

## How to make a 10L batch of concentrated nano-emulsified product using #Q2000F Sonicator with Cannasol Technologies NanoOptimizer™

### Equipment and Ingredients List

#### For Initial Mixing

- Glass or Stainless Steel Vessel (sized for the batch volume, 5 – 20L typical)
- Hot Plate (induction or conventional)
- Variable-Speed Overhead Mixer w/ Stand & Appropriately-Sized Prop.
- Electronic Balance w/ Sufficient Weighing Capacity

#### Consumables:

- Active Ingredient (THC/CBD/Other API)
- Surfactant (NanoOptimizer™ or similar)
- Water (RO/DI/Distilled)

#### For Sonication

- Q2000 Sonicator with Floccell & Sound Enclosure
- Regulated Source of Dry Compressed Air (Air Dryer/2hp+ Compressor) **or** Qsonica Air Conditioner
- Recirculating Chiller (1200W min. rating for continuous-duty operation)
- Heat Exchanger (shell & tube style typical, needed for continuous-duty applications)
- Process Tank/Vessel with Mixer (venturi or mechanical mixer, 10 – 30L capacity typical, stainless/glass/polypropylene construction)
- Magnetic-Drive Pump (preferred) or Peristaltic Pump (2 L/min. minimum, 5+ L/min recommended)
- Thermometer/Thermocouple (typically tank-mounted)
- Assorted valves/connectors/hose/tubing

#### For Filtration

- Hydrophilic Membrane Filter – Capsule or Cartridge-Style (.2 – 1.0um pore size typical)
- Sanitary Filter Housing (if using cartridge-style filter)
- Peristaltic Pump (2+ L/min, variable-speed, compatible with size-36 tubing or similar)
- Peristaltic Pump Tubing (size 36 or similar)
- Storage Container (polypropylene or glass, 1-10L capacity, must be able to sterilize or sanitize)
- Assorted valves/connectors

#### Consumables:

- Hydrophilic Membrane Filter (typically re-usable, throughput varies widely, Cannasol Technologies' 10" .2um cartridge filters 100 – 200L of nanoemulsion)
- 70% Ethanol, Peracetic Acid Solution, or Other Food-Grade Chemical Sanitizer
- Water (RO/DI/Distilled)

**Note:** The lifespan of the titanium probe is approximately 50-100 hours. Replacements can be ordered from Qsonica and the part number is #4676.

## Instructions:

**Note:** all measurements are by weight

1. Add 5 parts NanoOptimizer™ and 1 part active ingredient (CBD isolate, CBD distillate, F.S. hemp extract, THC distillate, etc.) to a large heated mixing vessel (stainless pot + hot plate).  
For 10.0L batch: 2500g NanoOptimizer™ / 500g active.
2. Heat the contents of mixing vessel to 65°C and mix thoroughly with an overhead mixer (Take care not to heat the NanoOptimizer™ above 80°C).  
NanoOptimizer™ will melt to produce a medium-viscosity liquid. Mix until material is 100% homogeneous. Scrape sides of vessel if necessary.
3. Add 14 parts distilled or de-ionized warm water (~55°C) to the mixing vessel slowly while mixing vigorously.  
For 10L batch: 7000g of warm water.
4. Continue to mix, scrape vessel walls with a stir stick to remove any stuck material (if necessary).  
When the coarse emulsion has formed completely, the vessel contents should appear mostly homogeneous.
5. Transfer the contents of the mixing vessel into the stainless process tank.  
Ensure the 3-way valve at the bottom of the process tank is in the “left” position prior to adding the coarse emulsion.
6. Turn on the magnetic-drive pump to initiate liquid flow through the system. Use the diaphragm valve to adjust flow rate to approx. 6L/minute. The mixing eductor on the end of the tank dip tube should be submerged just below the surface of the emulsion.  
Return liquid flow can be observed through the 3” port in the tank lid. Exact flow rate can be determined by measuring the liquid flow volume into a 2L beaker over a time duration. Never run the magnetic-drive pump dry - ensure it is primed with liquid upon starting.
7. Initiate sonication at 90% amplitude. Monitor emulsion temperature during sonication (ideal processing temperature is 55 – 60°C), adjust chiller/heat exchanger parameters as necessary to maintain temperature - do not allow the emulsion to exceed 70°C.  
For faster processing, target a temperature as close to 60°C as possible.  
Never operate the Q2000 without supplying dry air-cooling to the transducer – see manual for details\*.
8. Monitor progress by assessing the color and clarity of the emulsion – the emulsion will appear to take on more color as particle size decreases. Upon completion, the emulsion should appear transparent in a glass dropper when held up to a bright light source.  
Typical processing times with the Q2000 Floccell range from 1.5 - 2 hours for a 10L batch at 5% active ingredient content (50mg/ml).
9. Upon completion, stop sonication and turn off the magnetic-drive pump. Rotate the 3-way valve at the bottom of the process tank to the “**upright**” position prior to filtration.
10. Ensure that the sanitary filter housing is fully assembled with the 10” cartridge filter properly installed and sanitized/sterilized. Ensure that the outflow valve and the bottom drain valve on the filter housing are fully closed. Open the top bleed valve on the filter housing and, with a beaker held under the bleed valve, initiate flow with the peristaltic pump to prime the housing. When emulsion flows out of the bleed valve, stop the peristaltic pump and close the bleed valve.
11. Place a sanitized/sterilized container under the outflow port of the filter housing, open the outflow valve, and initiate flow with the peristaltic pump to fill the container.  
For best filter life, limit filtration flow rate to approximately 2L/min.

12. When the process tank runs dry, rotate the 3-way valve on the bottom of the process tank to the “down” position to recover some residual emulsion from the pump/flow cell. Continue pumping to build air pressure inside of the filter housing, which will continue driving emulsion through the filter membrane. Monitor pressure on the filter housing pressure gauge – hose clamps may be necessary to prevent the tubing from blowing off the hose-barbs at pressures above 15psi.
13. Once the emulsion stops flowing from the filter housing outflow port, use the top bleedvalve to relieve the air pressure in the housing.
14. Flush the filter with 8 - 10L of clean (DI/RO) water. Perform the filter housing priming procedure (**step 10**) with water at the beginning of the water flush. At the end of the flush, use pump-driven air pressure to remove as much residual water from the membrane as possible, then bleed off the air pressure and disassemble the filter housing. Filter cartridges should either be stored dry or in an antiseptic solution to prevent microbial growth.

The instructions above will yield a 5% w/v concentration of active ingredient. If you choose to increase the active ingredient percentage, particle size will increase accordingly, resulting in reduced emulsion transparency. If you choose to decrease the active ingredient percentage, particle size will decrease slightly and processing time/L, will also be reduced.



*#Q2000F System with Sound Enclosure*

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\*Air-cooling of the ultrasonic system is required. If you do not have a continuous duty compressor, this portable unit is an effective and low cost alternative.

Contact Qsonica at 203-426-0101 or [info@sonicator.com](mailto:info@sonicator.com)