

Cannabis Extraction Methods

The cannabis market uses three main extraction techniques. In all processes, the plant material is subjected to a solvent to remove active compounds from the plant matter and filtered to yield a solution of the solvent with plant extracts.

All processes rely on standard techniques that have been used for years in the botanical, chemical and petrochemical, and distilled spirits industries.

Super Critical Carbon Dioxide

Use carbon dioxide (CO₂) pressurize the CO₂ to its subcritical or supercritical state. The CO₂ stream passes through a chamber containing cannabis material. The distillate can be isolated easily by reducing the pressure which evaporates the CO₂, leaving a cannabis extract with no solvent. Working on temperature and pressure affords CO₂ systems the ability to yield extracts with a complete terpene profile.

Liquefied Hydrocarbons

Pressurize butane, propane or other low molecular weight hydrocarbons to a liquid state. The liquid hydrocarbon passes through a bed of cannabis material and filter, yielding an extract solution of hydrocarbon and plant extract. Like the CO₂ method, a reduction in pressure evaporates the hydrocarbon liquid, yielding a solvent-free plant extract.

This method requires great attention to safety due to the flammability of the hydrocarbon used.

Ethanol Extraction

Use food grade or USP grade ethanol as a solvent to extract plant material. This method varies from vessels to reactors, filter reactors, spinning vessels to barrels. A popular process has the ethanol chilled to <-20°C (-4°F) either in a cold room or freezer and then pumped into a container of cannabis.

After a soak period, the ethanol solution is either filtered or the plant material removed in a 'tea bag' fashion. The resultant mother liquor of ethanol and extract is then concentrated by removing the ethanol. Typical distillation apparatus used to remove the ethanol include rotary evaporators, falling film evaporators or a batch vacuum distillation system.

Extraction Process Residues and Winterization

All extraction methodologies described above yield an oil once the solvent has been removed. This oil contains plant lipids, possibly chlorophyll, waxes, fats, terpenes, THC and other cannabinoids. Additional processing to remove the plant lipids and waxes is necessary to produce a more desirable extract product.

Winterization is the term used to describe the process of removing the plant lipids, fats and waxes. Dissolution of the extraction oil in ethanol and chilling to temperatures <-20°C causes the lipids, fats and waxes to precipitate. This cooling process is conducted in cold rooms, freezers or with jacketed vessels or jacketed filter reactors.

The Ethanol Extraction is slowly making its way to an industry standard thanks to high-quality, low-risk, and relatively inexpensive results it produces. Not to mention the huge investments needed for the Super Critical Carbon Dioxide and Liquefied Hydrocarbons methods.

Which instruments are needed for the Ethanol Extraction Method?

Rotary Evaporator, Water Chiller, Vacuum Pump

The rotary evaporator enables the removal of solvent in a controlled manner under vacuum. Sizes range from bench top (to 3 L flasks) to pilot scale (20 L and up). Reducing the pressure in the rotary evaporator by a vacuum pump lowers the boiling point of the solvent to be removed. In this case ethanol has to be removed. Typically, the distilling flask is filled to 50% volume. The water bath is heated to 30-40°C. The condenser temperature, controlled by a recirculating chiller, is set to -5°C to 0°C. Once the water bath and condenser have reached the set points, the distillation flask is rotated from 150-200 rpm. This creates a thin film on the

upper surface of the round glass flask, which increases the solution surface area and enhances the solvent evaporation rate. Applying an appropriate vacuum to the system lowers the boiling point.

To achieve a recommended target, set the vacuum to achieve an ethanol vapor temperature of 15-20°C. As the ethanol evaporates, it will condense and collect into the distillate flask.

Pay attention: Increasing the evaporation rate by lowering the vacuum and/or increasing the water bath temperature can lead to capacity overload on the condenser. The evaporation rate can exceed the condensation capacity of the recirculating chiller. In this case, ethanol vapor will pass through the condenser and into the vacuum pump. Cannabis extracts require lower water bath temperatures to minimize thermal decomposition.

As a consequence, the condenser temperature of -5°C to 0°C will require a good quality chiller with adequate cooling capacity at those low temperatures.

Temperature control plays a vital role in the cannabis extraction workflow therefore it is paramount to use good and reliable instruments. Attention to detail and optimization of the processing conditions from extraction to component isolation remain critical to maximization of yield and purity.