# Method Abstract

## Scope

This method is used for the determination of ammonia in estuarine and coastal waters (seawater) according to USEPA Method 349.0 and Standard Methods 4500–$NH_3$ G. This method can also be used to analyze low-turbidity limnological and freshwater samples.

## Summary

The ammonia ion reacts with alkaline phenol and dichloroisocyanuric acid (DIC) to form indophenol blue in an amount that is proportional to the ammonia concentration. The blue color is intensified with sodium nitroferricyanide, and the absorbance is measured at 640 nm. The quality of the analysis is assured through reproducible calibration and testing of the Segmented Flow Analysis (SFA) system.

## Interferences

Eliminate precipitation of calcium and magnesium hydroxides by adding sodium citrate. Filter or centrifuge turbid samples prior to determination. Samples with background absorbance at the analytical wavelength may interfere. The presence of more than 2 mg/L of sulfide can negatively interfere. Remove sulfide by acidifying samples to pH 3 with sulfuric acid, then stripping with gaseous nitrogen prior to analysis.

## Performance Specifications

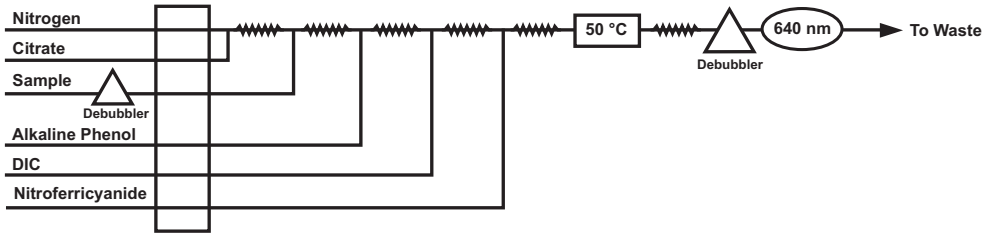
| | | |
|---|---|---|
| Range: | | 2.0–2,000 µg/L |
| Throughput: | | 30 samples/hour |
| Precision | at 5.0 mg/L: | <5% RSD |
| | at 50 mg/L: | <1.5% RSD |
| | at 500 mg/L: | <1% RSD |
| Method Detection Limit (MDL): | | 1.0 µg/L |
| Accuracy*: | | 101% |

*Undigested; Environmental Resource Associates (ERA) WasteWatR Minerals Quality Control Sample

## Chemicals

Ammonium Sulfate, $(NH_4)_2SO_4$
Brij®-35, (21% Solution) (Part #A21011033)
Deionized Water (ASTM Type I or II)
Dichloroisocyanuric Acid Sodium Salt, $NaC_3Cl_2N_3O_3$
Hydrochloric Acid, concentrated, HCl
Magnesium Sulfate Heptahydrate, $MgSO_4•7H_2O$
Phenol, solid or liquefied, 88%, $C_6H_5OH$
Sodium Bicarbonate, $NaHCO_3$
Sodium Chloride, NaCl
Sodium Citrate Dihydrate, $C_6H_5Na_3O_7•2H_2O$
Sodium Hydroxide, NaOH
Sodium Nitroferricyanide Dihydrate, $Na_2Fe(CN)_5NO•2H_2O$

## Basic Flow Diagram



**Selected References**

Determination of Ammonia in Estuarine and Coastal Waters by Gas Segmented Continuous Flow Colorimetric Analysis. *Methods for Chemical Analysis of Water and Wastewater;* EPA-600/4-79-020; U.S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring and Support Laboratory: Cincinnati, OH, 1997; Method 349.0.

Patton, C.J.; Crouch, S.R. *Anal. Chem.* 1977, 49 (3), 464–469.

Sample Preservation. *Methods for Chemical Analysis of Water and Wastes*; EPA-600/4-79-020; U.S. Environmental Protection Agency, Office of Research and Development, Environmental Monitoring and Support Laboratory: Cincinnati, OH, 1984; xvii.

Whitledge, T.E., et al. *Automated Nutrient Analysis in Seawater*; Brookhaven National Laboratory: Upton, NY, 1986.

**Figures**

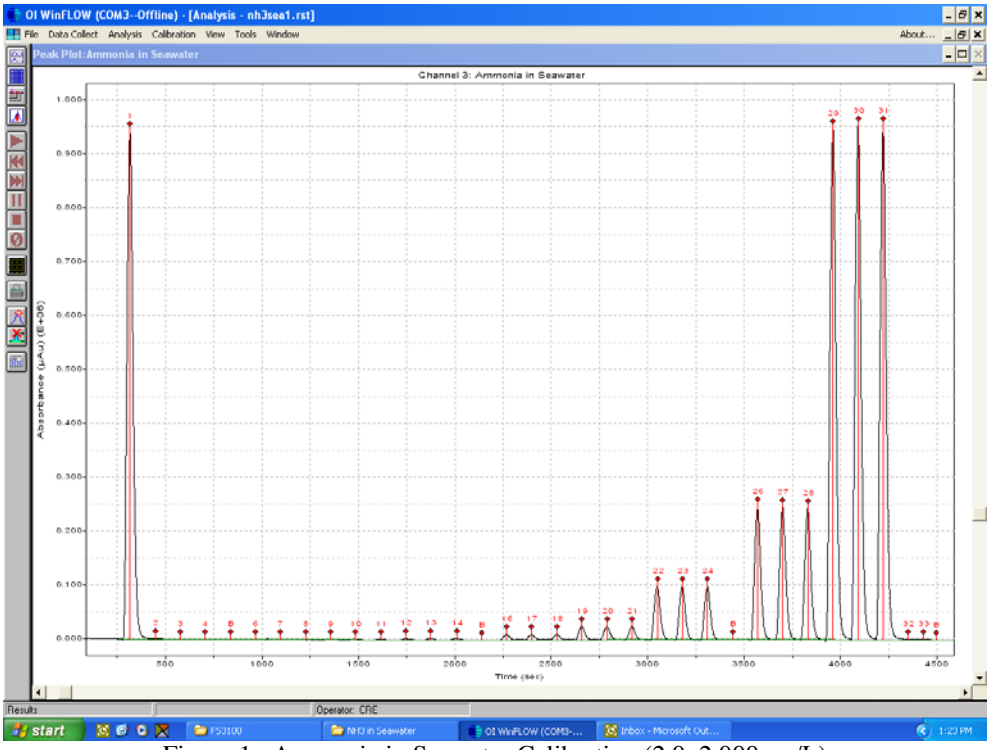



Figure 1. Ammonia in Seawater Calibration (2.0–2,000 µg/L)



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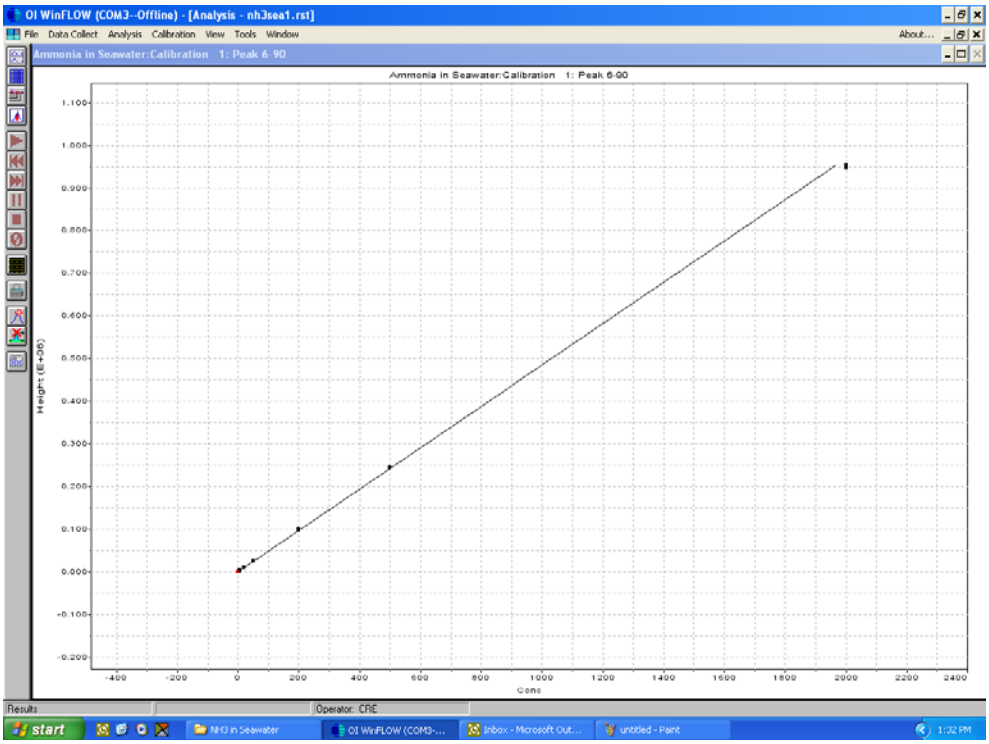


Figure 2. Ammonia in Seawater Calibration Curve (2.0–2,000 $\mu$g/L)

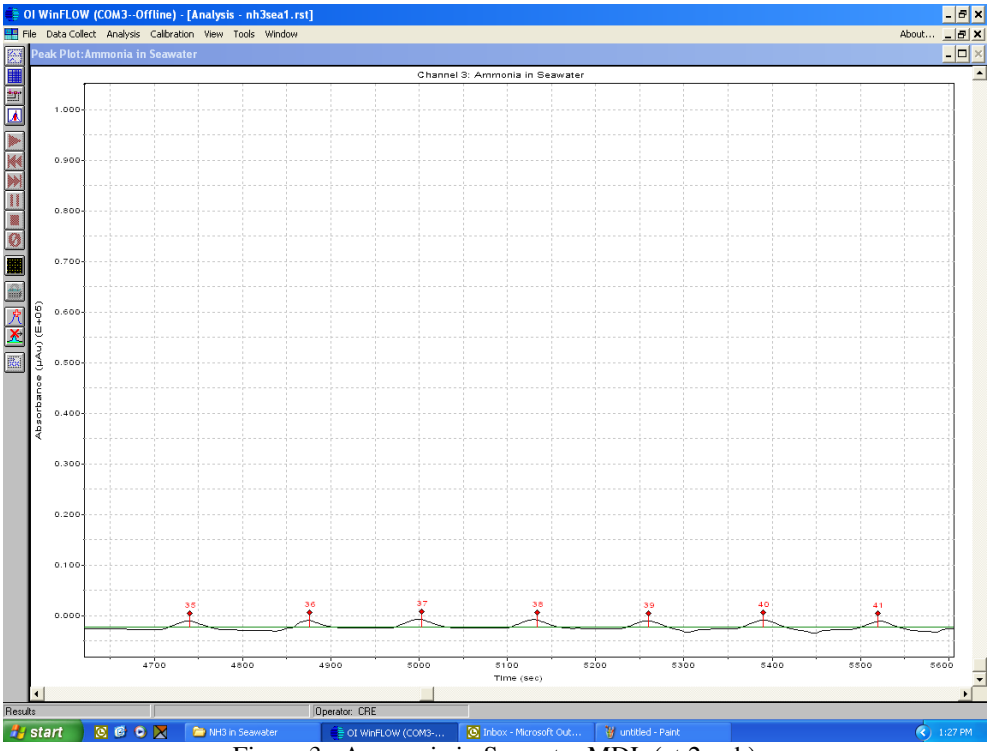


Figure 3. Ammonia in Seawater MDL (at 2 ppb)



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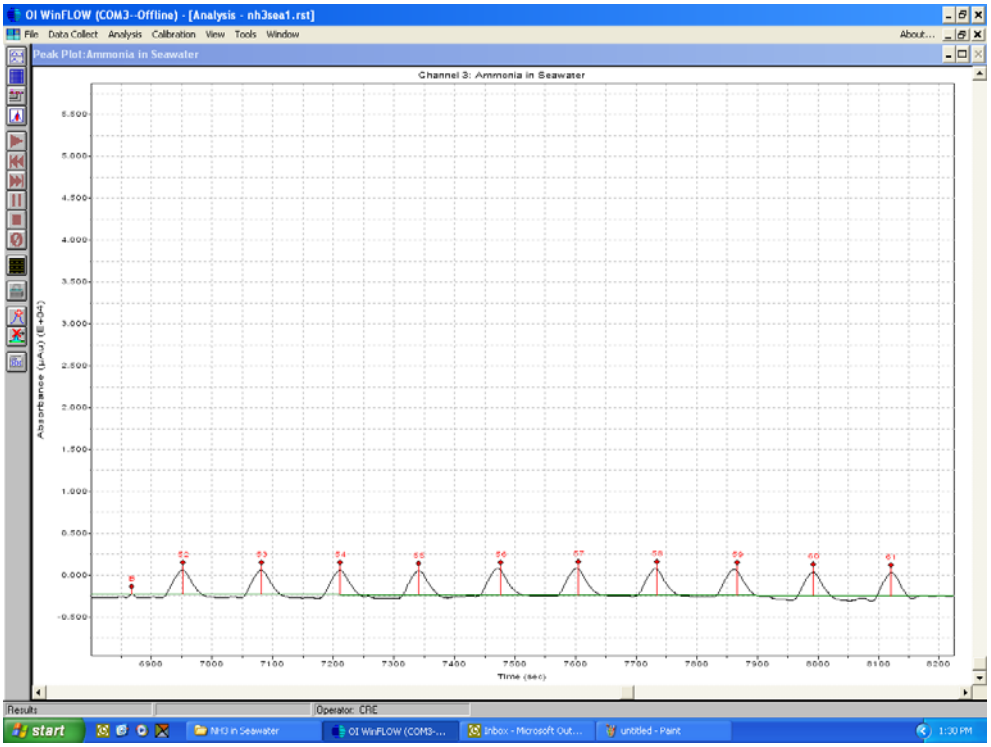


Figure 4. Ammonia in Seawater Precision (at 5 ppb)

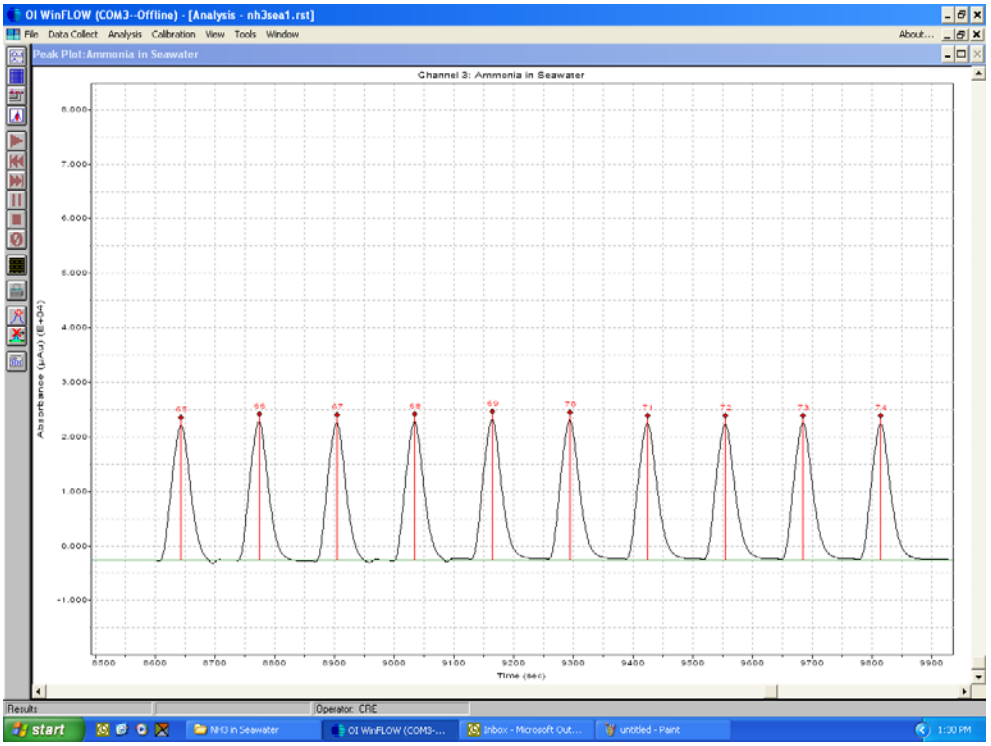


Figure 5. Ammonia in Seawater Precision (at 50 ppb)

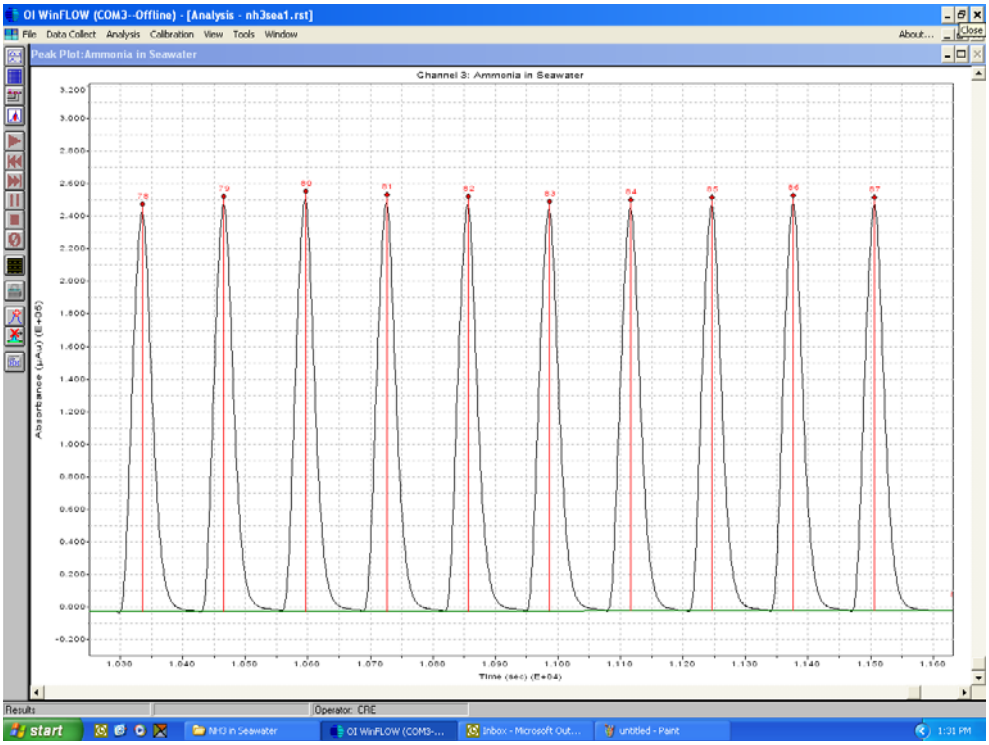


Figure 6. Ammonia in Seawater Precision (at 500 ppb)

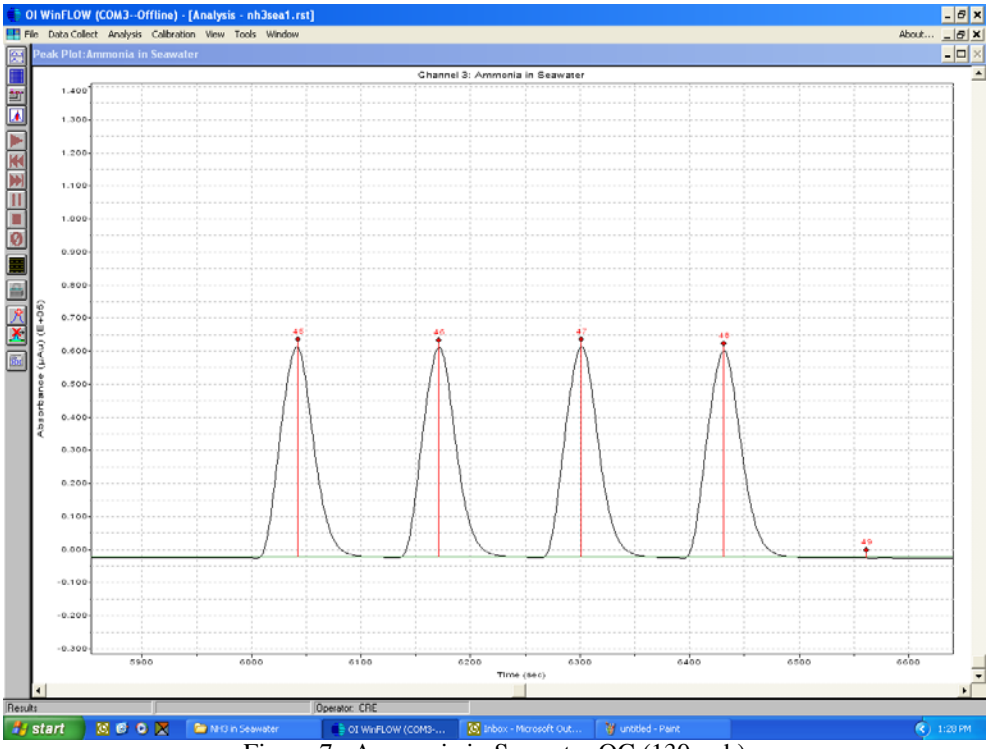


Figure 7. Ammonia in Seawater QC (130 ppb)

Table 1. Ammonia in Seawater Method Data

| Parmeter | Calibrant 2.0 µg/L | Calibrant 5.0 µg/L | Calibrant 50 µg/L | Calibrant 500 µg/L | ERA QC Standard 4.57 mg/L |
|---|---|---|---|---|---|
| Rep 1 | 2.2713 | 5.5371 | 50.4420 | 506.1328 | 130.6669 |
| Rep 2 | 2.4766 | 5.5601 | 51.8872 | 515.3280 | 130.1684 |
| Rep 3 | 2.6391 | 5.5973 | 51.3871 | 521.3938 | 130.7549 |
| Rep 4 | 2.5517 | 5.5644 | 51.8828 | 516.5193 | 128.0400 |
| Rep 5 | 2.2255 | 5.8107 | 52.7053 | 514.7170 | — |
| Rep 6 | 2.4998 | 6.0280 | 52.4744 | 508.2965 | — |
| Rep 7 | 1.9346 | 6.0819 | 51.2129 | 510.4082 | — |
| Rep 8 | — | 5.7762 | 51.0783 | 512.9644 | — |
| Rep 9 | — | 5.3788 | 51.3680 | 515.5889 | — |
| Rep 10 | — | 5.3661 | 51.1732 | 513.3723 | — |
| Average | 2.3712409 | 5.6700474 | 51.5611115 | 513.47212 | 129.90757 |
| Standard Deviation | 0.2428266 | 0.2477128 | 0.6813206 | 4.3693492 | 1.2715241 |
| % RSD | 10.240485 | 4.3687964 | 1.3213845 | 0.8509418 | 0.9787913 |
| MDL | 0.7624754 | — | — | — | — |
| % Accuracy | — | — | — | — | 100.79 |

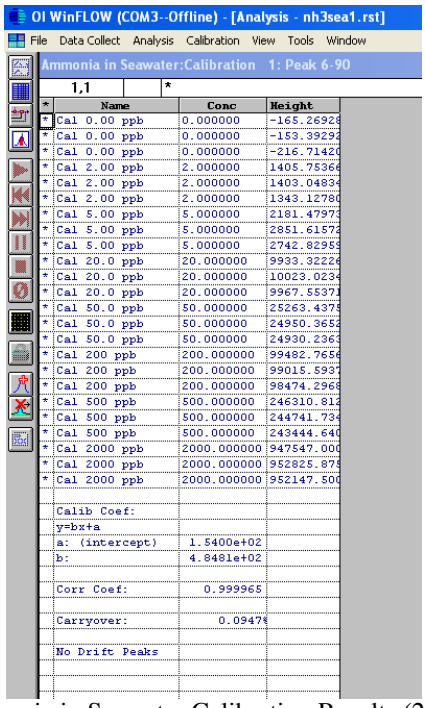


Figure 8. Ammonia in Seawater Calibration Results (2.0–2,000 µg/L)