

## DETERMINATION OF DISSOLVED IONS BY COLOURIMETRIC AUTOANALYZER

- 1. Principle of Methods:** Dissolved target analytes, including  $\text{SO}_4\text{-S}$ ,  $\text{NO}_3\text{-N}$ ,  $\text{NO}_2\text{-N}$ ,  $\text{Cl}^-$ ,  $\text{PO}_4\text{-P}$ , and  $\text{NH}_4\text{-N}$ , are measured via well-known colour reactions. Samples and method reagents are injected into reaction cuvettes, generating coloured complexes after reaction. A separate analysis method is run in each cuvette. The intensity of colour change in the solution is dependent on the concentration of analyte in the sample, and is measured by light absorbance at a specific wavelength. The amount of light absorbed by the solution follows the Beer-Lambert law:

$$A_\lambda = \varepsilon_\lambda lc$$

where:  $A_\lambda$  is the absorbance of light at the target wavelength,  $\varepsilon_\lambda$  is the extinction coefficient of the colour complex at that wavelength,  $l$  is the path length of the cuvette in cm, and  $c$  is the concentration of the analyte in solution.

- 2. Instrumentation Used:** Thermo Gallery Plus Beermaster Autoanalyzer. Manufactured by Thermo Fisher Scientific, Vantaa, Finland, 2017.

### 3. References

- 3.1.  $\text{NH}_4\text{-N}$ : Salicylate-hypochlorite method.** Bower, C. E. and T. Holm-Hansen. "A salicylate-hypochlorite method for determining ammonia in seawater." *Canadian Journal of Fisheries and Aquatic Sciences*. **1980**, 37:794–798.

- 3.2.  $\text{Cl}^-$ : Ferrithiocyanate method.** *EPA Method 325.2*

- 3.3.  $\text{PO}_4\text{-P}$ : Molybdenum Blue method.** *EPA Method 365.1*

- 3.4.  $\text{NO}_3+\text{NO}_2\text{-N}$  (TON) and  $\text{NO}_3$  by calculation: Hydrazine reduction method.** *EPA Method 353.1*

- 3.5.  $\text{NO}_3+\text{NO}_2\text{-N}$  (TON-V): Vanadium chloride reduction method.** "Automated Nitrate (TON) Assay Method Using Vanadium as Reductant - Correlation to Cadmium and Hydrazine Reductant Methods in Sea, Natural and Waste Waters." January **2013**, <https://www.envirotech-online.com/article/environmental-laboratory/7/thermo-fisher-scientific-clinical-diagnostics/automated-nitrate-ton-assay-method-using-vanadium-as-reductant-correlation-to-cadmium-and-hydrazine-reductant-methods-in-sea-natural-and-waste-waters/1346>

- 3.6.  $\text{SO}_4\text{-S}$ : Barium chloride turbidimetric method.** *EPA Method 375.4*

### 4. Standards Used:

Certified standard solutions purchased from SCP Scientific and Thermo Scientific are used for calibration, and separate certified solutions are used as external reference and CCV check standards. Where appropriate, standards are prepared in solutions matching the sample matrix, such as water, 2M KCl, or Modified Kelowna extraction solution.