

MEDICAL MARIJUANA PRODUCTION AND EXTRACTION

The background of processing / extracting
Cannabis Sativa L. oils and the use of adopted
Codes in the Marijuana Industry.



Hemp vs. marijuana

While hemp and marijuana are both part of the cannabis species, each has unique properties that distinguish its use.

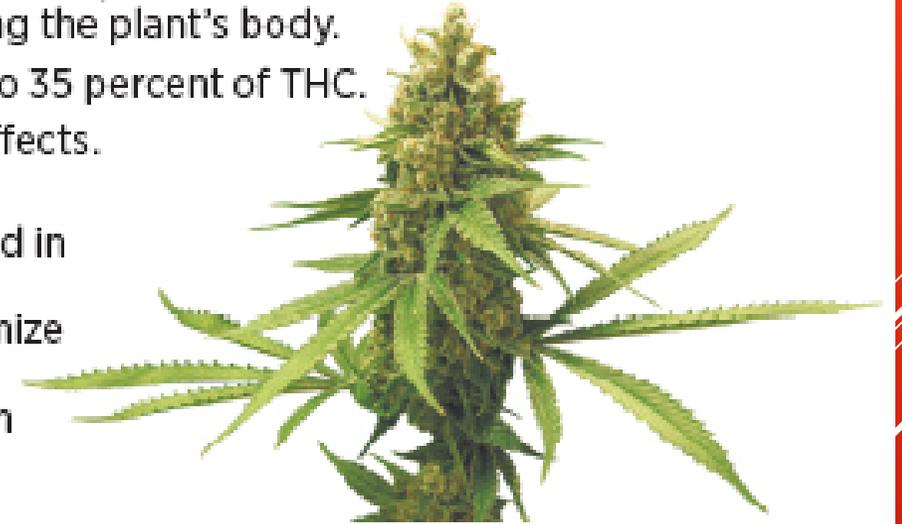
Hemp

- ▶ Can grow as high as 20 feet, with leaves bunched near the top of the stem.
- ▶ Contains 0.3 percent or less of tetrahydrocannabinol (THC).
- ▶ No psychoactive properties.
- ▶ Can grow in most climates, bunched together with other plants; requires little care.



Marijuana

- ▶ Shorter, resembles a bush, with more leaves and buds surrounding the plant's body.
- ▶ Contains 5 percent to 35 percent of THC.
- ▶ Psychoactive side effects.
- ▶ Growth is carefully monitored, controlled in an isolated, warm, humid area to maximize psychoactive uses. Cross-pollination can ruin THC content.



Sources: Purdue University Hemp Project, Ministry of Hemp

**BOTH HEMP & MARIJUANA ARE
PART OF THE CANNABIS SPECIES**

- ▶ Upstream Process:
 - ▶ Harvesting
Cannabis Sativa L.
 - ▶ Drying
 - ▶ Storage
 - ▶ Analysis

INITIAL PROCESSING



- ▶ Biomass Cooling
 - ▶ Conveying
 - ▶ Milling/Grinding
- ▶ Extraction – pathway 1
 - ▶ Degumming & Winterization
 - ▶ Filtration
 - ▶ Miscella Desolventization
- ▶ Extraction – pathway 2
 - ▶ Biomass Desolventization
 - ▶ Biomass Waste & Analysis
 - ▶ Azeotropic Solvent Distillation
 - ▶ Clean Solvent

**These Pathways
produce the crude
cannabis oils**



EXTRACTION PROCESS

▶ Distillate

▶ Distillation

- ▶ Decarboxylation and Analysis

- ▶ Crystallization

 - ▶ Sonification

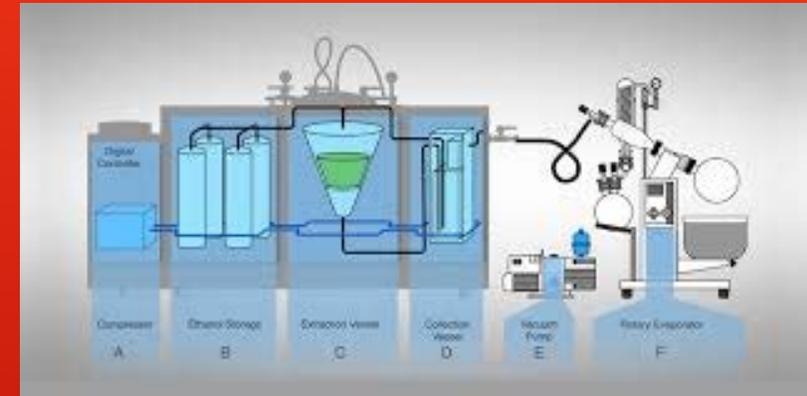
 - ▶ Water Soluble Cannabinoids
and Analysis

 - ▶ Isolate and Analysis

POST PROCESSING



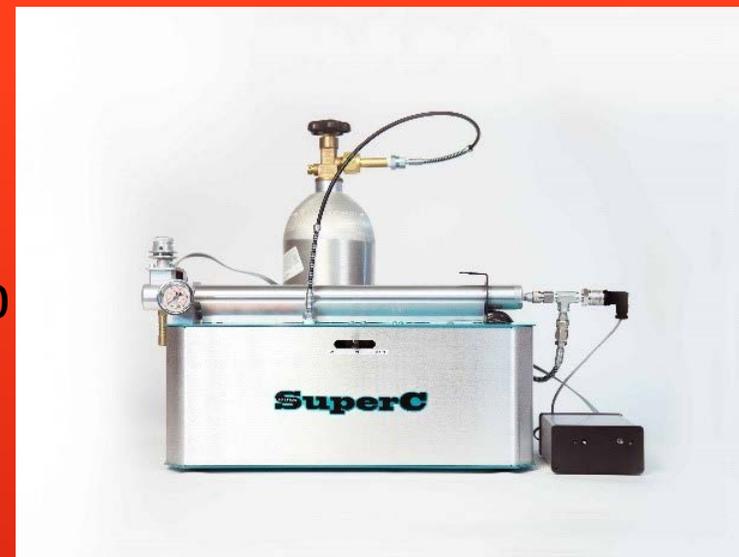
- ▶ Dry-sieved then pressed hashish
- ▶ Water extracted, dried, pressed hashish
- ▶ Rosin, heat and pressure applied, squeezing out the resin
- ▶ Liquid nitrogen extraction
- ▶ CO₂ extraction
- ▶ Ethanol alcohol extraction
- ▶ Distillation, wiped film, thin film or short path
- ▶ Hydrocarbon extraction
 - ▶ Butane, Isobutane, Propane, Propylene, Hexane



EXTRACTION METHODS



CO₂
Cannabis SFE \$49,500



CO₂
Super C \$4,000



Eberbach ES703
Ice Water
\$10,000



Ai SolventVap
\$19,470
Rotary Evaporator



Solvent Extractor
\$20,000
Hexane

In CO₂ extraction, carbon dioxide is pressurized in metal tanks until it becomes a supercritical fluid, then the fluid pulls out the desirable compounds from flower.

The fluid is then separated, leaving only concentrates including hash oil, shatter and budder.



Hash Oil



Shatter

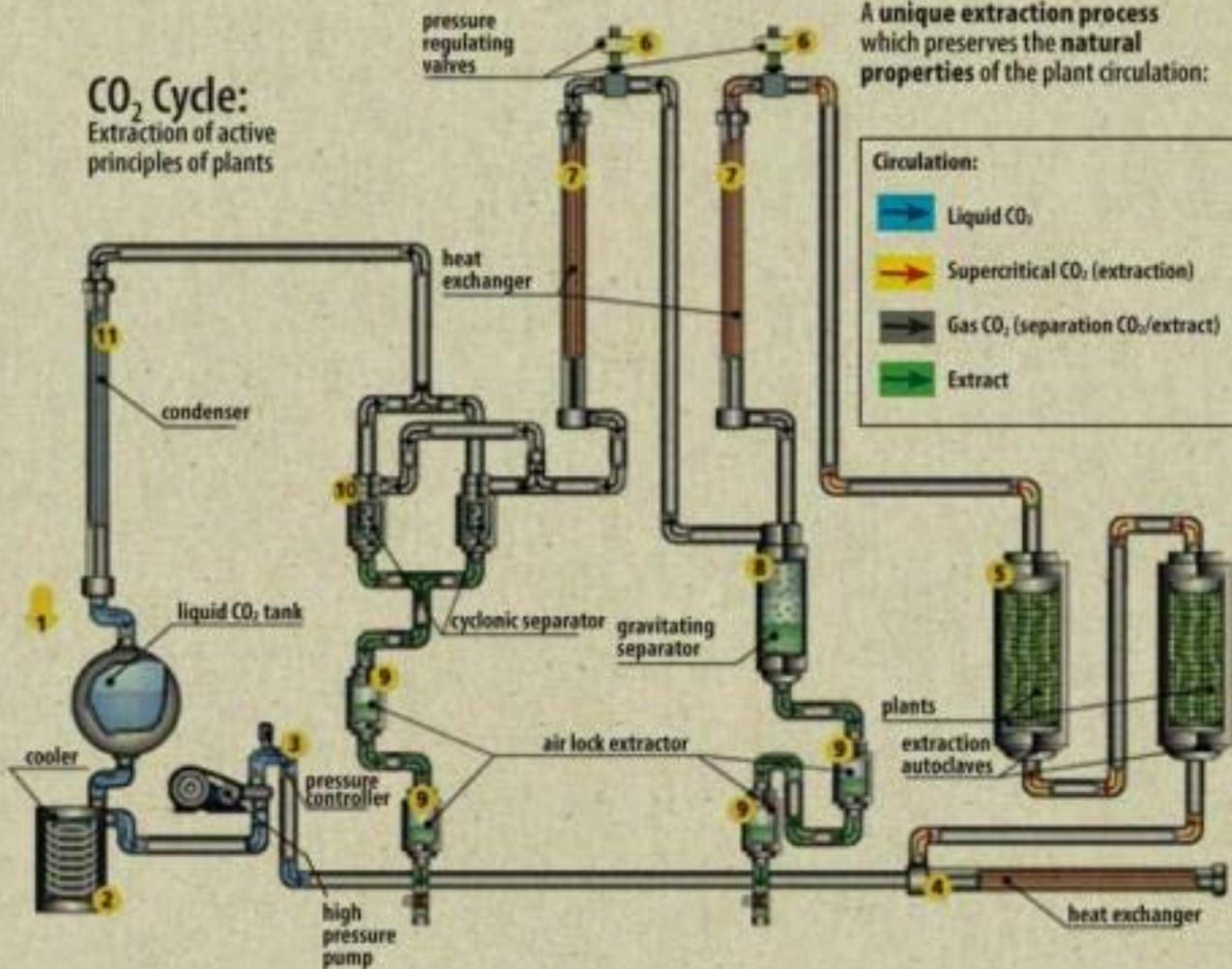


Budder Wax

CO₂ EXTRACTION

THE SUPERCRITICAL EXTRACTION PROCESS

CO₂ Cycle: Extraction of active principles of plants

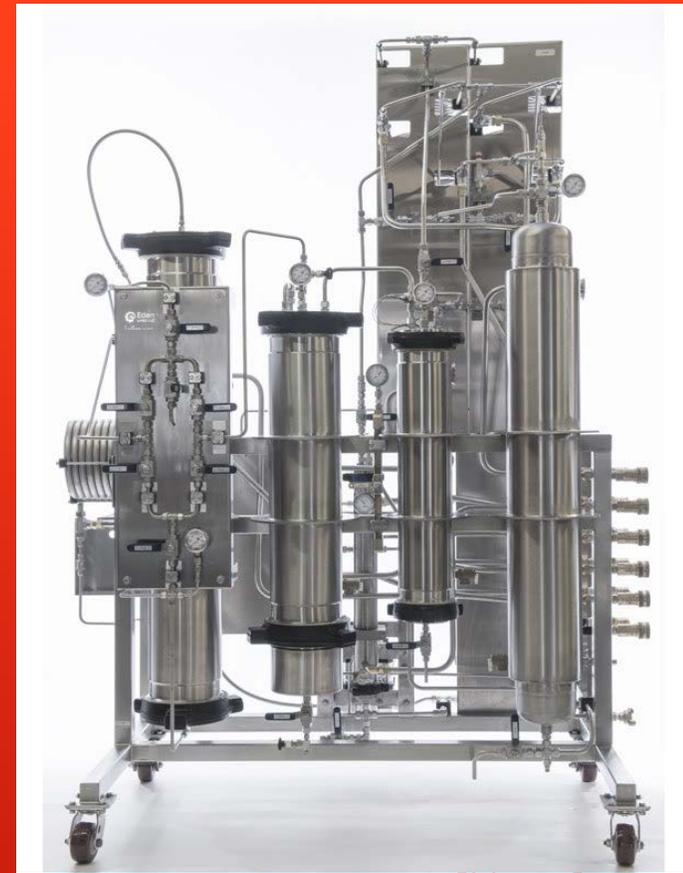


1. **CO₂ storage**
2. **Cooling:** CO₂ passes into a cold exchanger to maintain its liquid state before entering into the high pressure pump.
3. **Pressurization:** the pressure is raised to 300 bars.
4. **Reheating:** the temperature is raised to 31° C. CO₂ is supercritical.
5. **Extraction:** CO₂ supercritical is used as solvent to extract active plant ingredients without denaturing them.
6. **Relaxation:** Lowering of the pressure and thus return of the CO₂ to a gas state allows the separation of the extract from CO₂.
7. **Reheating:** The temperature is maintained at 30° C.
8. **Separation:** 1st separation stage: separation of CO₂ from the extract by gravity.
9. **Under pulling:** The extract is decompressed gradually to be under drawn in total safety.
10. **Cyclonic separation:** 2nd stage separation: Separation of CO₂ extract by centrifugal force.
11. **Liquefaction:** still in a gas state, CO₂ is cooled for liquefaction.

BOSS (CO2)
\$250,000



Hi-Flo FX2 (CO2)
\$175,000



Apeks Supercritical CO2 System \$445,000



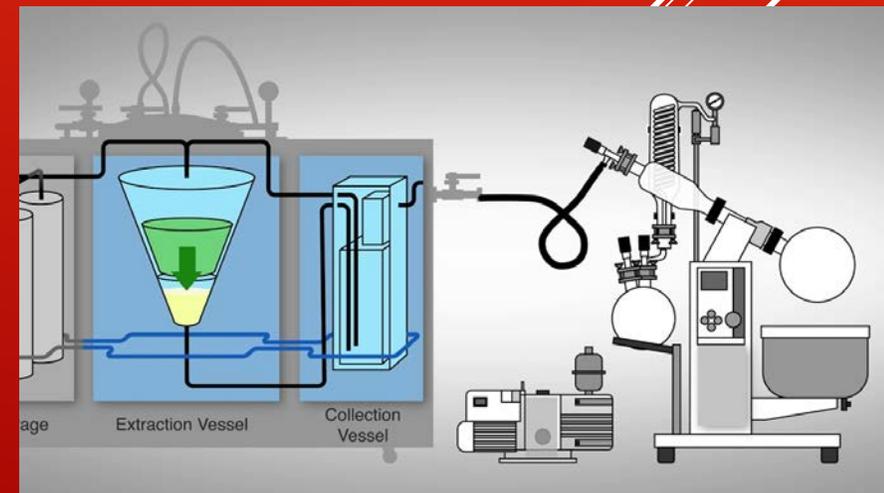
Trichomes are the little hair like structures

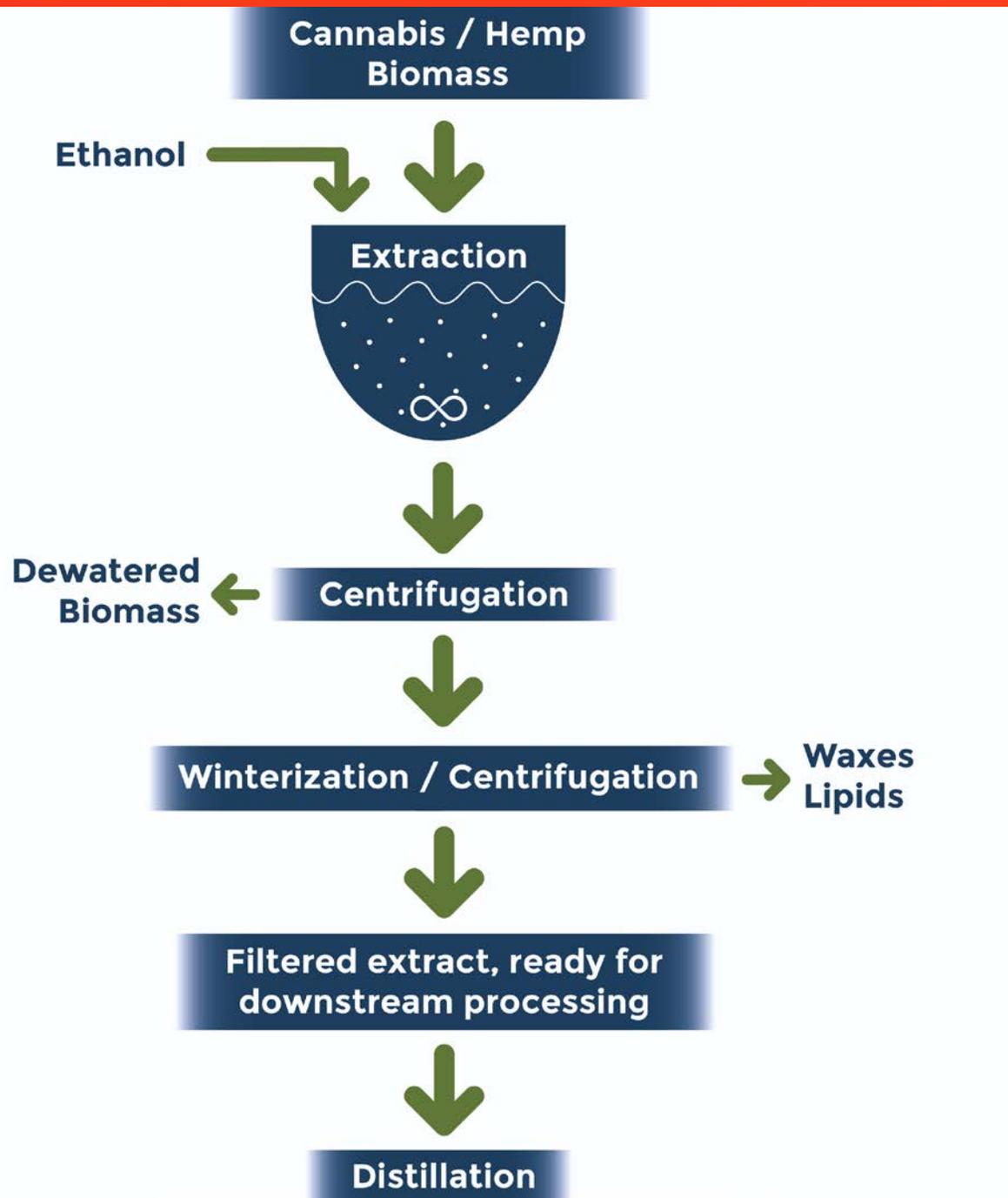


Ethanol extraction is conducted by soaking raw cannabis in ethanol to pull trichomes into the solvent.

The cannabis is then removed; the liquid is filtered and the alcohol purged from the extracted material.

ETHANOL EXTRACTION





Winterization is essentially an extraction process that purifies the extracted oils by removing potentially harmful waxes, transforming it into a pure isolate.

Typical winterization:

Use 10 Liters of ethanol for every Liter of crude extract. Get as close to the freezing point of pure ethanol (-76 C) as possible. Use chillers, walk in freezers, chest freezers, dry ice, etc. 24 hours or more is a normal time to wait for waxes to precipitate out.

To see if any waxes remain in the filtered solution, place a small sample (several mL) back in the freezer for a day. If the solution appears cloudy when checked, further winterization may be needed.

Hydrocarbon extraction typically refers to using butane or propane as a solvent that's passed through the raw cannabis matter to collect cannabinoids and terpenes.

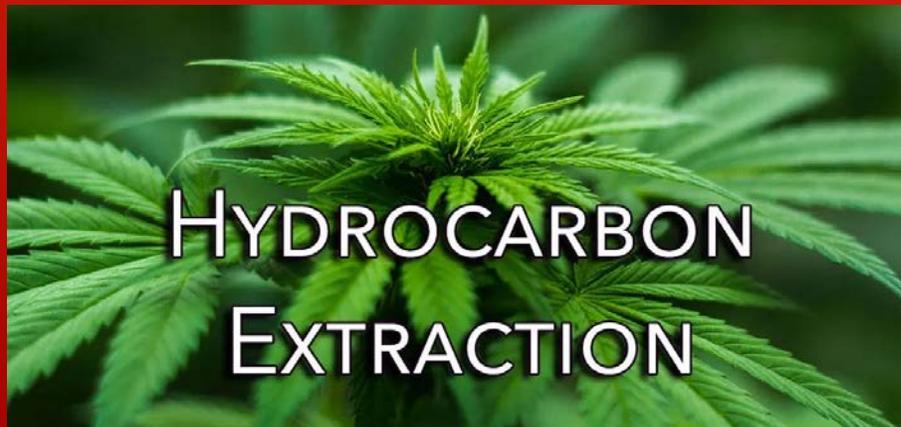
The solvent with the cannabis oils is then heated up to evaporate off the butane or propane, leaving behind the extract.

HYDROCARBON EXTRACTION



Hydrocarbon compounds are highly flammable: but they are efficient cannabinoid extractors. In practice; only propane and butane are used.

Why these? They work efficiently, and evaporate very quickly, making recovery of the dissolved cannabinoids easy. They also leave the colored pigments and chlorophyll behind.



The properties of hydrocarbons that are ideal for cannabis extraction (high volatility, low viscosity) make them extremely dangerous. All hydrocarbons can form explosive mixtures

(Butane will explode at concentrations between 2% and 8% in air).



There is no way to make these hazardous compounds safe, thus extensive engineering controls MUST be employed to avoid disaster. Even then, operator error, or inadequate SOPs can lead to hazardous conditions.

Cannabis Oil



Extraction Machine:

The Complete Buying Guide



Ablaze Mini (Butane) \$510



Io Extractor (Butane) \$225,000



PX40 (Butane) \$189,000

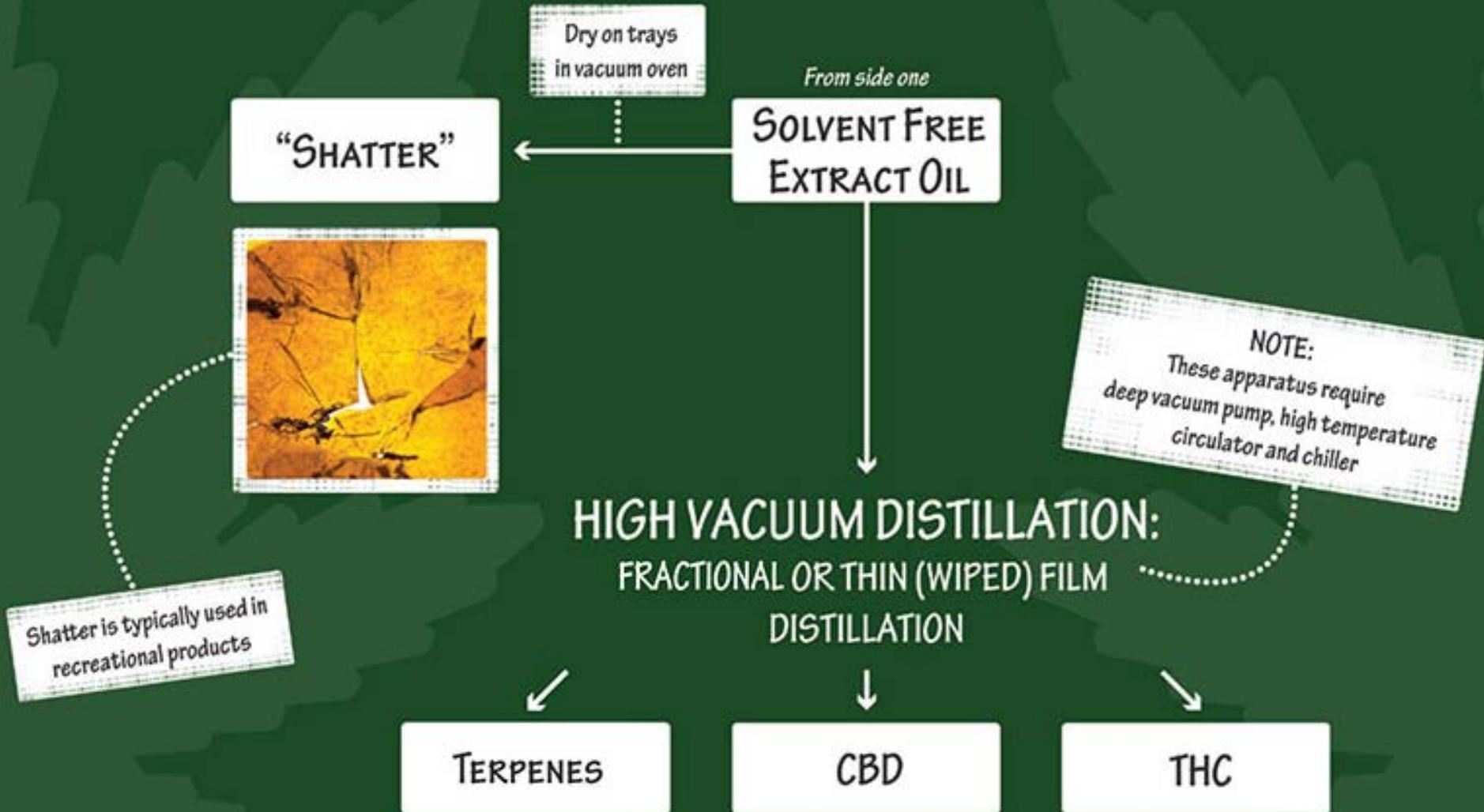


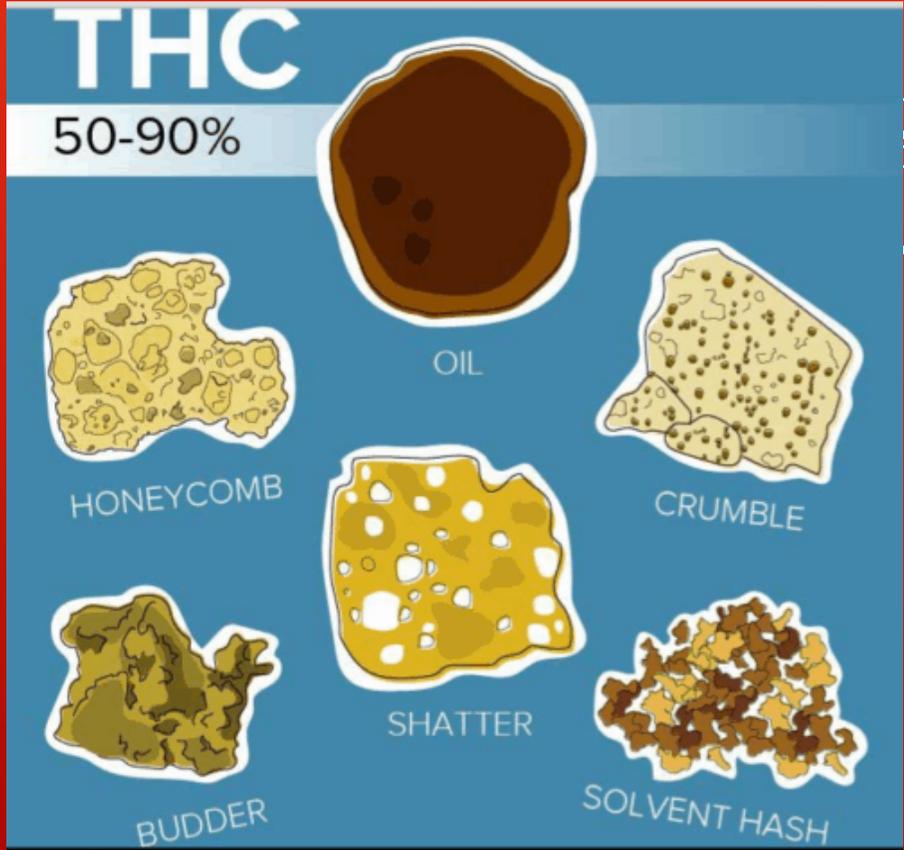
- ▶ **Centrifugal terpene removal:** The process of separating terpenes from a primary extract using a centrifuge device.
- ▶ **Winterization:** The process of removing plant lipids from a primary hydrocarbon extract via a secondary solvent, freezing, and filtration.
- ▶ **Decolorization/Carbon Scrubbing:** The process of removing the dark color and undesirable components of a primary extract via various filtration media.
- ▶ **Dewax:** The process of reducing and removing plant lipids via low-temperature single solvent isolation and filtration.

REFINEMENT FROM HYDROCARBON EXTRACTION

FINAL PROCESSING

ISOLATION TO SHATTER OR INDIVIDUAL COMPONENTS





SOME TYPES OF FINISHED PRODUCT

- ▶ **Vacuum Purge:** The process of removing residual solvents via a low-pressure low heat oven cycling.
- ▶ **Decarboxylation:** The process of removing the carboxylic acid group from primary cannabinoids via heat.
- ▶ **Co-solvent separation:** The process of isolating one or more cannabinoids via matching various solvents to cannabinoid polarity.
- ▶ **Co-solvent crystallization:** The process of isolating cannabinoids via crystallization by matching various solvents to cannabinoid polarity.

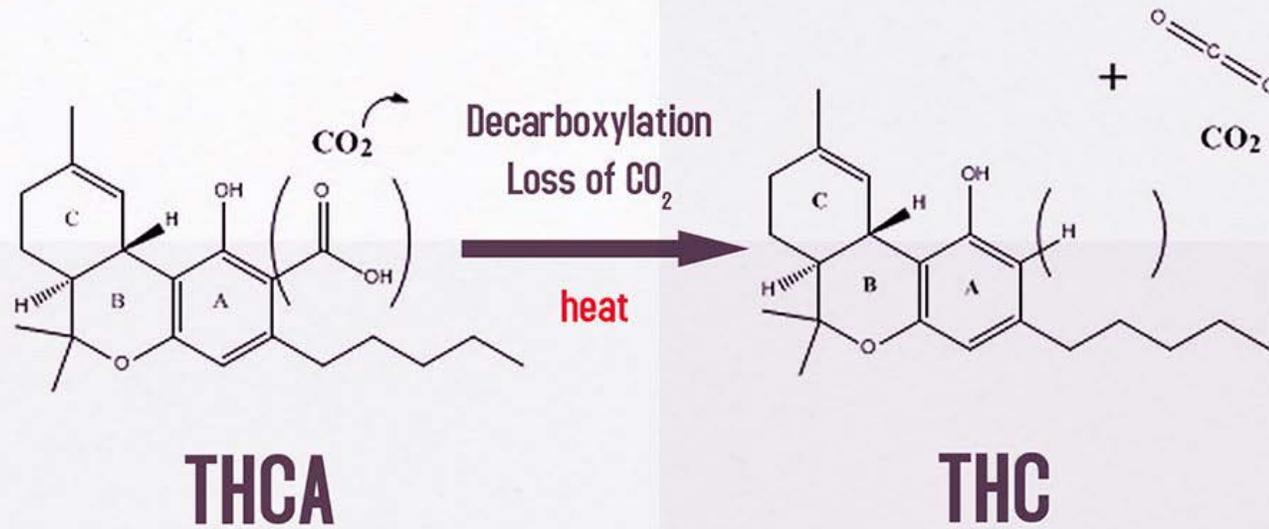
REFINEMENT FROM HYDROCARBON EXTRACTION

• DECARBOXYLATION TEMPERATURES AND TIMES •

Temperature +/-5F	Heating mode	Plant Material Time		Kief/Hash Time		Cannabis Oil Time
		High THC	High CBD	High THC	High CBD	
300 F	Oven	10-18 minutes	15-25 minutes	5-10 minutes	10-15 minutes	
250 F	Hot oil bath					Until bubbles taper off
245 F	Oven	50-60 minutes	60-90 minutes	30-40 minutes	40-50 minutes	
212 F	Boiling water bath	90-120 minutes	2-4 hours	90-120 minutes	2-4 hours	

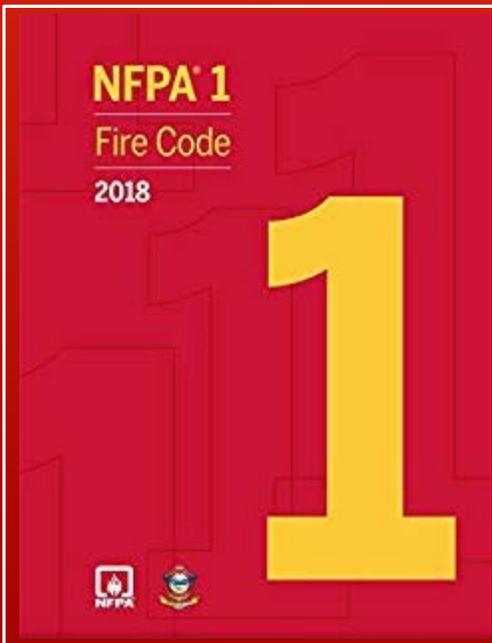


• DECARBING PROCESS •





IFC Chapter 39:
*Processing and
Extraction Facilities*



NFPA 1, Chapter 38:
*Marijuana Growing,
Processing, or
Extraction Facilities*

COMPLICATED PROCESSES:

Require the best sources
of code in dealing with
the actual operations
and processes within a
facility.



- ▶ Perimeter Fencing
- ▶ Vehicular Drives/Approaches
- ▶ Fire Lanes
- ▶ Parking Lot Layouts & Islands
- ▶ Parking Lot Lighting
- ▶ Loading Docks
- ▶ Site/Exterior Building Lighting
- ▶ Sidewalks - Pedestrian approaches
- ▶ Exterior Doors and Glazing
- ▶ Landscaping
- ▶ Bollards, Barriers, Level Changes, Walls
- ▶ Exterior Cameras
- ▶ Call Boxes

HEIGHTENED SECURITY MEASURES

Facility Hardening





SECOND HASH OIL EXTRACTION LABORATORY
EXPLOSION IN SAN DIEGO COUNTY WITHIN
TWO WEEK PERIOD 17 MAY 2019

- ▶ CO₂ and CO
- ▶ Pesticides
- ▶ Indoor air quality
- ▶ Compressed gases
- ▶ Electrical and lighting
- ▶ Extraction equipment
- ▶ Disinfectants and Cleaning Chemicals
- ▶ Nutrients and Corrosive Chemicals
- ▶ Ergonomics
- ▶ Flammable/Combustible Liquids
- ▶ Occupational Injuries
- ▶ Workplace Violence
- ▶ Walking/Working Surfaces
- ▶ Working at Heights
- ▶ Noise
- ▶ Emergencies
- ▶ Powered Industrial Trucks
- ▶ Machines and Hand Tools
- ▶ Confined Spaces

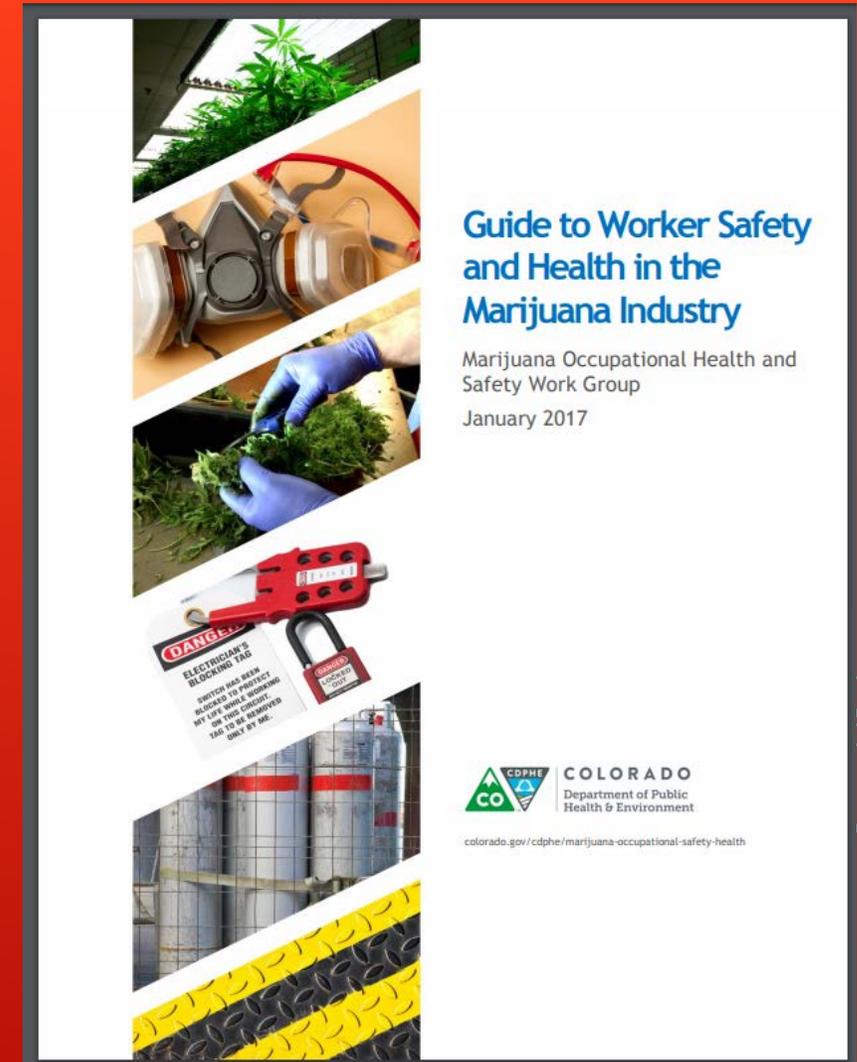
MARIJUANA INDUSTRY HAZARDS

<https://www.nesglobal.net/marijuana-industry-hazards/>



GUIDE TO WORKER SAFETY AND HEALTH IN THE MARIJUANA INDUSTRY

NES (environmental health & safety training company) summary of this report was “...that quite often little to no concern was given to proper training for employees regarding hazards inherent to the industry.”

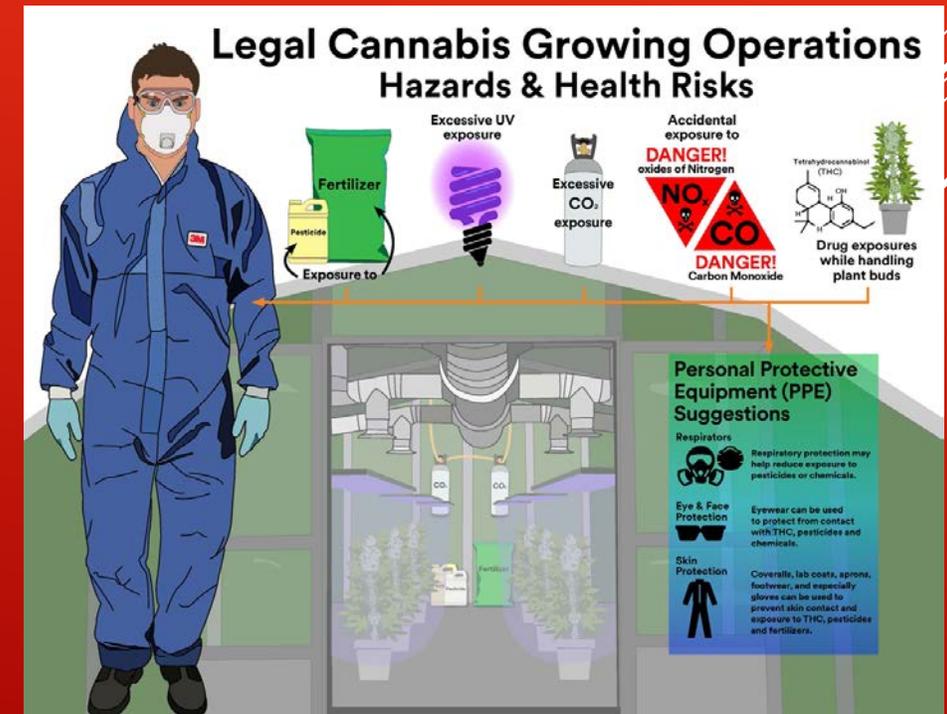


http://marijuanaindustrygroup.org/wp-content/uploads/2017/02/Guide-to-Worker-Safety-and-Health-in-the-Marijuana-Industry_-FULL-REPORT-1.pdf

- ▶ Fire / Explosion
 - ▶ Lower Explosive Limit (LEL) monitor
 - ▶ Fixed location and Handheld detector
- ▶ CO₂ Exposure
 - ▶ Emergency relief valves piped to exterior
 - ▶ CO₂ concentration monitor(s)
 - ▶ Proper Ventilation
- ▶ Cannabis Dust
 - ▶ Use point-source ventilation or N95 respirators
- ▶ Harmful Vapors
 - ▶ Use of Isopropyl Alcohol, Heptane or Ethanol.
 - ▶ Use of point-source ventilation or dedicated ventilation system. OSHA provides limits.
- ▶ Hearing Loss
 - ▶ Operators are often exposed to high levels of noise. Easy to overlook. Easy to remedy.

TOP 5 HAZARDS TO EMPLOYEES/OPERATORS

As identified by Brian Lukus, P.E.
Denver Fire Department



Closing the Loop



MARIJUANA WASTE STREAM

Nationwide Cannabis and HEMP Waste Disposal Services

Affordable Pricing and EPA Compliant

Call Now to Get a FAST Price Quote
(888) 7 [REDACTED]

[Get a price quote by email](#)

Cannabis and Hemp Waste Disposal Services

PegEx Hazardous Waste Experts provides affordable nationwide (USA) cannabis, hemp, and lab pack waste disposal services.

Per the EPA, cannabis and hemp waste must be made "unusable and unrecognizable" before disposal, mixed with at least 50 percent non-cannabis (or hemp) waste (such as non-consumable solids), and stored in a "secured" waste receptacle.

Cannabis and hemp waste must be disposed of in a



- ▶ Plant waste must be rendered unusable by grinding and incorporating it with other ground materials.
- ▶ The resulting mixture must be at least 51% non-marijuana waste by volume.
- ▶ Failure to meet marijuana waste disposal requirements can lead to fines or cancellation of license.



“TRACK AND TRACE” COMPLIANCE MEASURES

RESOURCES:

▶ Handouts:

- ▶ Generic Inspection Form for Marijuana Facilities
- ▶ Relevant 2018 IFC Code references spreadsheet
- ▶ NFPA 1: Chapter 38* *Marijuana Growing, Processing, and Extraction Facilities*
- ▶ NFPA 1: Chapter 38 *Annex A*
- ▶ List of marijuana grow facilities licensed by the Utah Department of Agriculture (8 businesses)
- ▶ Slide show presentation note pages

* SB 1002, 1st Substitute *Medical Cannabis Amendments* (lines 971-974) passed the Utah State legislature on 16 September 2019 and signed into law by the Governor on 23 September 2019.

UTAH MEDICAL CANNABIS PROGRAM

- ▶ <https://medicalcannabis.utah.gov>
 - ▶ Medical Cannabis Fact Sheet
 - ▶ Frequently Asked Questions
 - ▶ Medical Cannabis Fee Schedule
 - ▶ Resources
 - ▶ Patients, Providers,
 - ▶ Production, Pharmacies



QUESTIONS? COMMENTS?

