

ULTRASONIC MICRO-ENCAPSULATION

When used in conjunction with the solvent exchange method, Sonics & Materials, Inc. dual inlet 40 kHz atomizer has proven to be an effective tool for generating pharmaceutical preparation microcapsules. Using ultrasonics to encapsulate drugs is desirable because it is gentle and does not cause substantial denaturation nor compromises the viability of biological materials. This method is based on an exchange of water and a hydrophilic organic solvent, whereby a polymer dissolved in the solvent is deposited onto an aqueous core.

The dual inlet atomizer inhibits premature mixing of the components by delivering both liquids simultaneously but separately to the atomizing surface. As they come into contact with the tip of the probe, they are fragmented into 60 um microdrops, and ejected as a gentle mist. One component consists of an aqueous solution containing the drug; the other component consists of an organic solvent containing a polymer dissolved therein.

As the individually atomized droplets collide in mid-air, the polymer droplets spread on the aqueous droplets and solvent exchanged between the two liquids forms a polymer membrane on the surface of the aqueous droplets encapsulating them. Due to the surface tension gradient between them, the organic solvent spreads around the aqueous drops, while the aqueous drops having a higher surface tension relative to that of the organic solvent tends to maintain its spherical shape. The solvent exchange process begins as soon as the two microdrops come into contact with each other.

Because the droplets typically drift downward at low velocity under the influence of gravity, the atomizing probe is typically mounted with the tip facing downward, and precautions taken to insure air turbulence is minimized. Heating the area where the collision takes place is recommended as it does facilitate solvent removal. Hardening of the microcapsules can be accelerated by allowing the droplets to be collected in a water bath. Once hardened the microcapsules are then centrifuged and washed with distilled water.

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