

Ammonia Nitrogen (NH₃-N) Analysis: Accuracy and Linearity Evaluation



Introduction

Ammonia Nitrogen (NH₃-N) is a crucial parameter in water quality management and wastewater treatment, regularly measured in laboratories, wastewater treatment plants, food and beverage manufacturing, and water treatment facilities. This analysis is essential for complying with environmental regulations and monitoring nitrogen concentration in process.

Traditional test methods based on standard procedures are complex, time-consuming, and highly dependent on the operator's proficiency, leading to potential variability in results. This application note introduces a simplified analysis method using the QX Water Analysis Spectrophotometer and Hach Ammonia Nitrogen Reagent set.

The QX spectrophotometer allows direct measurement without the need for manual standard curve preparation, thanks to pre-set parameters. This not only reduces analysis time but also enhances user convenience.

K LAB Co., Ltd., a leading company in the domestic analytical instrument industry, is the only specialized research and manufacturing enterprise in Korea that manages the entire process—from R&D to production—under one roof.

Website
www.klab.im

Tel
+82-042-932-7586

Contact
info@klab.im



[Figure 1]. QX Water Analysis Spectrophotometer

► The QX is compatible with Hach and Merck reagents and supports various cuvettes (10 mm, 16 mm, 25 mm, 1-inch) through its All-in-One cell holder.

Experimental Conditions

Equipment

- QX Water Analysis Spectrophotometer (K LAB)
- 1,000 μ L micropipette and dedicated tips
- 25mL Graduated Mixing Cylinder with Stopper
- 1-inch Square Cell (Hach, Cat.no: 2495402)

Reagents

- Nitrogen, Ammonia Reagent Set, Nessler (Hach, Cat.no: 2458200)
- Nitrogen Ammonia Standard Solution, 1.0 mg/L NH₃-N (Hach, Cat.no: 189149)
- Ammonium Chloride (Sigma-Aldrich, Cat.no: 102279913)

Experimental Procedure

Preparation of Verification Solutions

To evaluate the measurement performance of the QX Water Analysis Spectrophotometer, ammonia nitrogen verification solutions were prepared through serial dilution, and the Nitrogen Ammonia Standard Solution (1.0 mg/L NH₃-N, Cat.no: 189149) was used for accuracy validation.

Ammonia Chloride 0.3819 g was dissolved in a 100 mL volumetric flask to prepare a 1000 mg/L NH₃-N standard solution. This was then diluted 1/400 times to prepare the first sample (2.5 mg/L NH₃-N).

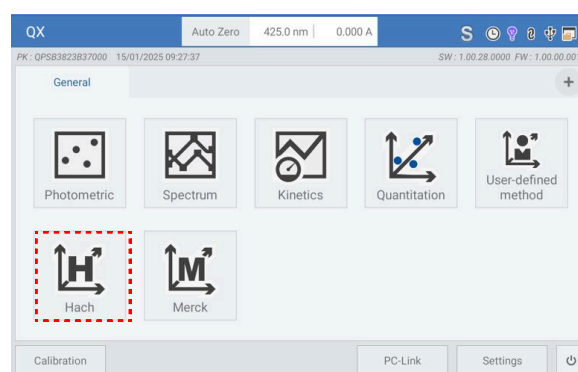
Subsequent 1/2 serial dilutions were performed to obtain a total of eight verification solutions.

[Table 1]. Concentration of Diluted Verification Solutions

First sample: 2.5 mg/L
 Second sample: 2.5 mg/L \times 1/2 = 1.25 mg/L
 Third sample: 1.25 mg/L \times 1/2 = 0.63 mg/L
 ...
 Eighth sample: 0.04 mg/L \times 1/2 = 0.02 mg/L

Test Procedure

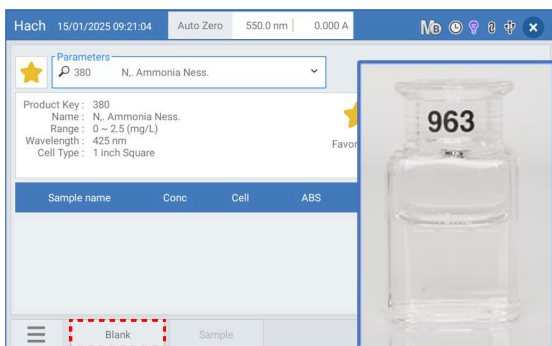
- ① Turn on the QX instrument and allow at least 20 minutes for warm-up.
- ② Select [Hach] mode and enter Program 380(N, Ammonia Ness) to access the measurement mode.



[Figure 2]. QX [Hach] mode selection screen

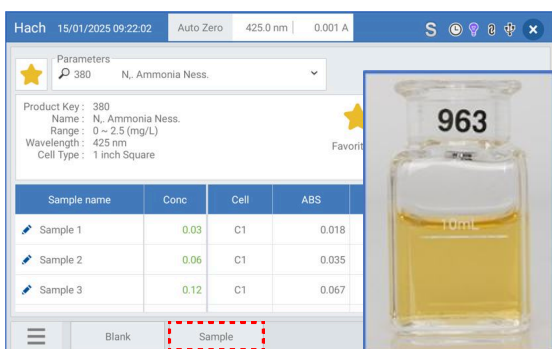
- ③ Add 25 mL of the sample to a 25 mL mixing cylinder (including the blank sample).
- ④ Add 3 drops of Mineral Stabilizer and gently invert the cylinder to mix.
- ⑤ Add 3 drops of Polyvinyl Alcohol Dispersing Agent and gently invert to mix.
- ⑥ Add 1 mL of Nessler Reagent, gently invert to mix, then let it stand for 1 minute.
 - ※Caution: Vortexing or vigorous shaking may cause bubble formation, leading to experimental errors.
- ⑦ Add 10 mL of the sample to a 1-inch cell.
 - ※Caution: Ensure the cell surface is free from fingerprints and contaminants for accurate measurement.

⑧ Insert the blank sample into the All-in-One cell holder of the QX instrument and press the [Blank] button to set the baseline.



[Figure 3]. QX [Blank] button and 1-inch cuvette (Blank)

⑨ Insert the sample cell and press the [Sample] button to start the measurement.



[Figure 4]. QX [Sample] button and 1-inch cuvette (Sample)

Experimental Results

Accuracy Evaluation Results

The Hach Nitrogen Ammonia Standard Solution (1.0 mg/L, Cat.no: 189149) was used as the standard solution to evaluate the accuracy of the measurement.

The experiment was conducted based on the Method Performance Data provided in the manual of the Hach Ammonia Nitrogen Reagent Kit (Cat.no: 2458200) used in this study.

In this experiment, the 1.0 mg/L standard solution was measured three times, and the results are shown below.

[Table 2]. Repeated Measurement Results of the 1.0 mg/L Standard Solution

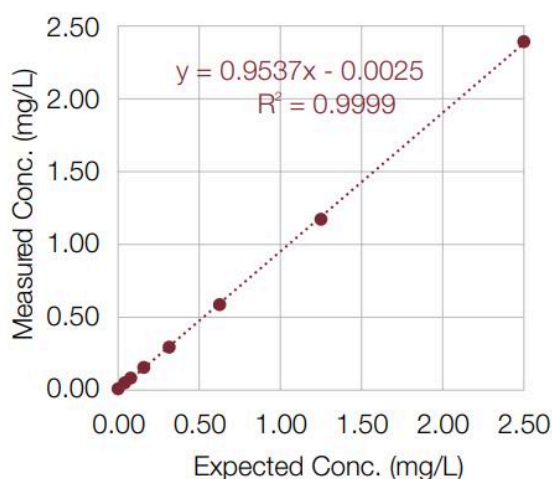
Measurement Count	Measured Value (mg/L)
Measurement 1	0.99
Measurement 2	0.99
Measurement 3	0.99
Average	0.99
Standard Deviation(σ)	0.00
%CV	0.0%

As a result, all measured values fell within the acceptance range (0.99–1.01 mg/L) specified in the Method Performance criteria, and the %Error was confirmed to be -1.00 %.

Evaluation of Stepwise Dilution Sample Linearity

The experiment results showed that after preparing a 2.5 mg/L ammonia nitrogen solution and performing 1/2 stepwise dilutions (0.02 ~ 2.50 mg/L), the coefficient of determination (R^2) was 0.9999 between the measured values and expected concentrations.

This confirms that the QX consistently measures diluted samples and maintains high linearity within the 0.02 ~ 2.50 mg/L range.



[Figure 5]. Regression analysis graph of measured concentrations vs. expected concentrations

Conclusion

This study evaluated the reliability of ammonia nitrogen analysis using the QX Water Analysis Spectrophotometer.

- ▶ The measured value of the 1.0 mg/L Hach standard solution met the Method Performance criteria (0.99 ~ 1.01 mg/L), confirming high accuracy with a %Error of -1.00 %.
- ▶ The stepwise dilution samples (0.02 ~ 2.50 mg/L) from the 2.5 mg/L solutions showed a high linearity, with a coefficient of determination(R^2) of 0.9999 between the measured values and expected concentrations.

Trademark Disclaimer

Hach® is a registered trademark of Hach Company. This product is not affiliated with, endorsed by, sponsored by, or approved by Hach Company. Any reference to the trademark is made solely for the purpose of describing technical compatibility.

***Reference**

- Hach Nitrogen, Ammonia Reagent Manual (DOC316.53.01078), p.5