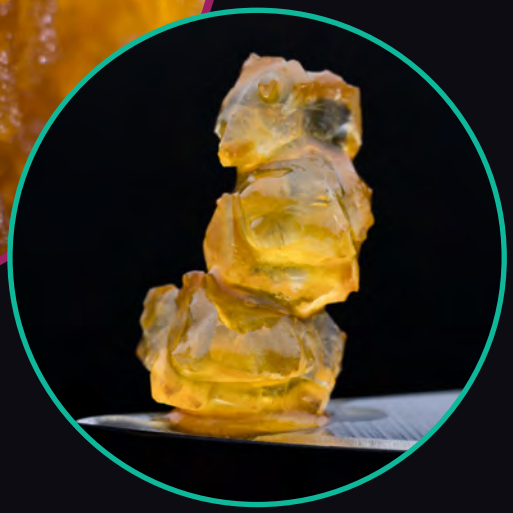

HARMONY OF SOLVENT & SOLVENTLESS EXTRACTION

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Over the last decade, the cannabis extraction sector has been in constant flux. New technologies and evolving consumer preferences have continuously disrupted established extraction systems. In just a few short years, the market has added distillate, full spectrum live concentrates, and everything in between. There are no guarantees that today's popular SKUs will still be popular with tomorrow's customers.

A producer's greatest challenge is landing on an extraction system that works in the current market and, perhaps more importantly, ensures longevity, given the market's highly unpredictable nature.

But, it may never be possible to develop a future-proof plan if it's based entirely around a single extraction type. That is because there are natural limitations to each extraction type, which frustrate a producer's ability to:

- Respond to changing consumer tastes
- Adapt to biomass quality
- Make data-driven decisions regarding market price fluctuations
- Grow a consumer base

If the extraction market has taught us anything, it's that the only winning strategy is one that is flexible and highly adaptable.

Instead of hyper fixating on a single extraction type as "the best," we examine a strategy that incorporates the high-throughput, lower-profit margin output potential of hydrocarbon closed loop extraction with the low throughput, high-profit margins of solventless.

A dual approach that combines solvent and solventless systems plays the disadvantages of one approach into the advantages of the other. It's flexible, adaptable, and already in play with the industry's largest producers.

Although the cannabis community still loves to pit one extraction technology against another, we contend this is an outdated and limiting way to think about extraction. Instead, we propose a more resilient approach, pairing two technologies together for unlimited growth potential.

- AGRIFY

INTRODUCTION

Elisabeth Stahura, in “Mining for Gold BDSA Market Outlook,” suggested that “[f]lower share continues to decline as ease of use and discretion become more valued by the larger consumer set.” Flower as a product category still holds the hearts of consumers, but as markets mature, it’s starting to lose ground to other products like vape pens, edibles, beverages, tinctures, topicals, and infused prerolls.[1]

Non-flower cannabis products now collectively make up the bulk of the consumer market. What they all have in common is their reliance on extraction. Everything from vape pens to edibles to infused pre rolls begins with an extraction process. With very few exceptions, these products collectively continue to see year-over-year sales growth across adult-use markets.[2]

Grand View Research evaluated the global cannabis extraction market at $2.74 billion in 2021, with a staggering compound annual growth rate of 20.6 percent to 2030. The increasing investment in cannabinoid pharmaceuticals, as well as the growing number of recreational markets, are key drivers behind this exponential growth.[3]

But it’s clear that there is no single extraction method or SKU that drives this growth. Banking on a single technology fails to consider the impact of shifting consumer preferences, biomass availability, wholesale prices, and other market influences. Critically, a production strategy that works in the current environment as well as over the long term must be adaptable.

A dual approach to extraction, pairing hydrocarbon and solventless technologies together, ensures this flexibility. It gives manufacturers the path to profit no matter the market forces at play, whether it's changing consumer preferences, harvest quality, or even the emergence of new influences altogether. Hydrocarbon and solventless technologies play off each other so well because they have complementary characteristics.

The key to long-term viability in the cannabis industry is to invest in operational adaptability. In the extraction sector, adaptability translates into utilizing both hydrocarbon and solventless technologies.

INDUSTRY EVOLUTION EMPHASIZES THE NEED TO STAY NIMBLE

The history of extraction started several thousand years ago with hand-collected resin in the Indian subcontinent. But it's only in the last 50 years that commercial production has taken off with solvent-based extraction systems, distillation, and, most recently, solventless technologies. If anything, the last decade of cannabis extraction is a reflection of the wild evolution of the cannabis industry more widely, and a roadmap for the shifts possible in the future.[4]

The shift from illicit to legal has spurred the development of extraction techniques. Legalization has given the sector an injection of investment, infrastructure, and the scientific attention necessary to advance extraction from the open blasting techniques of the past to the closed-loop C1D1-compliant systems we see today.

Each modern method is still widely used across the cannabis industry as a whole, but producers now consider each technology more strategically, based on its most effective application. For example, ethanol allows for the high throughput required for industrial hemp extraction; closed-loop hydrocarbon extraction is preferred for high-THC SKUs; and solventless is used for premium, terpene-rich SKUs.

Today, the major factors influencing extraction technology selection include consumer tastes, biomass quality, market price, and infrastructure requirements.

CONSUMER DEMAND

A new kind of consumer has evolved in mature markets, one more concerned with unique terpene and cannabinoid profiles than with high THC levels. This has shifted the premium concentrate market toward solventless extraction, live-flower processing, and other full-spectrum approaches.

BIOMASS AVAILABILITY

Not all biomass is suitable for all extraction systems. Solventless is a notorious example, where trichome morphology dictates the quality and possible yield. As a result, solventless production is entirely dependent on the availability of high-end, genetically suitable flower, while hydrocarbon extraction is much more adaptable to input quality.

INDUSTRY EVOLUTION EMPHASIZES THE NEED TO STAY NIMBLE

MARKET PRICE

New markets tend to demand high-THC, low-cost products, while mature markets lean into flavor-forward premium options, specifically solventless SKUs. But rosin doesn't always work within established markets. For example, the unique circumstances playing out in Illinois mean wholesale flower prices, and therefore solventless prices, are still some of the highest in the country. Illinoisans simply can't afford the steep price tag. Therefore, each market still requires a unique approach, marrying consumer tastes with their willingness to pay.[5]

INFRASTRUCTURE

Solvent and solventless extraction systems sit at opposite ends of the spectrum for infrastructure and CapEx requirements. There is a low barrier to entry for solventless systems, whereas closed-loop hydrocarbon systems require a much more significant upfront investment and larger facility footprint.

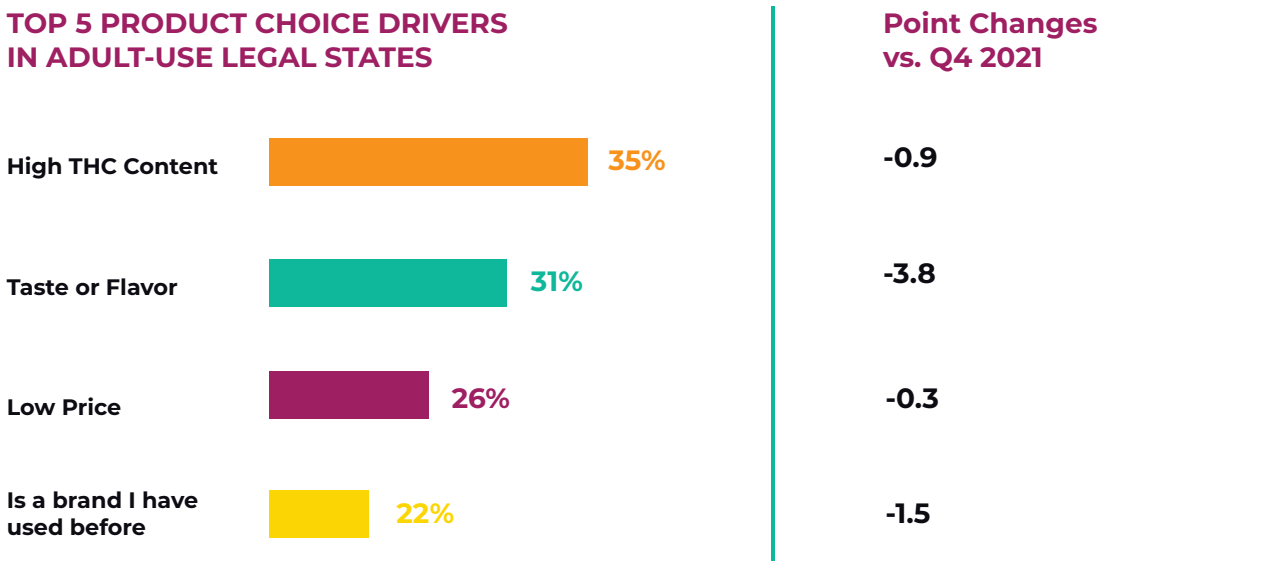
If the last decade has taught us anything about the commercial cannabis industry, it's the need to stay nimble. Success comes from having the operational flexibility to respond to changes in the market, whether they stem from consumer tastes, biomass availability, price, or something entirely new.

LIMITATIONS OF A SINGLE EXTRACTION TECHNOLOGY

In business, there is a long-established strategy of 'niching down.' Carol Sankor, writing for *Inc.*, suggests that "[n]iching down is an entrepreneur's best chance of standing out" because by "strategically pursuing the subcategories that will work best for your brand, you can increase your profitability and better define what makes your company unique."[6]

Strangely, the inverse is proving true for cannabis extraction. The consumer demand is simply too fluid, biomass quality too volatile, and technologies changing too rapidly. A hyper-fixation on a single extraction technology type places significant limits on your production and long-term profitability.

THC CONTENT STILL THE TOP PRODUCT DRIVER



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LIMITATIONS OF A SINGLE EXTRACTION TECHNOLOGY

LIMITATIONS OF A HYDROCARBON-ONLY MODEL

To elucidate just how limiting a single extraction technology can be, let's start with an example: hydrocarbon extraction.

Hydrocarbon extraction, reliant on butane, hexane, and/or propane, excels at high-phytochemical extraction while eliminating undesirable compounds like fats (lipids), waxes, and chlorophylls. It's especially adept at separating cannabinoids and terpenes, more so than other solvent-based approaches.[7]

CONSUMER TASTES EVOLVING

Hydrocarbon extraction is beginning to lose its foothold among consumers. In most mature markets, consumer tastes are shifting beyond the quest for high THC. Yes, THC remains the top driver of consumer purchasing decisions, but now taste and flavor are coming in as a close second.[8]

Hydrocarbon technology cannot capture the most volatile terpenes, even with low-temperature closed-loop systems. Solventless extraction is now feeding the growing demand for terpene-rich concentrates.

In market after market, sales numbers are demonstrating the rising demand for solventless options. BDSA Retail Sales Tracking data indicates that "average retail prices (ARP) for solventless products like Rosin are holding significantly higher than for Live Resin. In the California market, the ARP for Live Resin has fallen to ~$20/gram in Q3 2022, while Rosin's ARP has begun to stabilize at ~$35/gram in Q3 2022, suggesting that solventless products can maintain a premium price point at retail."

But it's not just flavor driving consumers' preferences. The clean cannabis movement has also affected the concentrate market. There is a small but vocal segment of consumers (particularly in mature markets) who purposefully seek out products with all-natural inputs and 'cleaner' processing. The clean cannabis movement strongly prefers solventless products like rosin and hash over solvent-based SKUs due to the fear of solvent residuals.[9]

Of course, hydrocarbon extracts are tested for solvent residues as a baseline requirement across all legal markets. But, from a consumer perspective, hydrocarbons are out and solventless is in. Considering that major news outlets like CBS are reporting on 'clean weed,' this consumer segment will likely grow, especially as newer markets mature.[10]

LIMITATIONS OF A SINGLE EXTRACTION TECHNOLOGY

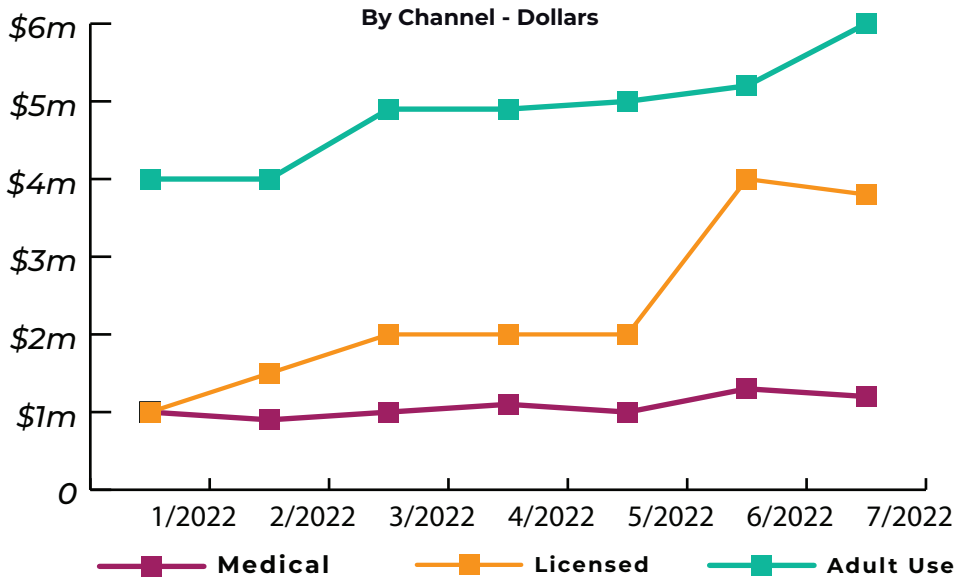
ROSIN UPSELLING IN VAPES

109%

Jan 22 - July 22
Rosin Vape Sales

20%

Jan 22 - July 22
All Other Vape Sales



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PREMIUMIZATION OF SOLVENTLESS SKUS

In many mature markets, like California and Colorado, solventless extraction has rapidly taken over the premium concentrate category. Where once live resin reigned, rosin is now capturing the hearts — and dollars — of cannabis connoisseurs.

Vape sales perfectly exemplify this trend. BDSA reported that between January and July of 2022, rosin vapes saw a 109% increase in sales, whereas all other vape categories only captured a 22% increase. Under their analysis, "Rosin is now attainable and understood by a larger consumer set than ever at current prices and there is evidence consumers see added value." [11]

Cannabis Science and Technology also reported on this trend, finding that "Solventless products are demanding much higher prices than their counterparts and consumers are paying it! It seems as though consumers are understanding of the fact that producing solventless concentrates and products costs more and is higher in value than other products."[12]

The premiumization of solventless products isn't just happening to pure concentrates and vape carts. BDSA is predicting that "[s]olventless products will represent the new way of premiumization in the edibles and concentrate categories," going forward into 2023.[13]

LIMITATIONS OF A SINGLE EXTRACTION TECHNOLOGY

LIMITATIONS OF A SOLVENTLESS-ONLY MODEL

Looking at the flip side of this argument, there are different yet equal limitations related to an exclusively solventless approach.

Solventless is a mechanical approach to separating and extracting. The two main technologies, mechanical trichome separators and rosin presses, produce terpene-rich cannabis concentrates without chemical solvents—the only inputs are ice water and biomass.

UNPREDICTABLE BIOMASS QUALITY

Solventless extraction requires a particular trichome morphology. Only specific genetics work — and only if the biomass is of the highest possible quality. This means crop planning plays directly into the extraction production schedule.[14]

A lot rides on the final harvest for a vertically integrated solventless manufacturer. All the labor, time, and space invested into growing out a specific cultivar must pan out as planned during extraction for the business model to turn a profit. If a harvest doesn't deliver the expected yield or quality during a solventless trial run, does all that investment go to waste?

Non-cultivating solventless extractors face a similar risk, as they rely on outside cultivators to feed their production line. It can be a logistical nightmare to plan a production schedule around the availability of premium biomass, which may or may not exist. What happens when no appropriate flower is available or wholesale prices go through the roof?

Producers relying on exclusively solventless extraction could be left trying to flip low-quality biomass on the wholesale market to recoup even a portion of the cultivation costs. Alternatively, those sourcing flower on the open market could be priced out of production entirely.

LIMITATIONS OF A SINGLE EXTRACTION TECHNOLOGY

While the range of possible product types is growing for solventless extractors, it's still challenging to winterize solventless extracts and dial in the viscosity. Meaning, solventless extractors end up with a much more limited number of SKUs: full-melt hash, rosin, edibles, and vape pens, all dependent on post-processing.

Solventless SKUs may fetch a premium price tag, but the greater range of SKUs available through hydrocarbon extraction means they sell to a larger consumer base. Beyond adding new strains to your solventless SKU portfolio, there is only so much room to diversify with this single extraction technology.

A LIMITED SKU PORTFOLIO COMPARED TO HYDROCARBON

Because hydrocarbon extraction works on a molecular level, it is easy to manipulate for a greater range of final products than what is possible through a solventless system. Depending on pre- and post-processing procedures, crude oil produced via a closed-loop hydrocarbon system can end up as butane hash oil, badder, resin, wax, sugar, diamonds, and more. With the addition of distillation, it also is suitable for edibles, topicals, vape pens, and beverages.

LIMITLESS POTENTIAL: HARMONY OF SOLVENT & HYDROCARBON SYSTEMS TOGETHER

A dual-extraction strategy is not a new approach. However, it's often ignored by the online cannabis community, which loves to pit one technology against another. But, we only need to look at the country's most successful MSOs to see that a diversified extraction portfolio works — and works at scale.

In the below example, pulled from BDSA's Mining for Gold 2022 Report, the strategy of extraction diversification is undeniable. Cresco Labs®, Stiizy™, Ozone™, and Wana™ , which all began with hydrocarbon extraction and distillation, have now added premium lines to their brand portfolio, both solventless live rosin (Florcal™, Stiizy™, Wana™) and live resin (Ozone™).

In practice, a diversified approach to extraction, which combines solventless with hydrocarbon systems, creates long-term advantages and stability for brands navigating the unpredictable nature of such a highly volatile market.

Diversification appeals to a broader audience, rides out biomass quality fluctuations, and shifts in response to market demands.

PORTFOLIO PRICE TIERING ACROSS BRANDS AND CATEGORY ASSORTMENT

Top brands are starting to see the true benefit of this earlier implemented strategy as prices compress and consumers continue to mature and look for more "premium" attributes in mainsteam products.

	Value	Mainstream	Premium
Cresco Labs®	High Supply™	Cresco Cannabis™	Floracal™
Stiiizy™	Botanical-Derived Terps	Cannabis-Derived Terps	Liquid Live Resin	Solventless Live Resin
Ozone™	Ozone™	Ozone Balance™	Ozone Reserve™
WANA™	Classic	Quick	Optimals	Full Spectrum (Live Rosin)

[15] *https://bdsa.com/wp-content/uploads/2022/10/BDSA-Mining-for-Gold-Sept-2022.pdf*

LIMITLESS POTENTIAL: HARMONY OF SOLVENT & HYDROCARBON SYSTEMS TOGETHER

BROADEN YOUR CONSUMER BASE

For starters, adding both solvent and hydrocarbon systems exponentially increases the number of SKUs in your portfolio. Cresco Labs®, Stiiizy™, and other notable MSOs typically break extraction types out into specialized inhouse brands, creating unique brand identities that appeal to new consumer groups.

As one example, Cresco Labs'® High Supply, their hydrocarbon-extracted concentrate line, aims to please consumers seeking high-THC, low-cost vape carts, while Floracal™ caters to an audience looking for flavor-forward, top-end live rosin concentrates.

Combined with smart branding and differentiation, new SKUs help you cater to entirely new audiences, which would never have been accessible through a single extraction strategy.

ADAPT WITH FLEXIBLE PRODUCTION

If there is any absolute in cannabis cultivation, it is that there are no guarantees when it comes to harvest outcomes.

Outdoor growers face the uncertainties of climate change chaos and weather onslaughts. For example, in 2020, the unprecedented wildfires and associated smoke across the West Coast meant outdoor and greenhouse production was greatly delayed.

As a result, growers had to make the tough decision between harvesting early, or waiting it out and risking exposure to cold weather and rain. Furthermore, wildfire smoke exposure impacted the quality of some harvests.[16]

While much more predictable, even indoor controlled environments carry some risk. As only one example, the ongoing industry-wide issues of Hop Latent Viroid continue to reduce potency and flower quality. By some projections, this pathogen may already translate into substantial commercial losses, as much as $4 billion annually.[17]

These scenarios demonstrate that flower quality, even within controlled environments, is subject to fluctuation. With hydrocarbon and solventless systems in play, you'll be able to extract cannabinoids from available biomass, no matter the quality.

Solvent and solventless extraction work together to allow your operation to adapt to biomass quality, thereby providing as many pathways to profit as possible.

LIMITLESS POTENTIAL: HARMONY OF SOLVENT & HYDROCARBON SYSTEMS TOGETHER

RESPOND TO MARKET DEMANDS

Structuring a business around multiple extraction technologies allows you to shift production in response to market conditions. With several extraction systems, it's possible to repurpose biomass into new products as retail sales dictate.

For example, if a small run of live rosin keeps flying off the shelves, shifting resources toward additional runs would make sense. Or, if a longstanding staple is no longer as profitable, you'll want the flexibility to shift production to other higher-margin SKUs.

Adjusting production in real-time in response to market demand is a game changer. Instead of a production schedule chained to a single system, a limited range of SKUs, and available biomass quality, a dual approach naturally allows your production to shift from high-throughput, lower profit margins (solvent) to low thru-put, high-profit margins (solventless) as needed, depending on biomass and demand.

LIMITLESS POTENTIAL: HARMONY OF SOLVENT & HYDROCARBON SYSTEMS TOGETHER

PIVOT WITH DATA-DRIVEN PRODUCTION PLANNING

Wholesale prices also play into the equation, especially for solventless extractors who source all or part of their biomass on the open market. Even with the most meticulous projections, solventless extractors are susceptible to the impact of a poor harvest year. If there is no high-quality flower available or only available at astronomical wholesale prices, pivoting to hydrocarbon extraction allows you to process biomass of differing qualities and keep your production line going.

Alternatively, following a bumper crop and a glut of solventless-suitable flower, adding a solventless system allows you to pivot production into a premium category of concentrates.

In another scenario, what if a solventless run isn't hitting the projected yields? The difference between a four percent and a five percent yield may not seem substantial, but in practice, it leads to marked differences in profit margin. In a sample model by Pure Pressure by Agrify, a one percent difference in yield translated to an 18 percent reduction in daily profit margin — a possible loss of more than $10,000 a day.

Fundamentally, a dual extraction strategy means management can apply real-time data-driven insights to pivot into a more profitable production strategy. Production planners can play around with the numbers, experiment with small extraction runs, and take all the factors into consideration before ultimately choosing the course that makes the most business sense.

CONCLUSION

The cannabis extraction sector continues to operate on outdated messaging, pitting one extraction method against another. But a market valuation of $2.74 billion means it's time to put this conversation aside. Yes, all modern extraction systems have pros and cons, but a dual extraction strategy easily mitigates the disadvantages of basing production on a single extraction system.

Incorporating different extraction technologies into a broader production strategy ensures you have the flexibility to adapt to changing consumer tastes, biomass availability, and market price fluctuations. A dual-extraction approach pairing hydrocarbon with a solventless system is a perfect case in point.

The disadvantages of one system feed directly into the advantages of another. Instead of facing the limitations posed by one technology, you've built the capacity to pivot production as needed. For example, if the biomass isn't available for a profitable solventless run, you can shift your focus to hydrocarbon production. Alternatively, if the market has shifted from high-THC SKUs, you have the option to refocus production on premium market categories like rosin and full-melt hash.

Together, a strategy incorporating hydrocarbon and solventless extraction ensures a broader consumer base, adaptable production, and greater longevity. No matter how the sector evolves, it's a winning strategy offering more paths to profit than what is possible should all your production hinge on a single method.

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