

Cannabis Extraction by Supercritical Carbon Dioxide – Effects of Extraction Parameters

INTRODUCTION

Carbon Dioxide (CO₂) extraction of cannabis is becoming more prevalent as the extract market grows with the spread of medical and recreational legalization. However, due to the historically underground nature of working with the substance, little true scientific experimentation and process development has occurred; even less has been published. Those new to the field have limited guidance.

The following is a compilation of the process learnings regarding selection of extraction parameters that Supercritical Fluid Technologies (SFT) customers' companies who are currently working in the CO₂ cannabis extraction field have shared with us. Due to the proprietary nature of each company's specific process, the material here will be presented in a generic way that is applicable to the majority of processors.

EXTRACTION PARAMETERS

Extraction parameters will determine not only the type, quality and yield of cannabis extract, but also the ease and cost of the extraction process. Different parties on the internet have listed conditions ranging from sub-critical to super-critical with temperatures from 15-100 degrees C and pressures ranging from 600 to 10,000 psi. This is quite the range. Not surprisingly, our customers tend to be in the supercritical sphere. They typically choose starting parameters in the 45-60 deg C range and pressures ranging from 3000 to 5000 psi range and then run trials for their particular feed stock and desired final product. Once they have the desired extract for their specific feed stock, they experiment to find the appropriate flow rate to facilitate processing (as quick as possible without icing up, clogging lines, or causing channeling). Finally, they look at solvent-to-feed rates to balance out the completeness of the extraction (yield) versus the extraction time/solvent cost.

The following sections will outline some of the overall trends determined by each of four parameters.

Temperature

Although temperature can be controlled at many stages in the process, the primary concern is the temperature of the extraction vessel. From the initial chosen temperature,

Increasing the extraction temperature:

- decreases terpenoid concentration in the extract,
- risks possible denaturing of the product, and
- increases wax/resin extraction (thereby increasing extract quantity).

Decreasing the extraction temperature:

- increases the oil proportion of the extract, and
- reduces the wax proportion of the extract.

Pressure

The following are concerns regarding extraction pressure:

- From the initial chosen extraction pressure, increasing pressure increases wax/resin concentration in extract
- Pressure over 5000 psi at 45 deg C causes chlorophyll extraction,
- Increasing pressure increases chlorophyll in extract
- Increasing temperature increases chlorophyll in extract
- Higher pressures are harder to maintain if CO₂ supply is not continuous (cylinders instead of bulk)

Flow rate

The following are concerns regarding flow rate:

- Maintaining flow rate at higher pressures is more difficult due to a loss of CO₂ supply (especially when using tanks and the cylinders are emptying).
- Increasing flow rate can cause dry ice accumulation, resulting in a higher chance of icing up lines unless additional heat is applied.
- Decreasing flow allows for the material to be in contact with the solvent for longer, increasing potential yield.
- Decreasing flow slows processing.

Solvent-to-feed ratio

This is a processing time/solvent cost versus extract quantity amount issue. The correct ratio is the one that is most cost effective.

CONCLUSION

Ultimately, the selection of extraction parameters is a balancing act: product quality vs quantity, processing time vs yield, and the overall cost to produce product. The four parameters discussed are the main ones that our customers use to fine tune their processes.

This article is the second in a series of articles that will address the practical considerations of the extraction of cannabis. To learn more about our cannabis extraction equipment, please contact Supercritical Fluid Technologies at 302-738-3420 or info@supercriticalfluids.com