COMPLETE GUIDE TO CANNABIS

cannabis cultivation | cannabis extraction

FROM AG OPTIMISTS



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PRECISION INDUSTRIAL TEMPERATURE CONTROL SOLUTIONS



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WHAT IS CANNABIS?

Cannabidiol (CBD) and tetrahydrocannabinol (THC) are two of up to 144 known cannabinoids found in cannabis plants. While cannabis as we know it has been around for over 70 years, it has recently skyrocketed in attention and popularity. Unlike THC (another cannabinoid found in cannabis plants), CBD does not cause an altered mental state and has huge potential for medical applications. While scientific research done on cannabis is relatively new, results have been extraordinary. Many believe that as research progresses, cannabis will become a more readily-available treatment option for issues like epilepsy, pain management, anxiety, depression, and even cancer.

A BRIEF HISTORY OF CANNABIS



1940

Cannabis was first extracted by chemist Roger Adams.

1946

Dr. Raphael Mechoulam documented the three-dimensional structure of cannabis.

1946

Dr. Walter S. Loewe conducted tests that supported the theory that CBD didn't cause an altered mental state.



1960s

The first cannabis oil designed for therapeutic use was released by the British Pharmacopoeia.

1980

Dr. Raphael Mechoulam conducted research that supported the theory that cannabis could treat epilepsy.

2013

Charlotte Figi, a girl who suffered from chronic seizures, all but eliminated her seizures using high-CBD strain cannabis; her story gained national attention.

2017

The FDA advisory panel approved the CBD medication Epidiolex to treat two forms of childhood epilepsy.

2018

The "Hemp Farming Act of 2018" made hemp (THC < .3%) legal to grow as ordinary agriculture nationwide.



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CANNABIS TODAY

Many experts say that the evidence for the benefits cannabis are very positive. However, as research is still in its early stages, the benefits of cannabis require further evaluation. Researchers contend that it is essential to further understand these beneficial effects and the specific biochemical interactions that are affected by cannabis. Many are confident that continued research will confirm the widespread realizations of its medicinal advantages. Taking the time to establish a reputable cannabis business now will put you well ahead of others as research moves forward.

CANNABIS IS COMMONLY USED TO...



REDUCE PAIN AND INFLAMATION



ELIMINATE SIEZURES



TREAT ANXIETY AND DEPRESSION



PREVENT CANCER FROM SPREADING

LEGALITY

While cannabis is legal across most of the US, states have varying limitations on its use. Where limitations exist, the most important factor in determining legality is whether the cannabis is extracted from hemp or marijuana. Make sure you are familiar with your state's laws regarding cultivation and usage.



GROWING CANNABIS

High-quality cannabis products begin with high-quality cannabis! Understanding the nature of cannabis plants and following proper growing techniques will ensure you're producing the most potent buds possible.

Seeds or shoots of high-CBD or THC strain cannabis can be found online or, where they're legal, at local cannabis dispensaries.

HEMP VS. MARIJUANA



hemp



marijuana

The terms "cannabis", "hemp", and "marijuana" are used fairly interchangeably. However, it's important to understand the differences between the three. "Cannabis" is the family of plants that hemp and marijuana fall under. Hemp has much higher CBD levels than marijuana and low THC levels (typically less than 0.3%). Marijuana flower is lower in CBD and much higher in THC (can be anywhere from approx. 10-30%). Marijuana extracts can be concentrated to more than 90% THC.

MOST POPULAR STRAINS OF CANNABIS AND THEIR CBD:THC RATIO

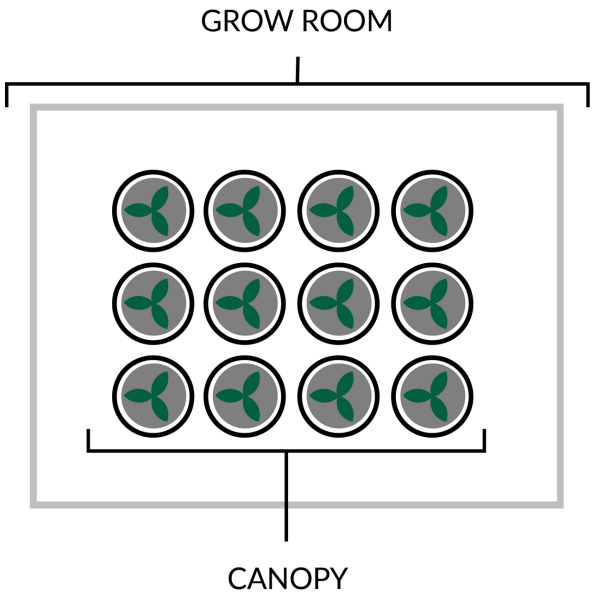
CHARLOTTE'S WEB 20:1
SWEET AND SOUR WIDOW 1:1
STEPHEN HAWKING KUSH 2:1
SOUR TSUNAMI 1:1
RINGO'S GIFT 24:1

HARLEQUIN 5:2
CANNATONIC 3:1
HARLE-TSU 20:1
CANNE-TSU 22:1
PENNYWISE 1:1
ACDC 20:1

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CANNABIS GROWING CHECKLIST

Whether you're just starting to grow cannabis or are a seasoned professional looking to revamp their setup, all the information and gadgets available can seem overwhelming. Specific needs will vary depending on your location, the strain you're growing, and the size of your operation. Following this checklist will help you determine the requirements for your setup. Contact our experts at AG-OPTIMISTS!



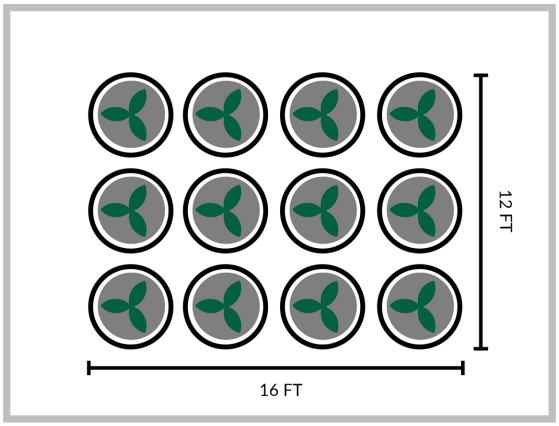
☐ GROWING SPACE

First, you'll need to determine where you'll set up your grow space. Your options fall under two categories: Grow Rooms and Grow Tents. Grow rooms require more planning and handiwork, but typically offer much more space.

Within your grow area is your canopy - the specific area your plants will be growing.

☐ GROW LIGHTS

There are a few options for grow lights including LEDs, CFLs, and HIDs. Any will work fine; what's most important is that you have enough lighting . Your grow area will require approximately 65 watts of of light per 4 sq feet (or per plant).To calculate the total wattage requirement for your grow space, follow these steps:



1. Calculate the area of your canopy (LxW)

ex. 12 ft x 16 ft= 192 ft ²

2. Divide by 4 ft ²

ex. 192 ft ² / 4 ft ²= 48

3. Multiply by 65 w

ex. 48 x 65 w = 3,120 w

☐ TEMP + HUMIDITY

Temperature and humidity are significant contributing factors to nutrient absorption and overall plant health. They can be adjusted as needed via heaters, cooling units, humidifiers and dehumidifiers. Measurements for each should be taken at least twice a day using a thermometer/ hygrometer. Ask our experts about our automated options! Measurements should fall in the following ranges:

- **Temperature: 65 ° F- 80 ° F Humidity:**
- **60-70% for young plants, 40% for flowering plants**





☐ AIR FLOW

Good air flow prevents stunted growth, strengthens branches, and helps with temperature and humidity control. A good air flow system should include the following:

- **An exhaust vent near the top of your grow room or tent.**
- **A vent for fresh, cool air to enter from the bottom of your grow room or tent.**
- **At least two fans pointed at the top and bottom of your grow space.**

☐ pH + NUTRIENTS

The pH (acidity) and nutrient levels of plant grow water can make all the difference in overall plant health. Our engineers at AG-OPTIMIST will customize the perfect simple hands-off automated system for you.

- **A pH meter will measure the acidity; levels that are too high or low will disrupt nutrient absorption and damage roots. Shoot for pH levels between 5.5 and 5.8.**
- **Nutrient levels can be measured with either a TDS (total dissolved solids) meter or EC (electrical conductivity) meter. TDS measurements should fall between 750 and 1500. EC readings should fall between 0.8 and 2.0.**



☐ GROW SYSTEM

(SOIL OR HYDROPONICS)

Once you have your grow room set up with the proper tools to create a cannabis-friendly environment, it's time to set up your grow system! Growers can choose between a traditional soil setup and a hydroponics (soil-less) system. Plants grown in soil systems obtain nutrients from the soil, while hydroponically grown plants are suspended in a nutrient solution. Let's take a quick look at the pros and cons of each:

Soil

- **Requires less regulation**
- **More forgiving**
- **Better for beginners**
- **Lower yield**
- **Slower growth**

Hydroponics

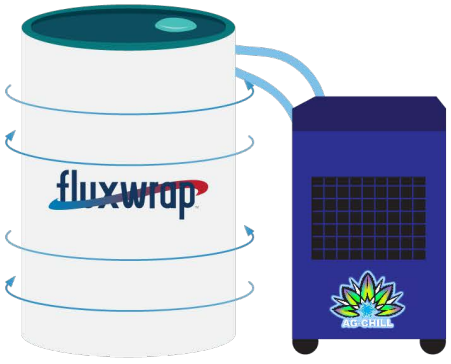
- **Allows for precise regulation of nutrients**
- **Faster growth**
- **Larger yield**
- **Easy to overfeed plants, less**
- **forgiving**
- **Plants require extra support**

STEP UP YOUR GROWING GAME

Don't let hydroponics scare you! Once you get the hang of it, it's pretty simple and, when done properly, it will yield bigger crops of larger, more potent buds. Additionally, hydroponics allows for the integration of growing technology that makes cultivation more precise. For example, Flux Wrap from AG-CHILL can be wrapped around nutrient solution reservoirs. Flux Wrap is a top of the line cooling blanket that will keep the nutrient solution (and, consequently the very important root zone) at ideal temps for maximum nutrient absorption. Perfect root temperatures can be the difference between a decent yield and the most beautiful crop of high-quality buds you've ever seen.

FluxWrap Standout Features

- **Proprietary multi-channel fluid path creates maximum flow with minimal pressure.**
- **Lightweight compact design.**
- **Elastic strap design ensures good thermal conductivity between blanket and drum. Full**
- **coverage cooling and the option for full coverage heating when adjusting fluid temperature.**
- **Blanket conforms to drum or tote to maintain thermal contact over uneven surfaces.**



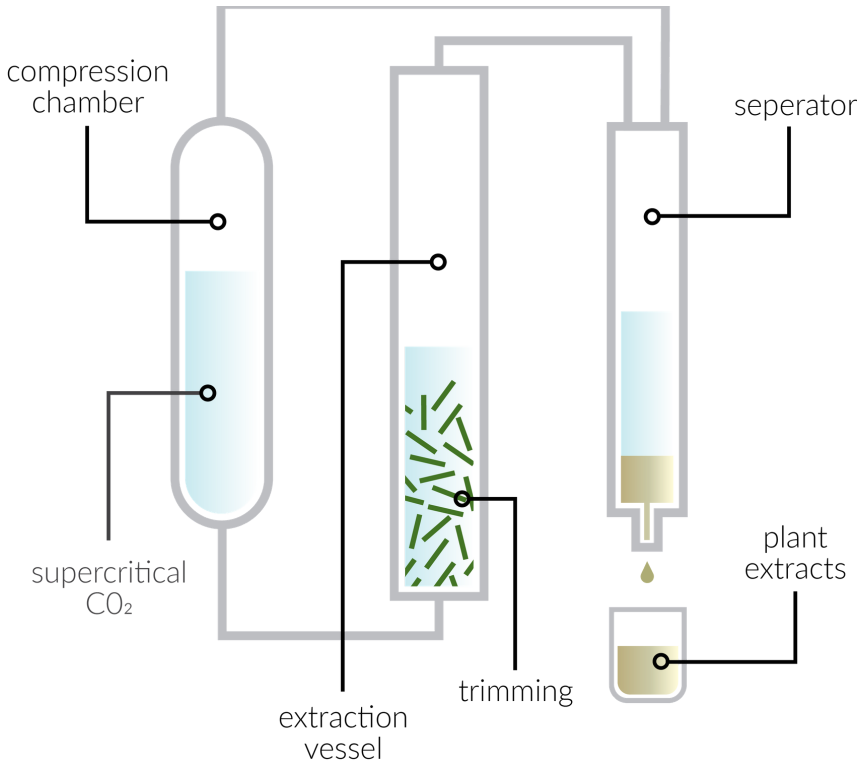


CANNABIS EXTRACTION

When cannabis oil is ingested, only 20% of it is absorbed. This means that for CBD or THC to be effective, the extraction process must be carried out carefully. There are several options for removing cannabis plant extracts from the plant materials. To be effective, however, each approach must begin with a cannabinoid rich plant material.

An important step in any extraction method is decarboxylation. Put simply, decarboxylation is heating the cannabis to activate the cannabinoids (CBD and THC). Most commonly, this is done at lower temperatures over longer periods of time to help preserve terpenes.

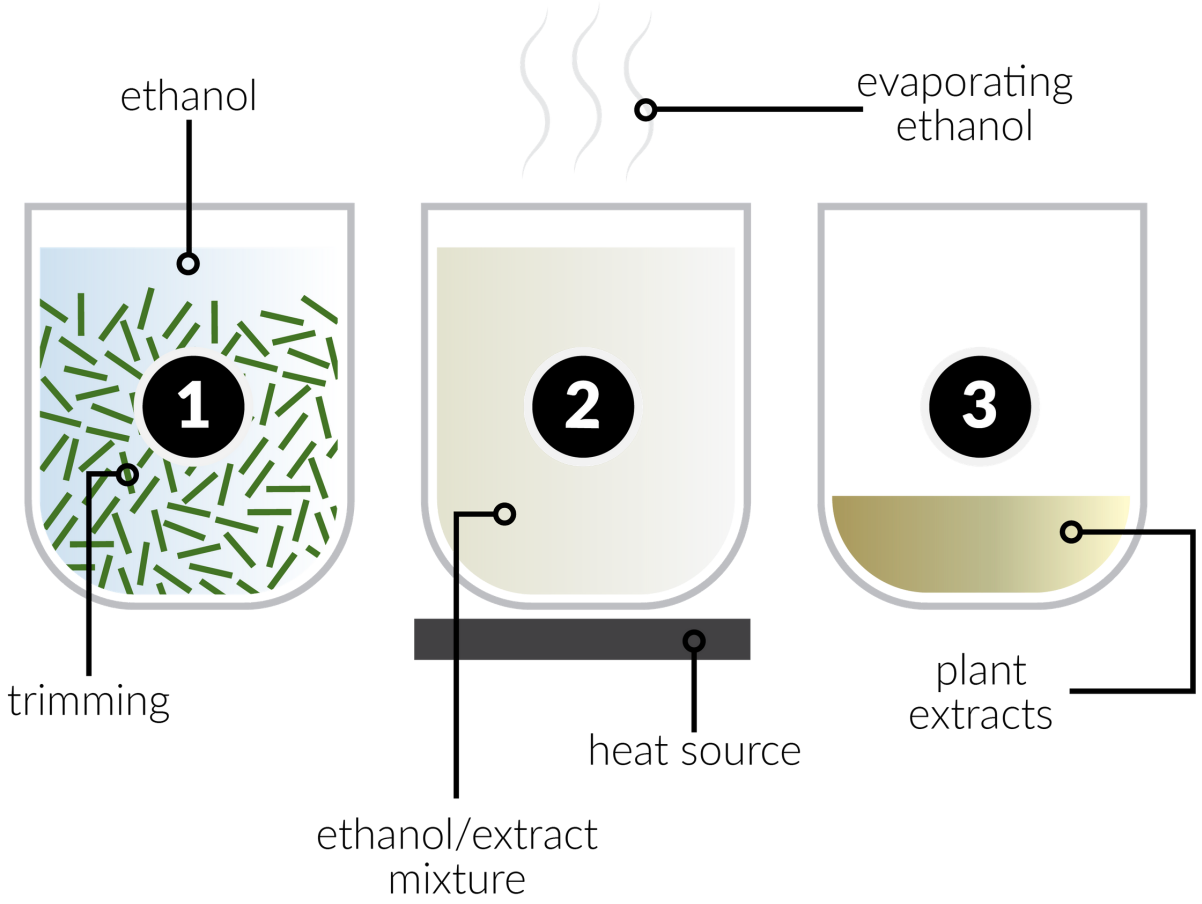
Let's take a quick look at some of the most common cannabis extraction methods and the pros and cons of each. Whether you are just starting up, looking to improve your quality and throughput, or would like to scale up and optimize your operation; our experts at AG-OPTIMISTS will engineer your perfect process!



CO_2 EXTRACTION METHOD

The CO_2 Extraction method uses supercritical carbon dioxide to pull phytochemicals from cannabis plants. Supercritical materials are not quite a liquid but not quite a gas and possess the properties of both. This state is ideal for plant extraction because supercritical CO2 can move through materials like gas and dissolve materials like a liquid. This method is expensive and technical but yields some of the highest-quality results. **CO_2 extraction typically follows these steps:**

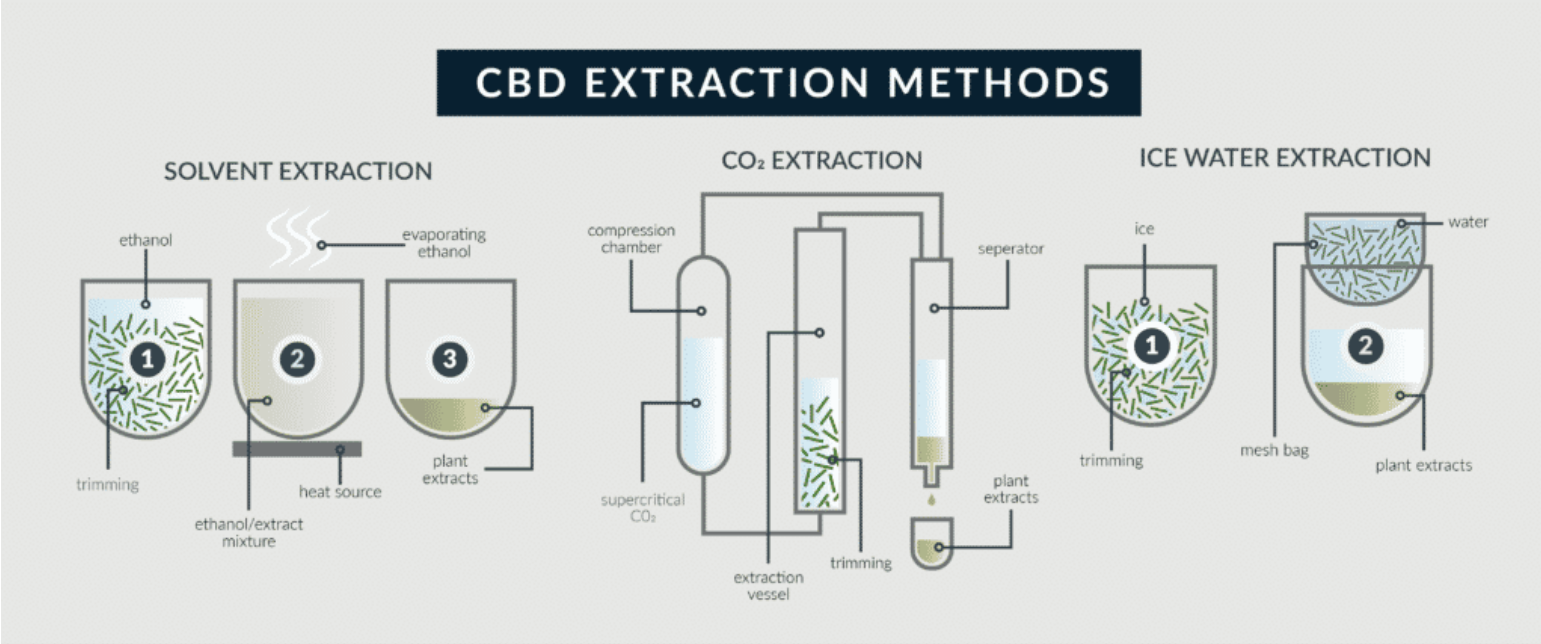
1. The CO_2 is prepared in a compression chamber. First, CO_2 gas is turned into a liquid; this is done by dropping the temperature to under -69°F and increasing the pressure to over 75 psi. Next, the the temperature and pressure are both raised until the liquid becomes supercritical.
2. The supercritical CO_2 passes through cannabis trimmings in an extraction chamber where it dissolves and collects extracts from the plants.
3. The CO_2 / extract solution then enters a lower-pressure separator chamber. The lower pressure causes the CO_2 and plant extracts to separate. The CO_2 returns to the CO_2 chamber and the cannabis oil is drained from the separator.



SOLVENT EXTRACTION METHOD

This extraction method works by using ethanol or light hydrocarbons as a solvent to remove extracts from cannabis plant trimmings. Ethanol extraction is simple and inexpensive but is more likely to denature the cannabinoids. It usually looks something like this:

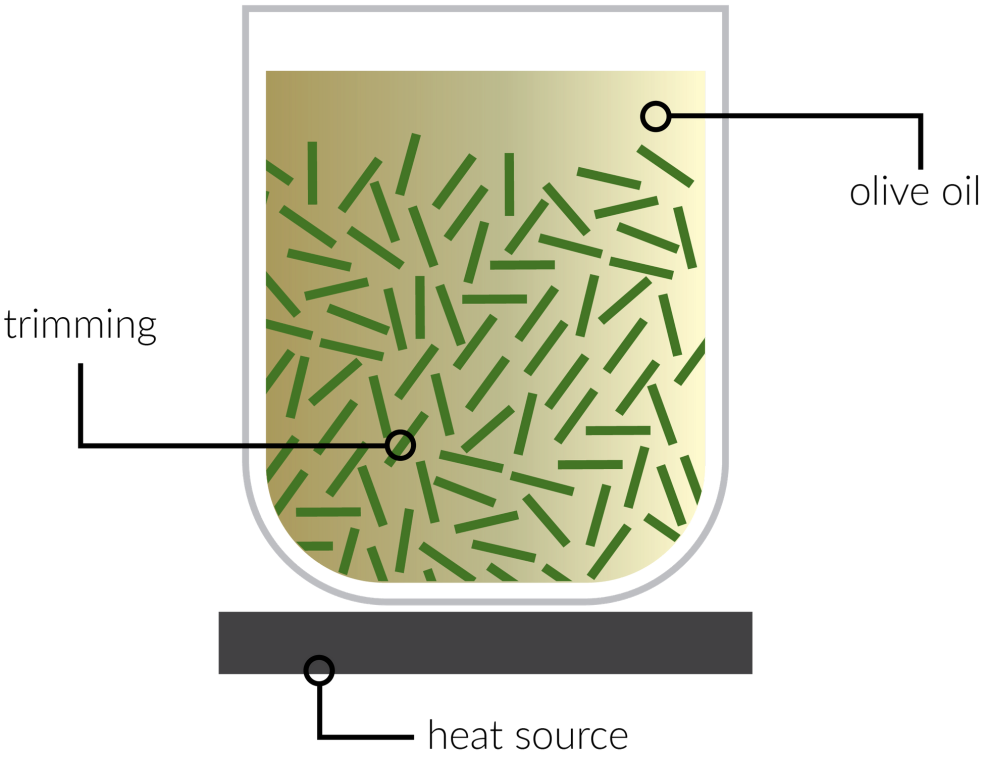
1. Ethanol is added to trimmings and mixed for a couple of minutes to allow the ethanol to dissolve extracts from the plant materials.
2. The ethanol is strained from the trimmings.
3. The ethanol/extract mixture is slowly heated until all ethanol evaporates and only the plant extracts remain.
4. Ultra low temperature light hydrocarbons such as butane and/or propane can be used for much higher quality and purer extractsed products.



ICE WATER EXTRACTION

Ice water extraction creates a powdery resin extract often referred to as “hash” or “bubble hash.” This is another fairly inexpensive process but can sometimes be labor intensive. There are several variations to this method, but they all follow these general steps:

1. Finely-chopped plant trimmings are mixed with ice water. An industrial chiller may also be used. This step is necessary to help separate the trichomes from the plant material.
2. Chilled water is always added before agitating or "washing". The mixture is strained through a mesh bag.
3. Often, the mixture is strained multiple times through progressively smaller-micron mesh bags until the purest-possible extracts are obtained.
3. The extracts settle at the bottom of the strained mixture. The excess water is drained from the top and the extracts are then dried until they become like a powdery sand.



OLIVE OIL EXTRACTION

This technique results in cannabis-infused oil, not pure cannabis extract. It can be done with just about any type of oil or butter (not jut olive oil) which is then used for cannabis-infused cooking. It follows these two simple steps:

1. Cannabis plant trimmings are placed in olive oil (or any other cooking oil) and warmed for 1-2 hours.

2. The infused oil is strained from the plant trimmings.

DECARBOXYLATION:
TEMPERATURE MATTERS!

Without proper temperature control during processing, cannabis and cannabis extracts aren't going to do much for you. All cannabinoids contained within the trichomes of raw cannabis flowers have an extra carboxyl ring (COOH) attached to their chain. Until it's decarboxylized, THC is THC-A and CBD is CBD-A. To access any of the impressive benefits associated with CBD, the cannabis MUST be **carefully** heated at some point.

CBDA ▶ *DECARBOXYLATION* ▶ **CBD**

Why carefully? If not adequately heated , the cannabinoids will not be activated. If overheated or heated too quickly, the cannabinoids can become denatured and stinky.

TOTAL TEMPERATURE CONTROL

AG-OPTIMISTS offers the best of the best when it comes to total temperature control. Our products are easy to install and remove and won't disrupt your current process. Our standard products are ready to ship. Additionally, all of our products can be customized to fit your specific needs with a very short lead time. If you'd like more information, give us a call at 541-610-6858 or e-mail us at either sales@ag-optimists.com or tech@ag-optimists.com.

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