

CSS Analytical Co. Inc.

“Your Upgrade Solution Provider”

Introducing:

cssOCN[©]

Self-Oscillating Nebulizer



Patented Technology

Smaller Droplets

Signal Improvements

ESI with 100% Water

1 ul/min to 3 ml/min

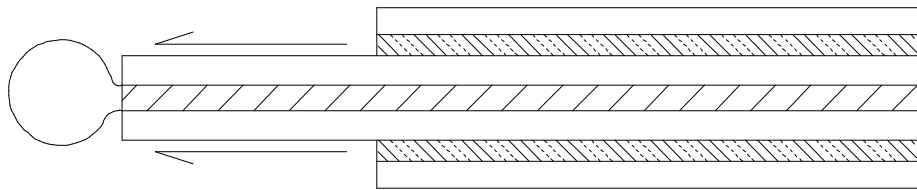


Figure 1

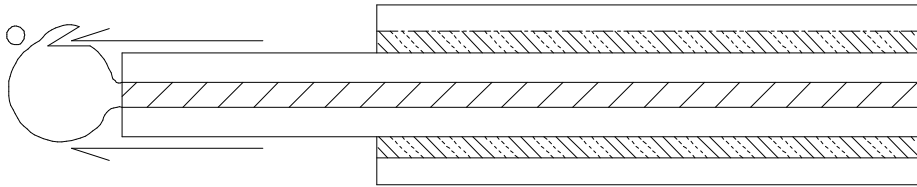


Figure 2

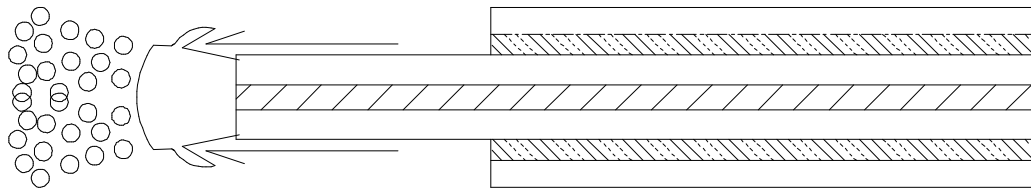


Figure 3

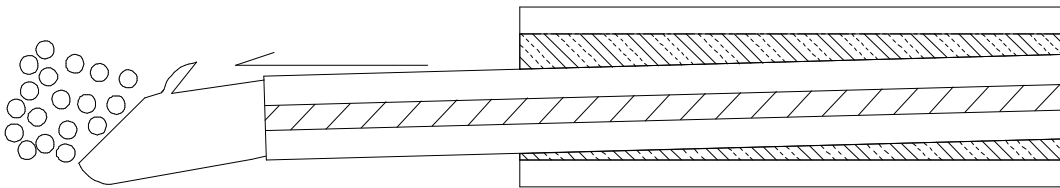




Figure 4

Liquid 
 Gas 

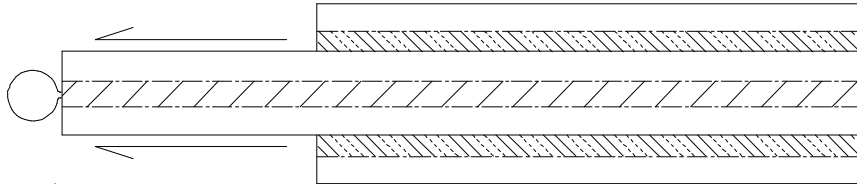


Figure 5

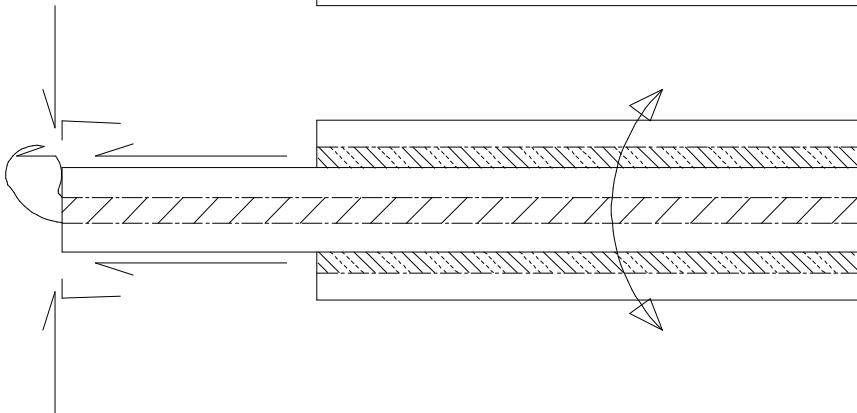


Figure 6

SPRAY MECHANISM – TYPICAL SPRAYER

On a typical concentric tube gas assisted nebulizer the initial droplet increases in size on the tip of the inner liquid tube (Figure 1) until the shearing force of the gas removes a part, or in some cases all of the initial droplet (Figure 2). At some time (possibly even before the first droplet is sheared) the initial droplet wets the entire surface of the tip of the inner liquid tube (Figure 3), grows until droplet shearing occurs, and the process of creating secondary spray droplets has begun. Droplets are sheared from every side of the inner (liquid) tube, so long as enough of the droplet is presented to the shearing force of the nebulizing gas. These secondary droplets and their sizes are of extreme importance to the electrospray phenomenon.

Often times the inner tube is pushed over to the side (Figure 4), by the force of the nebulizing gas, rather than remaining centered within the outer tube. This results in the nebulizing gas effecting only a portion of the initial droplet, that portion as presented on a part of the tip of the liquid tube. This makes the spray uneven, and the droplets of questionable size (compared to droplets in Figure 3).

SPRAY MECHANISM - OCN

For the Self Oscillating Nebulizer, OCN (Figure 5), the droplet increases in size, but at the same time the inner tube is oscillating at a frequency of as much as 2 Hz (Figure 6). This standing wave, provides a violent shaking effect on the tip of the inner tube, applying a shearing force perpendicular to the inner tube which presents a smaller initial droplet to the shearing force of the nebulizing gas. This orthogonal shearing force, due to the acceleration (force equals mass time acceleration, $f = ma$) of the inner liquid tube tip, in addition to the shearing force supplied by the nebulizing gas will remove much smaller droplets, providing a much smaller and much more uniform spray of secondary droplets for electrospray.

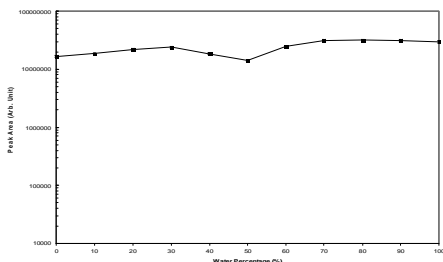


Figure 7. Reserpine [M+H]⁺ signal dependence on water% in mobile phase.

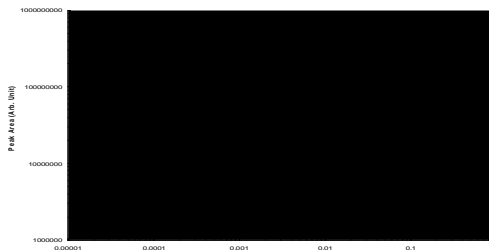


Figure 8. Reserpine [M+H]⁺ signal vs. concentration relationship.

SIGNAL INTENSITY AND PEAK SHAPE

For the Self Oscillating Nebulizer, signal intensity is consistent throughout the entire water/organic gradient. Figure 7 above shows the same signal response even with a 100% water mobile phase. Though not normally considered possible, electrospray occurs even with 100% water. Figure 8 shows Reserpine response over a range with 3 orders of magnitude and the linearity of response. Figure 9 shows improved peak shape when compared to a standard (OEM) nebulizer in the same mass spectrometer. Figure 10 shows a performance chart of the Oscillating Nebulizer versus the IonSpray™.

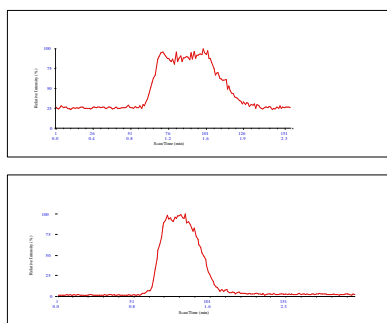


Figure 9. Performance of the original IonSpray (top) versus the OCN (bottom). Higher signal with better peak shapes and lower background are noteworthy features.

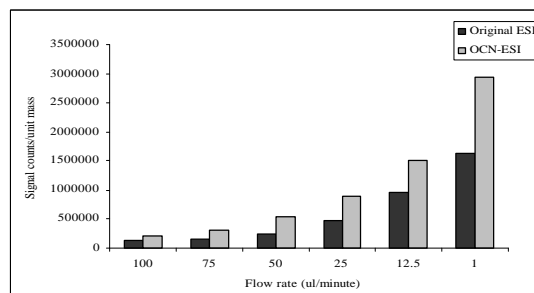


Figure 10. Performance of the IonSpray versus the OCN-ESI as a function of flow rate.

PATENTED TECHNOLOGY

The Self Oscillating Nebulizer developed in the laboratory of Dr. Richard Browner of Georgia Tech University in the early 1990s and patented by Georgia Tech Research Institute first in March of 1998 and then again in December of 1998 and once more in October of 2000. These patents completely define the device and preclude any other party from commercially producing a similar device. CSS Analytical Co. Inc. is the exclusive licensee of the patented materials and is offering upgrade nebulizers for all brands of mass specs. For additional information contact CSS Analytical Co. Inc. of Shawnee Kansas, USA at 1-800-277-5455 or visit our web page at WWW.CSSCO.COM