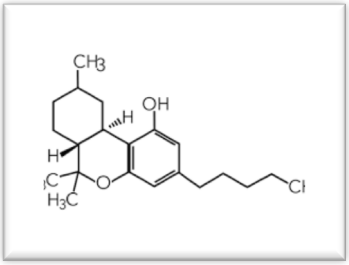
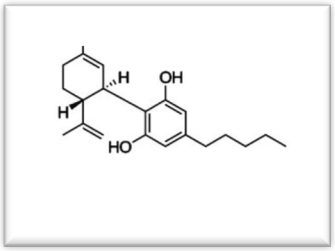
ULTRASONIC CANNABIS EXTRACTION

ABOUT CANNABIS

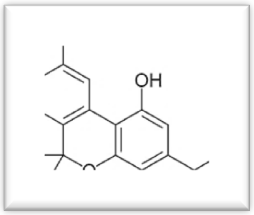
Cannabis products have been consumed in various forms for thousands of years. The very first mention of medical uses for cannabis products dates back to the first century A.D. in Chinese herbal texts, where cannabis tea concoctions were prescribed to relieve pain and induce sleep. Circa 1840, Dr. O'Shaughnessy introduced cannabis and its therapeutical properties to the Western medical community; however, during most of the twentieth century there has been little interest or advances in the medical use of cannabis. Outlawed in 1937 in the United States, its usage has until now been legally prohibited. Over the past few years, however, cannabis usage has grown in popularity due to the legalization process that has recently been taking place in this country and throughout the world.



Tetrahydrocannabinol (THC)



Cannabidiol (CBD)



Cannabinol (CBN)

In addition to flavonoids and terpenoids, cannabis also contains a number of therapeutically active compounds known as cannabinoids, including tetrahydrocannabidol (THC), cannabidiol (CBD), and cannabinol (CBN). THC and CBD and CBN are the most widely researched and widely sought ingredients of cannabis. Cannabis Sativa has high levels of THC and low levels of CBD and CBN. Cannabis Indica has medium levels of THC and medium levels of CBD and CBN. Cannabis Ruderalis has low levels of THC and high levels of CBD and CBN. THC is considered the primary psychoactive compound as it possesses analgesic, anti-inflammatory, appetite stimulant and antiemetic properties.

CBD and CBN have beneficial properties of their own, and they also have a tendency to inhibit some of the THC adverse effects. For example, high-THC strains may have many positive benefits, yet too much THC by itself, without other cannabinoids like CBD and CBN, can cause disorientation, lapses in memory and anxiety. In recent years, concentrated extracts of cannabis plants have become very popular because they allow for a wider range of delivery methods that are preferable to smoking the plant directly, and enabling a smaller dose to be consumed in order to produce the same effects.

As the cannabis industry has expanded, the share of the market attributed to cannabis concentrates (commonly referred to as *shatter, budder, or wax*) has grown exponentially as positive reviews published in the media by the medical and research communities have highlighted their benefits. These concentrates are significantly more potent, and they provide a purer therapeutic combination of cannabinoids and terpenes. Although today smoking the cannabis flowers (buds) is still viewed as the traditional marijuana consumption, an increasing alternative is the consumption of extracts containing cannabinoids in the form of edibles, sublingual drops, body lotions and vapor inhalation. As the

vaporized, smoked, or eaten concentrates ideally have no plant matter left, the resulting flavors are cleaner and more pleasant.

ULTRASOUND-ASSISTED EXTRACTION

Ultrasonic-assisted extraction is an effective and rapid technique for extracting cannabis concentrates. It does improve the diffusion process by accelerating mass transfer within the plant materials, causing the cell walls to rupture and to release the desired compounds.

A vibrating ultrasonic probe immersed in a liquid will transmit alternating high and low pressure waves. These fluctuations cause the liquid molecular cohesive forces to break-down, pulling apart the liquid and creating millions of micro-bubbles (cavities), which expand during the low pressure phases and implode violently during the high pressure phases. As the bubbles collapse, millions of microscopic shock waves, micro jet streams, and eddies are generated at the implosion sites and propagated to the surrounding medium. Although this phenomenon, known as cavitation, lasts but a few microseconds, and the amount of energy released by each individual bubble is minimal, the cumulative amount of energy generated by the imploding cavities is extremely high promoting surface peeling, erosion, and particle breakdown. By disrupting the cell in this manner, solvent penetration is enhanced, accelerating the release of bioactive compounds and other components from the biological matrix into the extraction medium. Because focused ultrasound extraction provides more than 100 times the radiated energy generated in an ultrasonic bath, it is ideally suited for the extraction of beneficial cannabinoid.

When extracted properly, the resulting concentrate is reminiscent of the cannabis strain it was extracted from – the taste smell and effects are simply amplified due to a larger concentration by weight. On average, cannabis plant buds will yield about 15% of extracted concentrate. As expected, the quality of the extract and bioavailability will greatly depend on the amount and potency of the plant matter/trichrome (the crystalline hair-like structures coating the outside surface of the flowers) used.

Sonics & Materials manufactures a variety of high amplitude ultrasonic liquid processors to satisfy the low volume requirements of the laboratory, as well as large scale continuous flow-through systems to satisfy the high volume requirements of full scale production.

BENEFITS OF ULTRASOUND-ASSISTED EXTRACTION

> Low cost

> High yields

> Wide range of solvent

> Rapid, safe and efficient

> Low energy consumption

> Neutralize bacteria, mold and fungi from extracted material

> Non-thermal - terpenes and cannabinoids are not denatured

> Increase solute extraction in a shorter time and at lower temperature

> Reduce thermal degradation of sensitive aromas and flavors

RECOMMENDED EQUIPMENT FOR ULTRASOUND-ASSISTED EXTRACTION

The volume of material that can be processed effectively with an ultrasonic processor is dependent on the power rating of the ultrasonic generator (power supply), and the diameter of the probe used with that power supply – the higher the rating of the power supply and the larger the diameter of the probe, the larger the volume of material which can be processed. The equipment of choice for processing batches between 10ml and 4 liters is our 500 watt Model VC500 with a solid probe. For larger volumes – up to 80 liters/hour on a flow-through basis, the equipment of choice is our 1500 watt flow-through system Model VCX1500 – by removing the probe from the flow cell and using it in conjunction with a slow speed mechanical blender, the same equipment can be used to process batches up to 20 liters.

METHODOLOGY

Although a variety of liquids can be used for cannabis extraction, the most common one is a mixture of 80% Ethanol or polyethylene glycol (PEG), 15% water and 5% non-ionic surfactant such as Triton X-100. NOTE: While shorter processing durations (about 5 minutes) will increase the concentration of terpenes, longer durations will increase the concentration of THC.

1. Using a slow speed or hand grinder, mince the dried inflorescences thoroughly just prior to sonication, and place the contents in a vessel. Do not use a blender or coffee grinder as processing the material to a very fine powder will effect the flavor and fragrance of the extraction.
2. Add the liquid. A ratio of 10 parts of liquid to 1 part plant material is recommended. For some applications, depending on the material's freshness, it might be necessary to adjust the percentage of liquid. Ideally the consistency will be such that the ultrasonics will cause the material to move freely within the vessel.
3. When processing a batch, immerse the probe halfway through the material and sonicate for 10 minutes at 70% amplitude. When processing a large batch, it is recommended that a slow speed mechanical mixer or stirrer be used in conjunction with the probe. To ensure that the temperature of the material being processed is maintained around 30°C, immerse the vessel into a larger vessel containing ice and water. When processing on a flow-through basis, circulate cold water (from a tap or chiller) through the flow cell water jacket in order to maintain the correct processing temperature.
4. Strain the resulting mixture thoroughly using a fine mesh sieve, in order to separate the extraction from the plant fibers.
5. Filter with Whatman Grade 1 filter paper*, and concentrate the filtrate at 50°C using a rotary vacuum evaporator.

   *For faster processing, the mixture can be filtered under a vacuum.