Instran®

Instran Test— NH_3 over 3 months

Objective

The objective of the experiment is to demonstrate the performance stability of the Instran online ammonia analyzer using an ion-selective electrode **over 3 months without any service to the electrode or the equipment—no calibration or reagent replacement**.

Additionally, the aim is to show that even though the response of the electrodes becomes unstable over time or simply drifts, the measurement technique developed by the Instran analyzer to determine concentration allows this instability to be corrected. This makes **Instran a reliable analyzer over time**, delivering unique precision and repeatability in its analyses.

Test

At Instru's facilities, 25 liters of a 5 ppm standard solution were prepared and measured over a 3-month period, from April 3rd to May 31st, 2025. To avoid having to prepare a massive amount of standard solution (since the intention was to measure exactly the same solution for 3 months), the analyzer's measurement frequency was set to one analysis every 3 hours, rather than the usual 10 to 15 minutes.

The analyzer was calibrated in a 0—10 mg/L range. To ensure the stability of the 5 ppm solution, it was acidified to pH 4 to guarantee it remained in the NH_4^+ form, which is significantly more stable than NH_3 due to its volatility. Additionally, reagent consumption during this period was 360 mL per reagent. A total of 717 analyses were performed over the three months.

Results

Over the 3 months, the average concentration was 5.0 mg/L, with a maximum of 5.3 mg/L and a minimum of 4.6 mg/L, this lowest value was recorded only twice among the 717 analyses. 18 analyses showed a value of 4.7 mg/L, and 33 analyses showed 5.3 mg/L. The remaining 664 results, representing **92.6%, showed values between 4.8 mg/L and 5.2 mg/L**.

More interesting, however, is observing the behavior of the electrode. In Graph 2, the electrode response over the entire experiment is shown. The brown line represents the electrode response to the standard reading, i.e., its response if the analyzer were performing the direct measurement technique to determine concentration. This response shows significant fluctuations, with a maximum of -103.6 mV and a minimum of -134.2 mV, almost a 30 mV variation. According to how these electrodes work, a change of one order of magnitude in concentration corresponds to a response of -59 mV. In other words, the difference between 1 mg/L and 10 mg/L is -59 mV. A regular analyzer response, using same calibration slope for 3 months, **the results would be working between 11 ppm and 3 ppm, shown in the Graph 1, for a 5 ppm standard.**

However, due to the measurement technique used by Instran—known addition—the analyzer takes a second reading, and the difference between both readings is the value used to calculate the concentration. In this test, this ΔmV ranged between -51.0 mV and -54.8 mV, **having a much smaller effect on the final concentration, only about 0.3 mg/L.**

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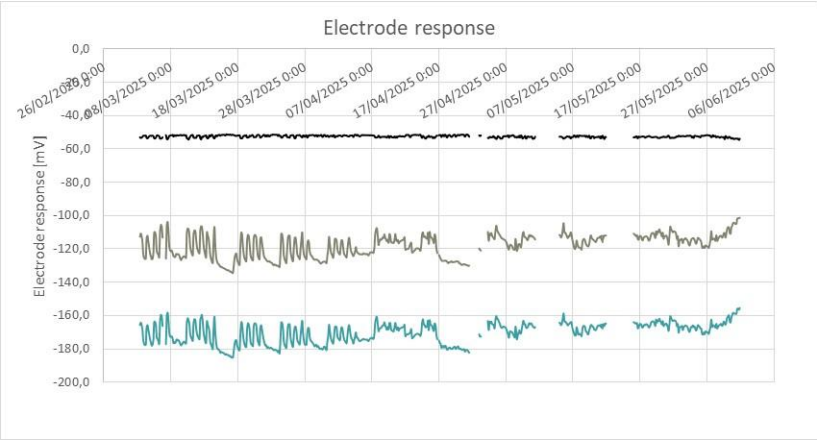
	Concentration [ppm]	Direct Measurement [mV]	Known Addition [ΔmV]
Maximum	5.3	-101.2	-51.0
Minimum	4.6	-134.2	-54.8
Average	5.0	-117.9	-52.4
Standard Deviation	0.144	6.804	0.754

Conclusions

Despite the inevitable drift of ion-selective electrodes, the measurement **technique that Instran analyzer performs corrects this measurement instability**, allowing for proper analysis **without electrode calibration for more than 90 days. The analyzer delivers accurate and reliable results**, enabling users to confidently monitor ammonia concentration in samples, significantly reducing maintenance without compromising performance. This makes it a **unique analyzer in the market due to its excellent performance-to-maintenance ratio**.

Graph 1. Instran analyzer results over the 3-month test.



Graph 2. Electrode response in direct measurement, second measurement, and delta used for the known addition technique, along with the concentration.

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