

## **Nanoemulsion Processing Instructions**

### **#Q700CA Sonicator with Axiomm Surfactant System**

The Q700CA is an ideal model to validate and process nanoemulsions. In addition to a sonicator, one will need some basic ancillary equipment such as a hot plate, scale, measuring tools and filters.

Surfactants are also necessary to create nanoemulsions with a wide range of active pharmaceutical ingredient (API) concentrations. The particle size, stability and resulting performance of a nanoemulsion will vary based on the surfactant used, the quantity of surfactant and the presence of other functional ingredients needed to maintain the stability of a nanoemulsion. One will also have to experiment with the ratio of surfactant to active ingredient input used when validating a nanoemulsion formulation.

To begin, scale the water weight, surfactant and input oil as needed for other batch sizes and/or loading according to:

$$W_o = C_o \times W_e / 1000$$

$$W_{\text{surfactant}} = (3 \rightarrow 8, \text{ depending on ratio}) \times W_o$$

$$W_W = W_e - W_{\text{surfactant}} - W_o$$

Where:  $W_o$  = Weight of input oil required (g)

$C_o$  = Desired oil concentration (mg/g)

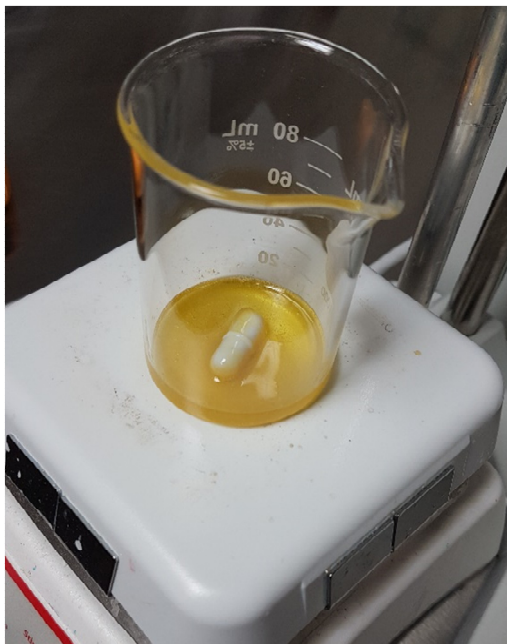
$W_e$  = Total final emulsion weight desired (g)

$W_{\text{surfactant}}$  = Weight of surfactant required (g)

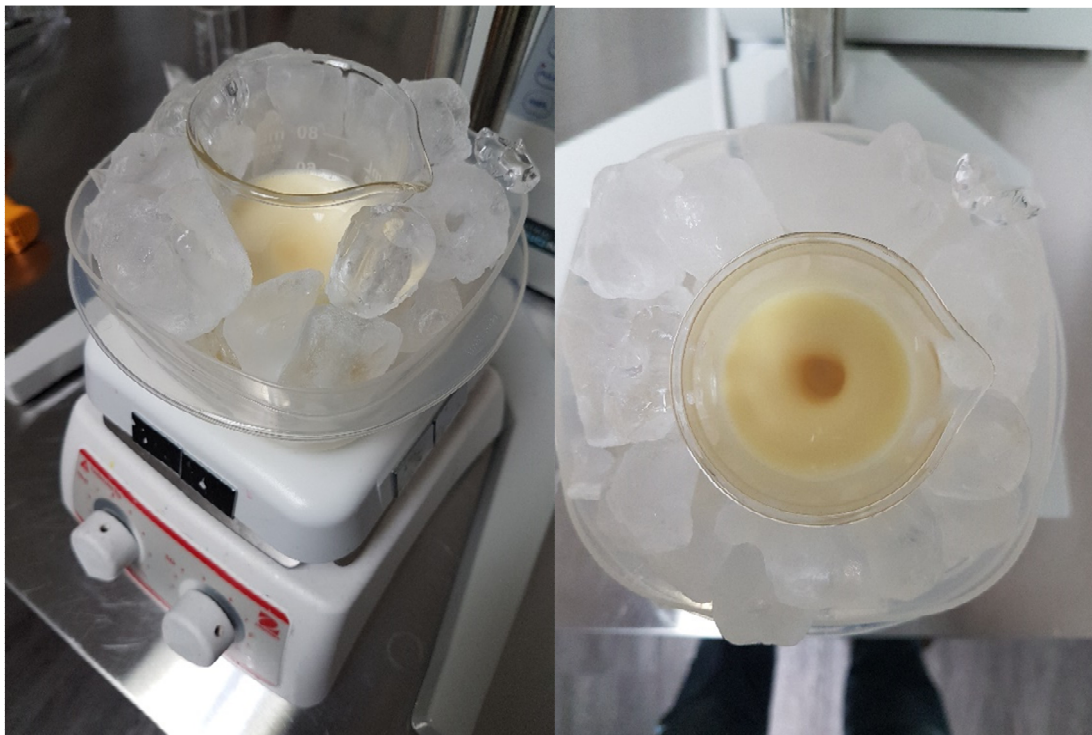
$W_W$  = Weight of distilled water required (g)

**The following instructions are for a nanoemulsion batch using the Q700 Sonicator System and a 6:1 ratio of Axiomm Technologies' surfactant system, [μGOO](#), to oil input.**

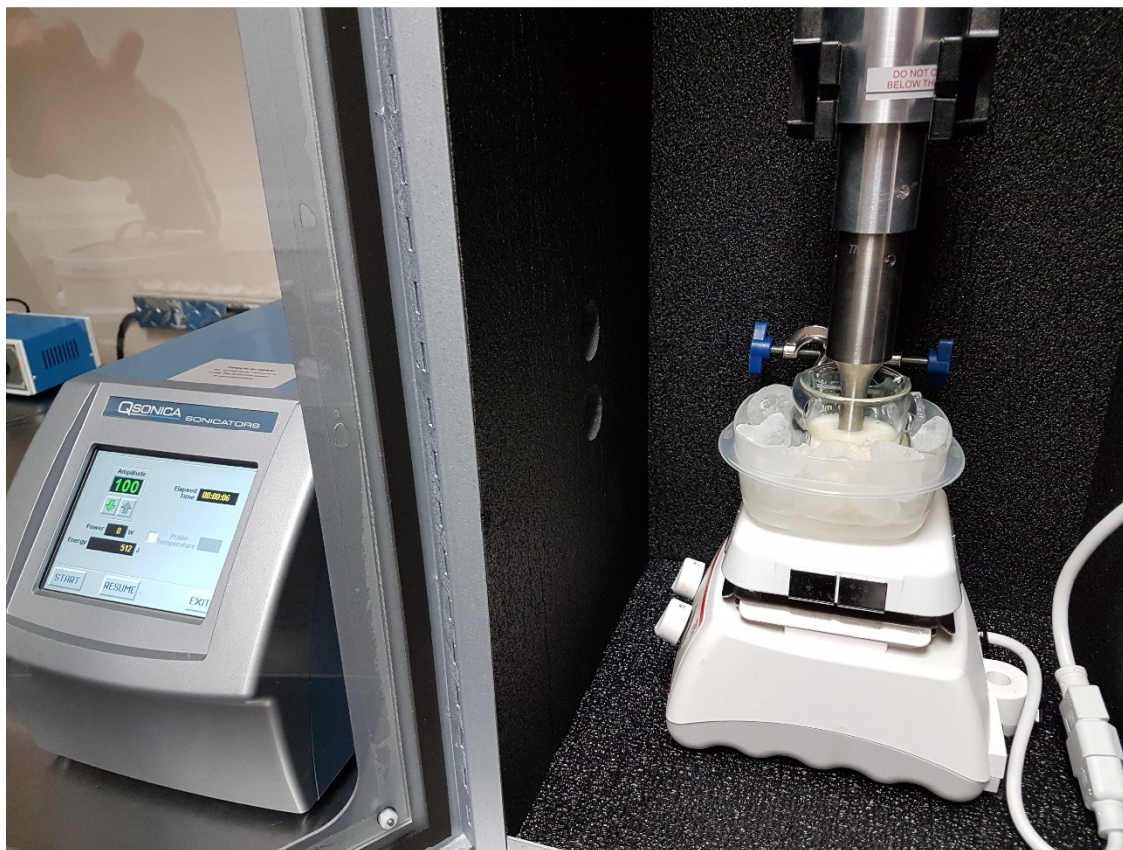
1. Place a magnetic stir bar in a 100mL beaker and place the beaker on a scale. Tare the scale and add your surfactant.
2. Heat the beaker on a hotplate until the surfactant covers the beaker bottom, keeping the temperature between 40°C and 60°C as measured with an infrared thermometer.



3. When the surfactant is fluid, place the beaker back on the scale, tare the scale and add the oil to encapsulate into the surfactant.
4. Place the beaker back on the hotplate and stir thoroughly until the oil is dispersed into the surfactant.
5. While still stirring, add the distilled water. Turn off the heat and stir until the emulsion is milky white and minimal solids are visible on the beaker wall.
6. Turn off the stirrer, insert the beaker into a larger container on the hotplate that will serve as an ice bath and restart the stirrer.
7. Add ice while the stir bar continues to stir the emulsion (see next photo).



8. Turn off the stirrer and insert the ultrasonic probe into the emulsion.



9. Set the generator amplitude and start the sonicator, pausing periodically to prevent overheating.
10. Run subsequent sonication cycles and sample the particle size. Repeat this process until the particle size is  $< 40\text{nm}$  (using a dynamic light scattering analyzer as measured by *intensity* method), refreshing the ice as needed while the generator is paused. If a particle size analyzer is not available, the translucence of the emulsion is an effective indicator of particle size. The ultrasonic probe should be visible under the surface of the emulsion when the particle size is sufficiently small as shown below.





11. Once the emulsion has reached a sufficiently low particle size or level of translucence the processing may stop. The final emulsion should be clear, translucent with no surface oil observed. The nanoemulsion below is one that is produced using Axiomm Technologies' [μGOO](#).



12. The emulsion must then be filtered. Discharge the filtered emulsion into an autoclaved container. Refrigerate the final emulsion.



The Q700CA Sonicator system with 1" diameter probe can process a 1L batch of nanoemulsified CBD with approximately 35 minutes of sonication time. To control sample temperature the system must be set to a pulse mode. This will result in a total elapsed time of approximately 1 hour depending on the desired temperature range. A loading of 50mg/ml concentration will result in 1,000 doses.