



Elemental Scientific Inc Technical Note-7

Self aspirating μ -volumes SC series auto samplers

A number of applications require the analysis of a limited volume of sample. One such example is the determination of metal/Ca ratios in foraminifera where small sample size and low DL requirements result in less than 400 μ L of sample volume. For such applications MicroFlow nebulizers are required. While pumping is possible, self aspiration is preferred to eliminate 1) difficulty with pumping low flow rates, 2) pump related noise and 3) pump related blanks. Here we demonstrate how specific features in the SC auto sampler are designed for robust self aspiration of micro volume samples.

Instrumentation & sample intro

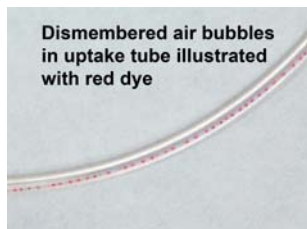
- SC-2 auto sampler
- 50 μ L min⁻¹ sample probe
- PFA-ST MicroFlow nebulizer
- PFA spray chamber & o-ring free injector
- Element-XR

SC Auto samplers

SC series auto samplers can hold the widest range of both large standard racks and/or micro racks, with vials ranging from 500 μ L to 250mL. The SC-2 auto sampler can accommodate 4 racks of 500 μ L vials each containing 60 positions allowing for 240 consecutive automated analyses.

MicroFlow nebulizers

Although it is possible that very high TDS samples result in the loss of self aspiration, due to clogs or solid buildup, this is rarely the case. More often it is due to the occurrence of dismembered air bubbles.



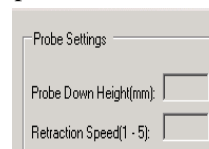
Numerous small bubbles increase the resistance in the micro bore uptake tube until it overcomes the ΔP at the tip of the nebulizer and stops free aspiration.

Four occasions when air may enter the uptake tube are

- 1) if air bubbles occur in the sample solution,
- 2) probe runs out of solution,
- 3) probe misses a sample or
- 4) during probe travel between solutions.

Careful sample prep and complete software control for exact calibration of probe accuracy and depth (see technical note 8) eliminates conditions 1, 2 and 3. Condition 4 is unavoidable, but the introduction of dismembered bubbles is. Numerous small air bubbles are generated by rapid and erratic Z movement or by drops wicking down the probe during travel between solutions. When these drops reach or hang on the base of the probe they are variably aspirated at the tip.

The SC series auto sampler with complete software control and probe design prevents droplet formation. Appropriately programmed probe depth and retraction speed allows sample solution to smoothly wick away from the probe. Penetration depths of 1 cm reduce



exposure to liquid likely to adhere the probe. Slow smooth probe movement, however, allows the solution to smoothly wick away, leaving no residual droplets on the probe exterior. Finally, smoothly contoured probe design promotes complete wicking of sample droplets from the probe exterior. All of these design features reduce droplet aspiration and dismembered air bubble formation in the uptake tube.

The stability of MicroFlow nebulizers combined with robust self-aspiration is illustrated by excellent element ratio precision (0.35% uncorrected) over long runs (9hrs).

