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Related products
Water Analyzer
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Technical Note
#T250005001

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

Summary

Ammonia Nitrogen(NH_3-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. leads Korea in developing high-precision spectrophotometers with innovative monochromator scanning mechanisms, prioritizing customer satisfaction and continuous improvement.

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Experimental Conditions

1. Equipment

1) QX Water Analysis Spectrophotometer (K LAB)
2) 1000 µL micropipette and dedicated tips
3) 25mL Graduated Mixing Cylinder with Stopper
4) 1-inch Square Cell (Hach, Cat.no: 2495402)

2. Reagents

1) Nitrogen, Ammonia Reagent Set, Nessler (Hach, Cat.no: 2458200)
2) Nitrogen Ammonia Standard Solution, 1.0 mg/L NH_3-N (Hach, Cat.no: 189149)
3) Ammonium Chloride (Sigma-Aldrich, Cat.no: 102279913)

Experimental Procedure

1. 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 NH_3-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 NH_3-N standard solution. This was then diluted 1/400 times to prepare the first sample (2.5 mg/L NH_3-N). Subsequent 1/2 serial dilutions were performed to obtain a total of eight verification solutions.

First sample: 2.5 mg/L

Second sample: 2.5 mg/L x 1/2 = 1.25 mg/L

Third sample: 1.25 mg/L x 1/2 = 0.63 mg/L

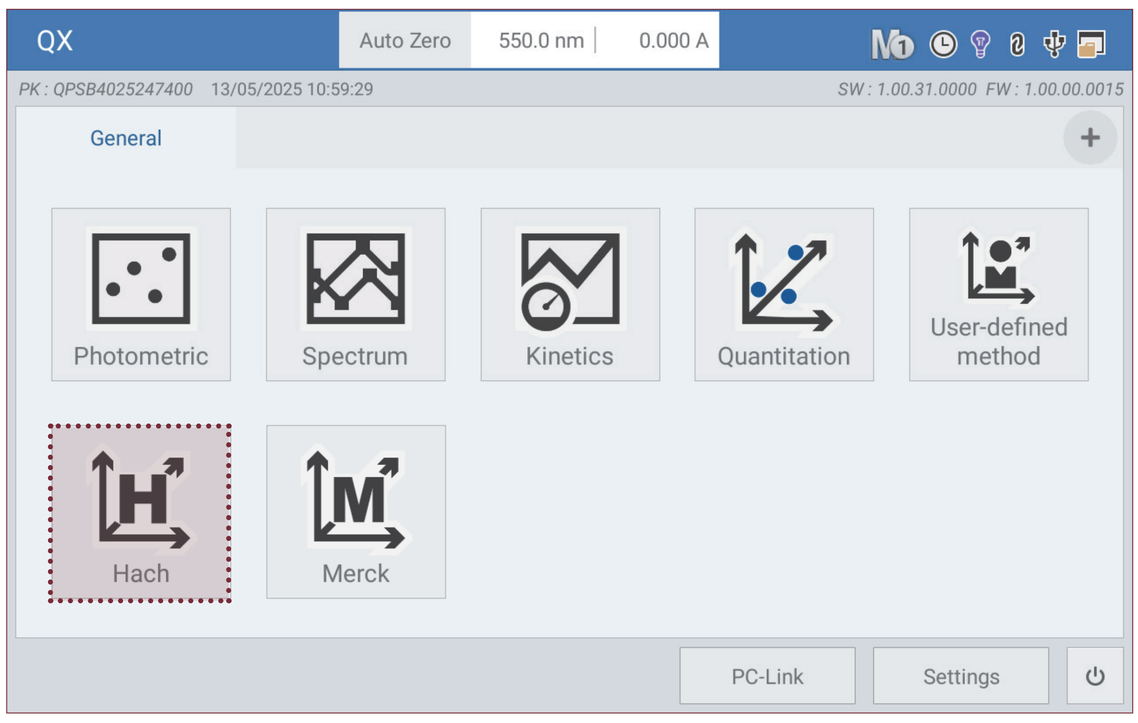
…

Eighth sample: 0.04 mg/L x 1/2 = 0.02 mg/L

[Table 1] Concentration of Diluted Verification Solutions

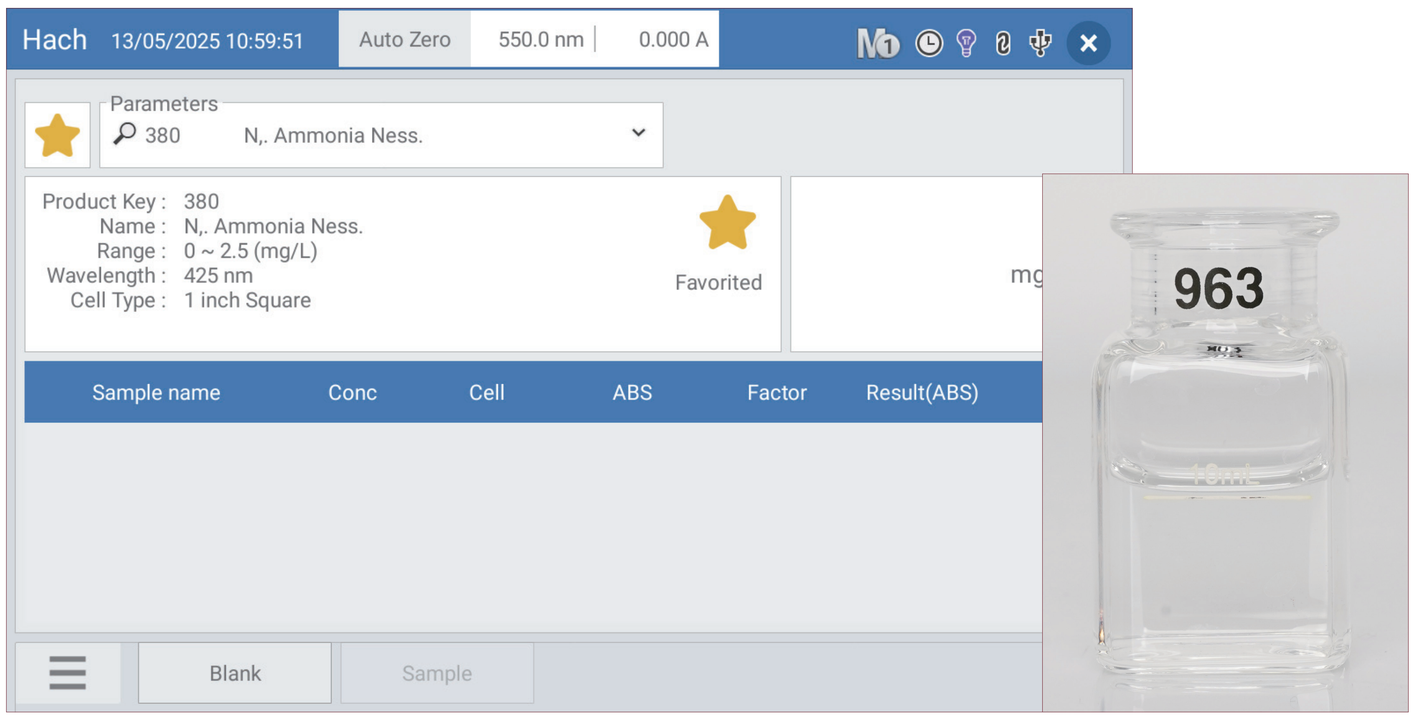
2. Performance Evaluation Procedure Using QX Analyzer

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



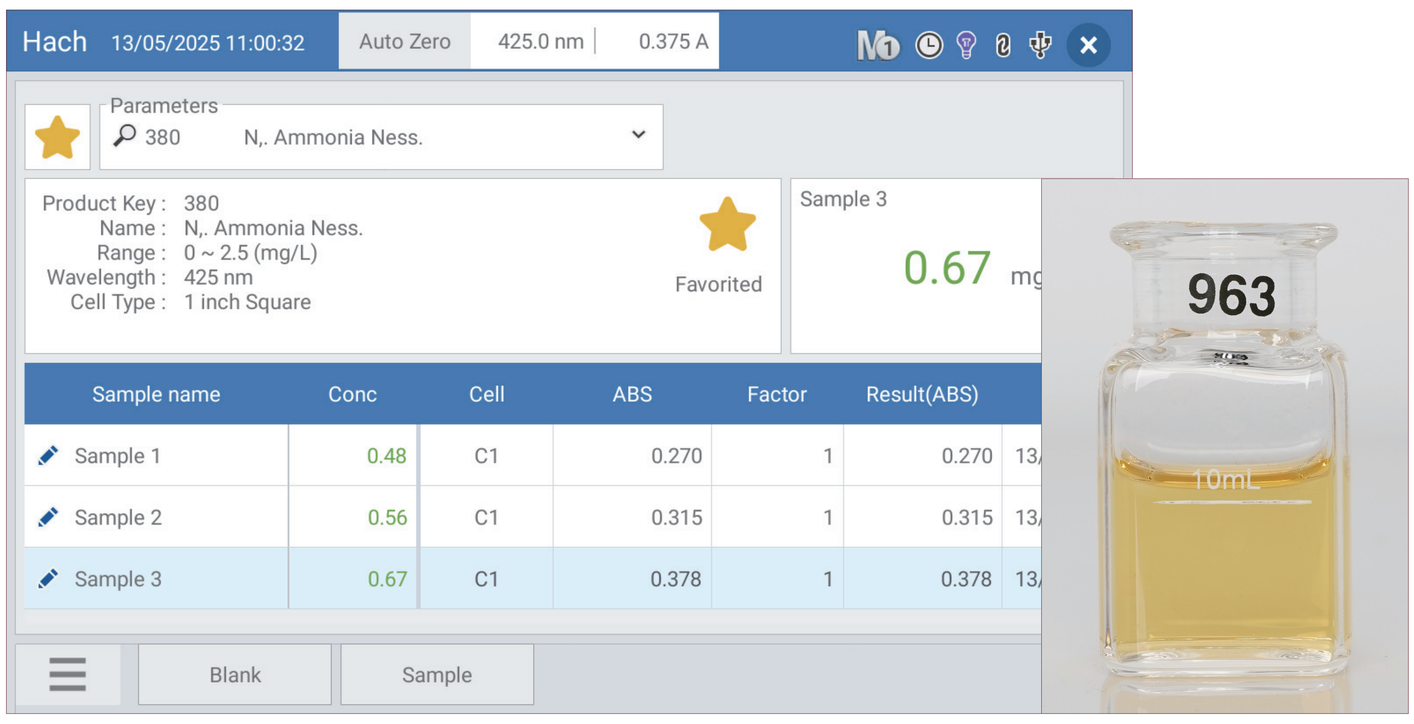
[Figure 1] QX Main Screen
Select Hach mode on the screen to enter that mode.

3) Select Hach mode on the screen to enter that mode.
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.(1)
7) Add 10 mL of the sample to a 1-inch cell.(2)
8) Insert the blank sample into the All-in-One cell holder of the QX analyzer and press the [Blank] button to set the baseline.



[Figure 2] QX [Blank] button and 1-inch cuvette (Blank)

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



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

(1) Caution
Vortexing or vigorous shaking may cause bubble formation, leading to experimental errors.

(2) Caution
Ensure the cell surface is free from fingerprints and contaminants for accurate measurement.

Experimental Results

1. 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.

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	**Below quantifiable variation**

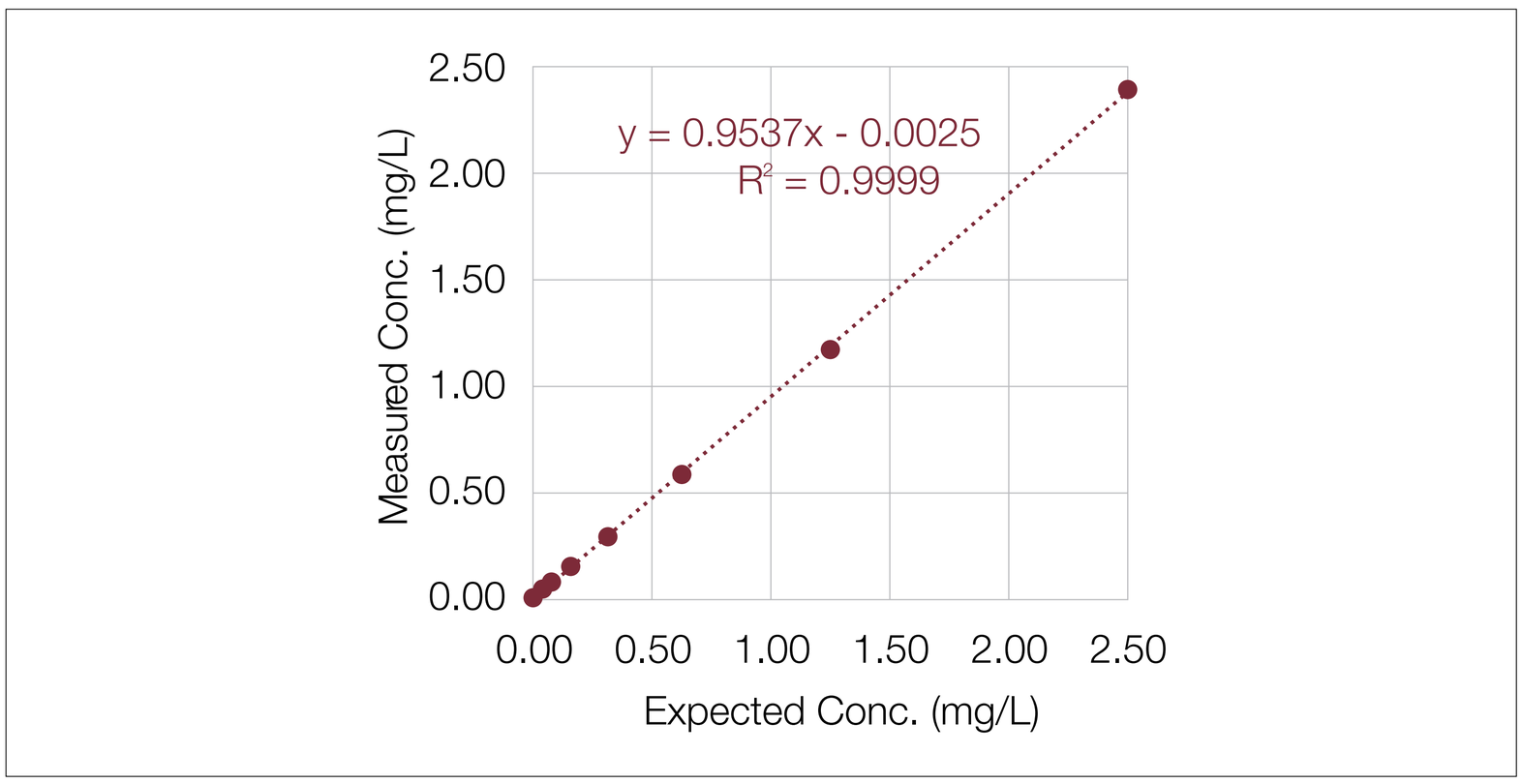
[Table 2] Repeated Measurement Results of the 1.0 mg/L Standard Solution

As a result, all measured values fell within the 95% confidence interval (0.99 ~ 1.01 mg/L) specified in the Method Performance criteria, and the %Error was confirmed to be 1.00 %.

2. Evaluation of Linearity

The experiment results showed that after preparing a 2.5 mg/L ammonia nitrogen solution and performing 1/2 serial 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 4] 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.

References

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