ethanol-extraction-process-review

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Ethanol Batch Extraction

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The interest in the cannabis and hemp industry for fast, inexpensive extraction of botanical oils, has led to the increasing use of batch ethanol extraction. Simply put, botanicals are put into a tank, along with ethanol, which dissolves the plant cells to release the oil. Wait too long, and it releases the green component, chlorophyll.

PDF Version of the webpage (first pages)

Ethanol Batch Extraction: Infinity Supercritical Looks at New Techniques for Fast Extraction and Evaporation

The interest in the cannabis and hemp industry for fast, inexpensive extraction of botanical oils, has led to the increasing use of batch ethanol extraction. Simply put, botanicals are put into a tank, along with ethanol, which dissolves the plant cells to release the oil. Wait too long, and it releases the green component, chlorophyll.

The downside to ethanol batch extraction is the cost of ethanol (you can reuse it if you have a rotary evaporator), the loss of terpenes (the aroma component of the botanical), and the potential for explosion (flammability).

The upside of the method is that it can include a full-spectrum extraction, decreased time, less equipment, lower pressures (than CO2 and hydrocarbon), and in general, less equipment acquisition cost.

The three basic components of the ethanol extraction methodology for ethanol extraction are time, temperature, mixing, and evaporation. The process of making the concentrate are extraction, winterization, and distillation. We'll examine some highlights of the entire process below.

Time: Ethanol and botanicals are combined in a tank. While some agitation may be introduced, for the main part, the ingredients are static. Because ethanol has a polar hydroxyl group, it will dissolve and extract water soluble components, such as chlorophyll. More time = more extraction of undesirable components. This can result in a darker coloration (starting at green and going to black), which has a grassy flavor. The non polar ethyl group works to extract the hydrophobic components (those which don't like water such as oil, wax CB D, and terpenes). The concentrate is winterized (by adding warm ethanol, cooling to solidify waxes/fats, and then filtering).

Value of Time: A longer extraction (with strong solvent) with a long post-processing session, may negate any expedient extraction time benefits of the ethanol process. In this case, the post-processing includes winterization to remove the undesirables (waxes/fats), charcoal filters to remove chlorophyll, and then distillation (to purge the ethanol so the concentrate is more or less solvent free). There have been some advancements using Zeolites for the in-situ filtration of waxes, which an be researched by the reader separate from this article. For the most part, early adopters prefer ethanol extraction, from the perspective of overall process time reduction. Some operators first do a CO2 cold extraction to collect terpenes, and then put into a ethanol batch extraction, then recombine later. Again, the process will meet or exceed CO2 extraction time, when you take pre-extraction, extraction, and post-processing into consideration.

Temperature: Cold ethanol (-70 C) is the holy-grail of the process because the solvent won't extract as many other undesirable compounds. Since the more common process isn't cold ethanol, we'll continue to look at the standard ethanol extraction process.

Value of Temperature: Cold ethanol is a shorter process, but requires more knowledge/expertise and expensive chiller equipment. In addition, the quantity of extraction is smaller, so it is generally not considered for larger process applications (until the chiller equipment hurdle is breached). Infinity Supercritical has done some experiments using a solid state Peltier cell for the super-chill, but the process produces a great deal of heat of the back side of the cooling cell.

Mixing: Stirred agitation and the use of co-solvents are the most exciting areas of research for the process, and the best part is that it's vertically integrated. Not only can it be used for extraction, but for winterization solution preparation, and evaporation. Mixing the batch of ethanol and botanicals will decrease resident time in the tank, and provide a more even saturation of solvent into the botanical. Stirred agitation allows a faster reaction, and provides a huge increase in surface area. One of our previous posts was for a Spinning Ball Reactor (SBR) which essentially was a rotary evaporator that provided mixing and evaporation by increasing surface area (think of a rotary evaporator on steroids). Using stirred agitation, the possible sonochemistry may also allow the use of co-solvents. In this example, using water with 10 percent ethanol is being experimented with for the extraction solvent mixture. Because of the nature of a stirred reactor, the accelerated fusion time of the solvent and botanicals allow the reduced use of ethanol. The holy grail of extraction processing is the Spinning Disc Reactor, where cell lysis is accomplished using only water.

Value of Mixing: With stirred agitation and use of water co-solvents, may reduce not only the processing time, but also the costs associated with ethanol (or reduction thereof using water as the primary solvent, and ethanol as the co-solvent).