

A Comparison of ICP Accessory Argon Humidifiers

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Introduction

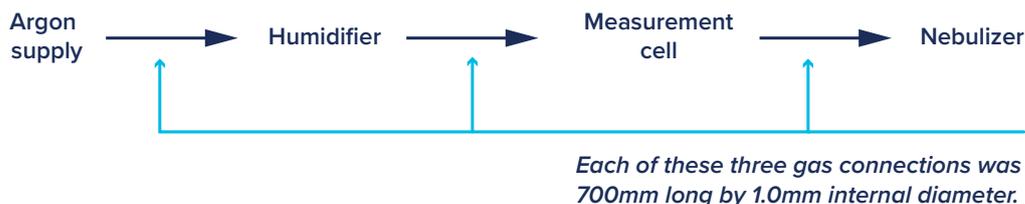
It is standard operation to use dry argon as your ICP nebulizer gas in order to generate an aerosol and transport the sample to the plasma. However, when dealing with samples containing high amounts of total dissolved solids (TDS) you have an increased likelihood of salt deposits forming at the tip of the nebulizer and injector; this can result in a failed analysis due to a drift in signal or an extinguished plasma. In order to handle a challenging sample matrix, such as high TDS, it is important that you carefully optimize your ICP sample introduction system. This includes choosing a nebulizer with the ability to handle high TDS, a baffled cyclonic spray chamber to minimize droplet size, and a large bore injector to allow for longer run times. For optimum performance, you can also humidify the nebulizer gas before it contacts the sample, decreasing the likelihood of salt deposits forming at the nebulizer and injector tip. Adding an argon humidifier will reduce maintenance and the chance of an extinguished plasma due to a blocked nebulizer or injector.

In 2016¹ Glass Expansion introduced the Elegra Argon Humidifier, a compact inert design that would eventually replace the Capricorn, Glass Expansion's original humidifier design. The relative humidity (RH) added by the Argon humidifier will determine the efficiency and overall performance as to how well the accessory can slow and prevent salt build-up at the nebulizer and injector. As a comparison of humidification efficiency, the RH output of the Elegra was compared to another commercially available argon humidifier that requires a power supply and heating element, which we shall refer to as Brand-X throughout. The Brand-X model was specifically selected in this comparison as it is listed as the supplier's "enhanced humidification model." Additionally, the RH performance of the Elegra was compared to the Capricorn to prove equivalent humidification performance and a suitable replacement.

Test Method

All tests were performed in a stable environment of 21°C. To ensure accurate results; the tubing for each humidifier setup remained the same. A glass test cell was added in-between the humidifier and nebulizer where the RH measurements were taken. The experiment setup is shown below in Figure 1.

Figure 1. Experimental setup for relative humidity.

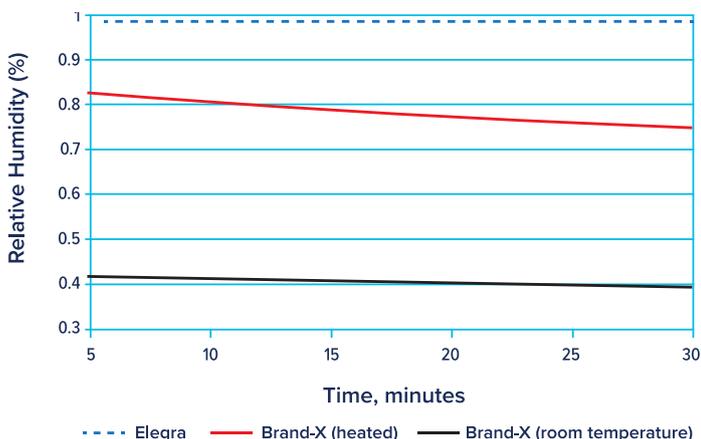


The nebulizer used was a SeaSpray, (P/N [ARG-07-USS2](#) and S/N S236513) operating at 40 psi, and each humidifier was filled and prepared according to their instructions. The test cell was purged with Argon for an extended period after each test to ensure no moisture carried over. Measurements were taken in 5 minutes intervals, for 30 minutes of operation. The Brand-X humidifier was tested at both room temperature (un-heated) and with a two-hour warm-up period in heated mode.

Results

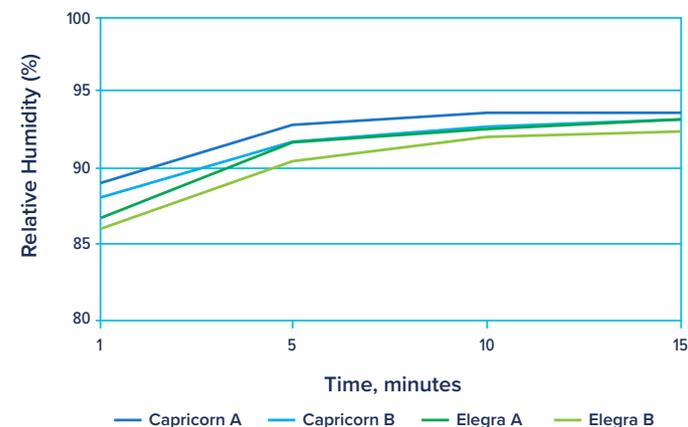
Afer a two-hour warm-up in heated mode, as illustrated in Figure 2, Brand-X would start high and gradually decrease in humidification over time, falling to approximately 25% RH to that of the Elegra. With no added heat, at room temperature Brand-X produced 60% less RH on average compared to the Elegra, which also runs at room temperature. In comparison, the Elegra is quite stable at initial startup, producing close to 90% RH and stabilizing in less than 5 minutes. At an argon gas flow rate of 0.7 L/min and in heated mode, Brand-X is 25% less effective compared to the Elegra, which requires no power supply, electrical cords, or added heat. Brand-X also offers no model with a convenient bypass switch. The bypass switch allows the user to disable humidification without having to disconnect the Elegra. This option is beneficial for quick sample introduction system troubleshooting, or giving the ability to run without humidification as needed.

Figure 2. Percent Humidity Relative to Elegra (Elegra =1)



Two Capricorn units, labeled A and B, were compared to two Elegra units, also labeled A and B, to ensure that the Elegra was an equivalent replacement to the original humidifier design (Figure 3). Two units were used to obtain averages of performance. After 5 minutes, both the Elegra and Capricorn average out to a stable RH of approximately 92%.

Figure 3. Elegra and Capricorn Humidifier % RH Comparison.



Conclusion

The elegant and compact design of the Elegra results in a relatively small footprint, making it easier to fit into each ICP model without overcrowding the sample compartment. Moreover, for easy installation on any ICP instrument and with any nebulizer, each Elegra Kit is packaged with customized gas connectors. The Elegra utilizes highly efficient membrane technology to consistently add moisture to the gas as it flows through the inert, metal-free construction. Furthermore, the membrane technology eliminates the need for the Elegra vessel to be pressurized or heated (no electrical power/cords), as required by some other humidifier designs. The convenient bypass switch feature of the Elegra enables the operator to turn humidification on and off without connecting or disconnecting any tubing. The rapid stabilization of near 90% RH generated by the Elegra provides more efficient and effective argon humidification to your nebulizer, which will optimize your instruments performance by significantly slowing the salt build-up at the nebulizer and injector tips during high TDS sample analysis. Compared to other available argon humidifiers, as this study demonstrates, the superior performance of the Elegra is unmatched.

References

1. Glass Expansion Newsletter, *The Elegra Argon Humidifier: Uninterrupted and Maintenance-Free ICP Operation*, February 2016.