

PEPPERMINT OIL EXTRACTION USING SUPERCRITICAL FLUIDS

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INTRODUCTION

Traditionally, the food industry utilizes steam distillation to extract peppermint oil. Steam distillation processes yield an extract that is a combination of pure and thermally decomposed peppermint oil. The extract from traditional steam distillation results in the familiar peppermint taste you find in peppermint candy.

SFT developed a process to extract pure peppermint oil utilizing supercritical carbon dioxide. This process yields completely pure peppermint oil. The purer, more potent peppermint profile is a very different and unique taste from that of the traditional steam distillation method.

First, SFT determined the general solubility parameters of the peppermint oil in the SFT-Phase Monitor. The SFT-Phase Monitor (as seen below) allowed exploration of the ideal matrix of extraction conditions. The SFE



conditions were optimized to obtain the highest yield, best quality, and purest fraction of peppermint oil. Then the extraction parameters were perfected using the SFT-110 SFE.

The SFT-110 SFE utilizes pressurized carbon dioxide to extract natural products. The SFT-110 replaces the need for the high heats of steam distillation, so a purer, less thermally decomposed extract is generated. Carbon dioxide is also advantageous over traditional extraction techniques because it does not introduce any residual organic chemicals, meaning that all peppermint oil extracts will be safe to consume. Supercritical carbon dioxide extraction is also a greener technology than steam distillation because it requires less heat to induce better final products. Following this method, the SFT-110 produces a natural, unaltered extract that gives food manufacturers a truly new flavor for their customers to enjoy.



EQUIPMENT

- Analytical Balance
- SFT-110 SFE Unit
- SFT 100 cc Sample Vessel

MATERIALS

- Peppermint Leaves
- 2 Cellulose Extraction Thimbles
- 2 SFT Collection Vials
- 6mm Glass Silica Beads
- 1 SFT Vent Tube



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Figure 1: SFT-110 SFE

EXPERIMENTAL PROCEDURE

Weigh 7.5 grams of peppermint leaves on an analytical balance. Grind up leaves to 1mm x 1mm and load into the cellulose extraction thimbles. Place the cellulose extraction thimbles into a SFT 100 cc sample vessel (10kpsi, 200°C operation). Seal the vessel and set into a SFT-110 SFE unit. Position a pre-weighed SFT collection vial filled with a thin layer of 6mm glass silica beads on the flow line (the beads help trap the oil). Extract the samples according to the following parameters:

EXTRACTION PARAMETERS

Two fractions of oil will be collected via multiple (8) soak @ pressure/temperature and dynamic flow @ 10 liters of CO₂ gas.

Fraction 1: Peppermint Oil (bright yellowish color)

- Pressure: 88bars/1280 psi
- Temperature: 60°C
- CO₂ Flow Rate: 23mL/min

- 8 static and dynamic steps for 10 minutes apiece

-After fraction 1, change out the collection vial and replace with another clean, tared vial for fraction 2 products.

Fraction 2: Peppermint Oil and Waxes (brownish color)

- Pressure: 150 bar/2175 psi
- Temperature: 21°C
- CO₂ Flow Rate: 23mL/min
- 8 static and dynamic steps for 10 minutes apiece

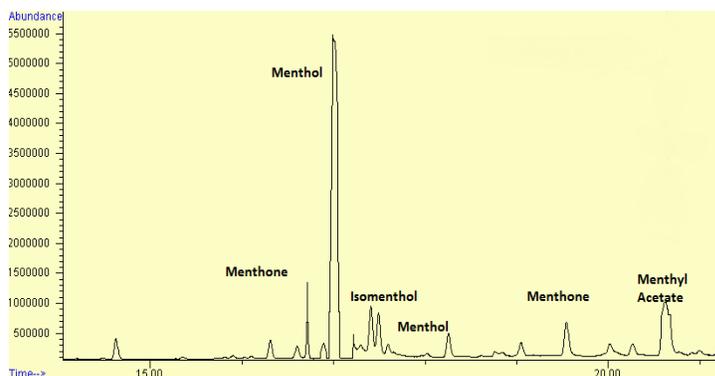


Figure 2: GC-MS Analysis of Fraction 1

RESULTS

Fraction 1 is pure isolated peppermint oil. The first fraction yielded 2.0% or 0.15 grams of pure peppermint oil.

Fraction 2 product is a mix of peppermint oil and waxes. The second fraction is brownish and yielded 3% or 0.22 grams.

GC-Analysis of Fraction 1 at 1280 psi corroborates with pure peppermint oil (see Figure 2 above). Commercially pure peppermint contains: menthone, isomenthol, menthol, and menthyl acetate. All four are present in the collected fraction.



CONCLUSIONS

Pure peppermint oil can be extracted using the lab-scale SFT-110 SFE Unit. Supercritical CO₂ extraction can isolate specific components within the peppermint by slightly adjusting temperature or pressure. Regarding peppermint, pure fractions are extracted at 1280 psi, and peppermint oil and waxes are extracted at 2175 psi.



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