

But Flippo advises caution before scaling up, pointing to what happened in the hemp industry with overproduction.

Remember that just 20 pounds of biomass, once extracted, can be turned into roughly 2,000 single-dose applications. Flippo has the smallest BHO setup he could buy and "we can still run 100 pounds a day."

Quality over quantity will rule the future of cannabis extraction, according to Flippo.

"You don't have to have an industrial 100,000-square-foot warehouse to provide a quality product for a lot of different people."

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THREE SAFETY CONSIDERATIONS IN CANNABIS EXTRACTION

No matter what cannabis extraction method extractors choose, safety must be a priority.

All of the most commonly used extraction methods have safety risks.
Photo by Matt Staver

Extraction labs must understand and implement safety standards appropriate for their extraction processes, said Casey Flippo, CEO of hemp processor Natvana LLC and medical marijuana extraction company Dark Horse Medicinal Inc., in Little Rock, Arkansas.

Flippo told *MJBizDaily* he once visited a butane hash oil (BHO) hydrocarbon lab without ventilation or a Class 1, Division 1 (C1D1) room, a manufacturing space set up with zero points of ignition and live gas monitoring designed to ventilate potentially flammable gases and built with fire-suppressing materials. A C1D1 room is required in hydrocarbon extraction labs.

"It was like a Molotov cocktail in the middle of the warehouse," Flippo said.

Hydrocarbon extraction is considered the most dangerous extraction method, with the potential to blow up if the highly flammable solvents used during the process leak and ignite.

But while hydrocarbon extraction raises the most safety concerns, all of the most commonly used extraction methods covered in the *MJBizDaily* Cannabis Extraction Buyers Guide have safety risks.

Carbon dioxide (CO_2) extraction risks carbon monoxide poisoning if a leak occurs. Ethanol is also highly flammable and can create a flashpoint if enough vapors leak into the air. Rosin is considered the safest extraction method, although burns are possible.

Additional health hazards in cannabis production include breathing of cannabis dust, hearing loss from loud equipment, and skin and eye exposure to harsh chemicals and cleaning products.

But if labs are designed and built correctly—and properly run—safety risks are significantly reduced. To ensure safety in their facility, extractors should consider three points when setting up a new lab facility:

- Facility design.
- Employee training.
- Personal Protective Equipment (PPE).

CANNABIS EXTRACTION LAB FACILITY DESIGN

Proper facility design can head off accidents, said Liz Geisleman, chief brand officer at 710 Spirits Extraction Products, a Colorado company providing solvents and supplies to extraction labs.

Make sure to have proper ventilation and that it's located in the right spot, Geisleman said. Some gases are heavier than air, so they should be ventilated at the bottom. In addition, alarms to spot gas leaks, whether odorless CO_2, or the butane or propane used in hydrocarbon processing, are critical.

A good consultant well-versed in extraction should help a processor navigate fire department regulations and help come up with a safe facility design, including if the lab is required to install a safety room as required by the chosen extraction method.

JD Garrick, managing partner of Illuminated Extractors, a Colorado company selling hydrocarbon extraction equipment, advises getting a third-party certified engineer to review design plans. This is especially important for hemp processors, which may not have established rules to follow that are as strict as the regulations marijuana processors must follow.

Having a third-party certification assures that "somebody has signed off on it as being safe to work in these environments," Garrick said.

PROPER EMPLOYEE TRAINING

Make sure employees are trained in all products and processes, following Occupational Safety and Health Administration (OSHA) standards, Garrick said.

"Anytime you're dealing with a solvent, whether it's flammable or not, you need to understand the SDS (safety data sheets) for what hazards are attached to that solvent," Garrick said.

Geisleman agrees. Employees should "understand whatever chemistry you're using," she said.

In some cases—especially for hydrocarbon and CO_2 labs—it may be appropriate to have specially trained technicians to run the equipment. Following OSHA guidelines will keep facilities up to date with ongoing employee training and facility safety maintenance.

DON'T FORGET THE PPE

"Whether you're talking about hydrocarbon or solventless in any lab setting, your PPE has to be on point," Nick Tanem, founder of Essential Extracts, a California solventless extraction company, said of personal protective equipment.

Even beyond the harsh chemicals used in solvent-based extraction methods, employees are exposed to harsh cleaning chemicals, as well as dust and terpenes that can be dangerous.

Nitrile powder-free gloves, eyewear and ear protection (when applicable) should be provided.

PPE also helps keep labs clean and products safe from contamination, Tanem said.

Make sure employees are trained in all products and processes, following Occupational Safety and Health Administration (OSHA) standards. *Photo courtesy of Clever Leaves*

BEYOND THE PRICE TAG: PLANNING FOR THREE IMPORTANT EXTRACTION COSTS

The initial financial outlay for cannabis extraction equipment varies widely, but there are additional costs to calculate.

Equipment costs vary depending on the size and complexity of the system purchased.

Post-extraction distillation, refinement, facility construction and further processing will drive processing prices higher.

A small-scale rosin press might run under $1,000, while a large carbon dioxide extraction system can go for more than $400,000.

Justifiable equipment purchases will depend on which end products the extractor hopes to create and at what scale.

There are additional costs that are important, but not always planned for in any extraction purchase, specifically:

- Maintenance and repair.
- Solvent prices.
- Energy use.

Machine used to evaporate ethanol from cannabis oil. *Photo courtesy of MariMed*

MAINTENANCE AND REPAIR COSTS

When your equipment breaks down, how expensive is it to fix?

That depends on the system, said JD Garrick, managing partner of Illuminated Extractors, a Colorado company selling hydrocarbon extraction equipment.

“Anytime you have moving parts, you’re going to have more maintenance,” Garrick said.

Things like vacuum pumps, mixers, recovery compressors, heaters and chillers are all high-maintenance items that eventually need replacement.

Ask a manufacturer what happens when something breaks down: “Will you need to fly a tech in for a repair?” Garrick said.

Garrick also recommends asking about third-party parts manufacturers, in case of a machinery breakdown in need of repair.

Ask how easy are those parts to find and how much do they cost? How often do they break?

PLANNING FOR SOLVENT PRICES

The COVID-19 supply chain breakdowns have been a reality check for solvent-based extractors, said Liz Geisleman, chief brand officer at 710 Spirits Extraction Products, a Colorado company providing solvents and supplies to extraction labs.

Remember, solvent-based extraction is all based on "commodity-priced chemistry," Geisleman said.

Extractors that invested in less common hydrocarbon solvents—like pentene—depend on global supplies that haven't been easy to get during the pandemic. But even common solvents like ethanol have been subjected to wild price swings over the past two years.

"In solvents, it's been all over the map, with the hand sanitizer crisis and all the ethanol used there," Geisleman said.

She recommends understanding and planning for solvent costs in about the middle of their typical price range. Extractors must make sure to understand "operationally what those consumables are and what they are really going to cost."

CONSIDER ENERGY USE

Another significant consideration is how much energy your system will use, Garrick said.

"Anytime you have a distillation process, it's going to be energy-intensive," he said.

Some chemicals, like CO_2 and propane, have low boiling points. Others, like ethanol, take a lot of energy to evaporate. Look for extraction systems designed to recycle and reduce energy costs, Garrick recommends.

"Using less energy is not only better for the environment, it's better in the real-world application," he said. "Your operating expenses are less because you're not consuming so much power."

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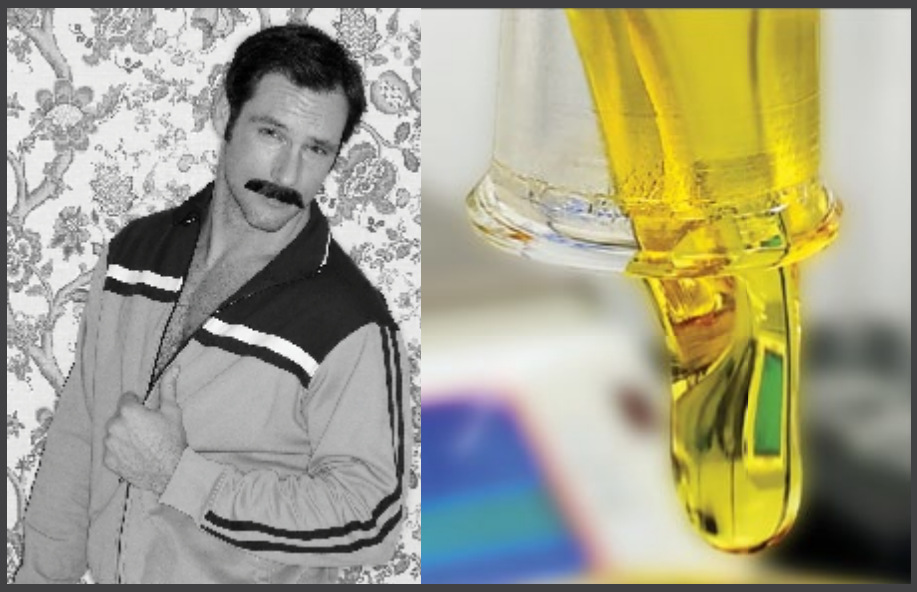

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UNDERSTANDING CANNABIS EXTRACTION

A glossary of common terms

Methodology and innovation are exploding in cannabis extraction and along with it so is the language.

The terminology surrounding cannabis extraction is a combination of the product and process names common in the days of the legacy market, plus the science, chemistry and innovations of an evolving and highly technical licensed market.

Cannabis processors interested in pursuing their own extraction methodology should have a solid grasp of the most commonly used terms they will likely run across, including product or derivative names, and terms used to describe extraction equipment or methods.

CANNABIS EXTRACTION GLOSSARY OF TERMS

Broad spectrum—A category of extract used for CBD products, similar to full-spectrum CBD but with the THC removed. Broad-spectrum and full-spectrum products take a "whole plant" approach to extraction, using extraction techniques that preserve many components of the cannabis plant, including additional cannabinoids, terpenes and flavonoids.

Budder—A creamy, yellowish, THC-rich, dabbable cannabis concentrate that looks like butter (hence the name). Budder is produced using a carbon dioxide or butane extraction process. It is highly concentrated in THC (over 80%) with high levels of terpenes that give concentrate product a favorable reputation.

Butane—A flammable gas used in hydrocarbon extraction to make butane hash oil (BHO). Butane is a petroleum derivative and is used in cannabis extraction because of its high purity and low boiling point.

BHO—Butane hash oil or butane honey oil, a concentrated cannabis extraction of up to 90% THC concentration that, when used, is typically referred to as "dabbing." BHO is made using butane in a hydrocarbon extraction process and offers a wide range of consistency, potency and representation of the chemical compounds in the original cannabis variety that was processed. Because butane is highly flammable, BHO can be dangerous to make when not done so with proper safety standards.

Bubble hash—Named for the way it bubbles when smoked. The extract is made by adding bags of cannabis flower to ice water, agitating and freezing. This process breaks off the resin glands from the flower, which are then passed through screens several times until an unpressed, almost crumbly material is left. This is then subjected to heat and pressure. Bubble hash is made from frozen (not dried) flower material, making it a "live" product similar to live resin, but without the use of solvents.

Cannabinoid distillation—Also known as fractional distillation, occurs after the extraction process. Intended to isolate desired cannabinoids from other chemical components in the cannabis oil. Cannabinoid distillation employs heat and vapor distillation and can be implemented at a small or large scale.

Chromatography—Another post-extraction process used to isolate individual cannabinoids or take distillate to a 99% purity level. The extract is dissolved in a fluid and then passed through a secondary media. Because different components of the cannabis plant travel at different speeds, this creates separations between chemical components such as terpenes, cannabinoids and other plant materials. Chromatography is often used to remove THC yet retain a broad-spectrum CBD product.

Closed-loop extraction system—An extraction system that seals in the air, preventing gases of flammable solvents from escaping and greatly reducing the risk of explosion. Prior to closed-loop extraction systems, extractors used open-loop systems, which allowed gases to escape and also left a solvent residue on the final product.

CO_2 extraction—Also known as supercritical CO_2 extraction, CO_2cannabis extraction uses pressurized carbon dioxide. Unlike butane and ethanol processes, CO_2 extraction works by subjecting the gas to extremely low temperatures, turning it into a liquid. Then it is heated and pressurized, creating supercritical CO_2 fluid, which in turn is passed through a chamber containing raw cannabis, dissolving the oils out of the plant matter while capturing active compounds.

Cold-pressed extraction—The same process used for cold-pressing essential oils, cold-pressed extraction is made by crushing the plant material to extract usable oil. The process is done at low temperatures. Cold-pressing typically results in smaller amounts of oil produced than other extraction methods, but it is considered a natural, solventless process for creating full-spectrum cannabis extract.

Concentrates—Extracts that contain extra-high amounts of cannabinoids, terpenes and other cannabis compounds. Concentrates can regularly reach THC levels of over 60%, with some—such as distillate—much higher. Concentrates are several times more potent than cannabis flower. Concentrates can be produced both through solvent-based and solventless extraction methods, with the end result including products such as shatter, wax, budder, rosin, crystalline and distillate.

Crude oil—The first oil, typically dark brown or black in color, that is produced during the cannabis extraction process, which needs additional steps to be ready for sale. It is more often discussed in ethanol and CO_2 extraction processes as the high amount of refinement in butane or propane extraction product doesn't require additional refinement.

Crumble—An extracted form of cannabis concentrate made via a butane or CO_2 process. It is typically dry, with the consistency of crumbs, but can have a honeycomb-like structure. Because it is made from dried or frozen-fresh flowers, it is considered a type of live resin with a high proportion of terpenes and other original compounds.

Crystalline—Also called diamonds or isolates, crystalline is a cannabis isolate with over 99% cannabinoids, with a high degree of purity that forms a crystalline-type solid. It is made using a supersaturation process that purifies active materials in the extract, concentrating it and hence increasing its stability.

Dabbable concentrate—Also known as dabs, a type of cannabis derivative that comes in a concentrate form. Dabbable concentrates may be crystallized or not and come in many different forms including shatter, budder, wax and crumble.

Decarboxylation—Heating plant extract or cannabis oil to 105 degrees Fahrenheight to convert inactive cannabinoids such as CBD-A and THC-A into their active compounds. Decarboxylation can occur before the plant is extracted or after. BHO concentrates require decarboxylation because raw BHO doesn't contain any activated compounds.

Derivatives—Another way to describe extracts from the cannabis plant. Derivatives can come in many forms and are typically further defined as primary derivatives (terpenes and crude oil) secondary derivatives (refined oil or dabbable concentrates), tertiary derivatives (distillate), and secondary or recombined derivates (isolate).

Distillate—A pure and extremely potent form of cannabis that does not contain any terpenes, making it tasteless. Distillate is made from a vacuum distillation process and has varied applications in edibles, topicals and beverages.

Distillation—A post-extraction process that isolates specific compounds from the cannabis plant. The process is done by boiling extracted oil at various temperatures to vaporize compounds at their boiling points, and then separating the compounds into their liquid forms on condensing coils.

CBD isolate is a product of distillation. *Courtesy Photo*

Emulsion—Cannabis extracts that have gone through an emulsification process to reduce the cannabinoid oils into tiny droplets that will disperse in water. Emulsions can be of the nano, micro or macro size, depending on the particle size. Manufactures use emulsions to incorporate cannabis extracts into products such as drinks, creams and edibles.

Ethanol extraction—Also known as cryogenic ethanol or cold ethanol extraction, which involves soaking the cannabis plant in ethanol held at a very low temperature to separate the trichomes from the plant. Ethanol, or grain alcohol, is also used to produce many other products including perfumes, food coloring, flavorings and essential oils.

Extraction—The process of converting cannabis biomass into a derivative using solvent or non-solvent technologies.

Extracts—Another name for cannabinoid derivatives.

Filtration—An essential step to create stable cannabinoid products. It involves using vacuums, pumps or paper filters to remove lipids that come to the surface of a cannabis extract such as waxes, fats and oils during the winterization process.

Full-spectrum extract—A whole-plant extraction process undergoing minimal refinement similar to broad spectrum; however, THC is not removed from full-spectrum extract.

Hash—A cannabinoid concentrate derived from trichomes, the resin-rich, ripe glands on the surface of cannabis flower heads. Hash can come in various types, such as dry sift hash and ice water hash.

Hydrocarbon extraction—A solvent-based extraction technology that typically uses butane or propane as its solvent. Hydrocarbon extraction uses a non-polarized method (unlike ethanol extraction), which captures desired cannabinoids and terpenes while not capturing undesirable compounds like chlorophyll and plant metabolites, which require further refinement. Hydrocarbon extraction creates a highly refined cannabis oil, which can then be further processed into many products. However, because it uses solvents that are highly flammable, hydrocarbon extraction is considered the most dangerous extraction method.

Ice water hash—See "Bubble hash."

Isolate—A purified individual cannabinoid in a crystalline solid or powder that is created through the chromatography process. Isolate contains only pure isolated cannabinoids.

Kief—The dried resin glands coating the outside of a cannabis plant. Kief is a decompressed precursor of hash.

Live resin—A cannabis concentrate made from fresh plant material that has not been dried or cured then extracted with a solvent. Live resin can be made from cannabis biomass that has been flash frozen, retaining desirable compounds and flavors. Live resin is considered a high-quality, connoisseur-level product

Nano emulsion—Using ultrasonic waves to shatter cannabinoid molecules into tiny nanoparticles that can then be used in an emulsification. Nano emulsion also involves an emulsifier, which allows the cannabinoid molecules to dissolve and be mixed into water without separating.

Open-loop extraction system—See closed-loop extraction system.

PHO—Propane hash oil. Sometimes called PHO wax. PHO uses the same hydrocarbon extraction process as BHO but with propane as the solvent instead of butane. PHO cannabinoid concentrates have a budder-like consistency and are high-potency extracts. PHO extraction can preserve even more terpenes than BHO so it may taste better than BHO, but it is not as versatile for creating products.

Refined extract—Also known as refined oil, cannabinoid-rich oil that has undergone additional winterization and clarification processes. Refined oil is processed from crude oil. Extraction processes like BHO are highly refined in the extraction itself, so they produce a highly refined oil without further processing.

Remediation: Removing THC from cannabis distillate, usually through a chromatography process.

Resin—The dark brown, sticky substance found on a cannabis plant's trichomes producing all the plant's medical and psychoactive effects. Resin is considered the most valuable part of the cannabis plant and products containing resin are called concentrates.

Rick Simpson Oil—Developed by Canadian Rick Simpson as a highly potent cannabis extract purported to cure cancer, hence named for him. RSO is a full-spectrum oil typically taken orally or applied topically. It is an unrefined cannabis oil made by crushing cannabis into ethanol, letting it steep, and then boiling off the alcohol. It can be made at small or large scale.

Rosin—Solventless cannabis concentrate made using high pressure and temperatures, resulting in a THC-rich resin that is typically dabbed. Rosin is a simple technique that can be done on a small scale, though new equipment innovation is allowing for larger-scale rosin manufacturing. Rosin is considered one of the safest methods for extraction.

Shatter—A refined cannabis extract with high concentrations of acid-forming cannabinoids, typically crystalline in appearance and usually used for dabbing or vaporizing.

Solvent—A substance with properties that allow the dissolution of cannabis plant material into a solute that is further refined into extract. Commonly used solvents in the cannabis industry include butane, CO_2, ethanol and propane.

Solvent recovery—The recovery and recycling of solvents used in the cannabis extraction system. Solvent recovery can make extraction processes more efficient and allow for larger facilities because less solvent is needed if solvents can be recovered and reused.

Shatter by Seed & Smith, a marijuana grow and dispensary in Denver.
Photo by Kate Lavin

Solute—The substance that is desirable to be removed from the plant material. In the cannabis industry, the desirable solutes are the cannabinoids, terpenes, flavonoids, etc.

Terpene juice—A typically liquid or sap extract used for dabbing or vaporizing. It contains large volumes of terpenes and low concentrations of cannabinoids.

Terpsolates—A product made post-extraction through the recombination of hemp-CBD isolates to terpenes in order to enhance flavor and terpene-related effects.

Tincture—A cannabis-infused oil typically consumed sublingually or mixed into food and drinks.

Wax extract—Also known as crude extract derived in the CO_2 extraction process. It is the first product in the extraction process and contains all the solutes extracted from the plant material.

Water-based extraction—A cold-water method that causes resin glands to break off of flower heads by agitating them in a freezing, cold-water bath. Not technically an extraction process, as it separates (versus extracts) cannabinoids from the plant material. See “Bubble hash.”

Winterization—A process of dissolving crude extract in ethanol at warm temperatures, and then cooling the liquid to allow for removal of fats, waxes and lipids left over from the extraction process. Winterization is typically needed following CO_2 extraction and turns crude oil into a refined oil that can be sold or further processed.

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