Flow-based Analysis for Environmental Monitoring

What is Flow-based analysis?

Flow-based analysis is the generic term which describes a group of automated sample manipulation procedures that make use of unsegmented flowing streams in micro-conduits (0.030" or 0.7 mm id.). Most common among these techniques is Flow Injection Analysis (FIA). FIA is the process whereby a small segment of sample solution, typically 20 to 100 µl, is injected into a flowing carrier stream. This stream either contains a reagent, or the stream is merged with a reagent stream to produce a compound which can be determined in a flow-through detector. Sequential Injection analysis (SIA) is a variation of FIA where a selection valve is used to produce a stack of well defined zones of reagent and sample. These zones penetrate one another as they are carried to the detector by a suitable pump. Determination of the analyte of interest is analogous to FIA.

Wet chemical techniques form the basis of many analytical measurements. These proven chemistries, many approved by the EPA and other regulatory bodies, can be automated by using Flow-based techniques such as FIA and SIA.

Advantages of Flow-based analysis

- Applicable to a broad range of compounds by using a variety of simple photometric and electrochemical detectors.
- Low instrumentation costs.
- Low scheduled maintenance requirement.
- Unattended automated operation over an extended period of time provides a detailed picture of analyte profiles. This detailed information is not available when grab samples, or even composites, are taken and analyzed at a later time and remote location. Unstable compounds can be measured *in-situ.*
- Accurate and precise sample manipulation.
- Quality control measures can be included to assure the integrity of the analytical results.
- A wide range of useful manifold components allow complex operations such as dilution, trace enrichment, gas permeation, dialysis, and several others to be incorporated into the analyzer manifold
- Constant flushing of the manifold lines minimizes the risk of fouling

How Global FIA, Inc. can help you

Global FIA, Inc. is a supplier of FIA / SIA components, supplies, and expertise and will gladly customize a Flow-based Analyzer to meet your specific requirements. Analyzers suitable for laboratory operation, continuous on-line process and field monitoring, and research and development are available.

GLOBAL FIA

Methodology Note : 95/1 Trace Ammonia in Water

Global FIA, Inc.
5717 Wollochet Dr, Suite 1A
Gig Harbor, WA, 98335
Support : (206)-851-2222
Fax : (206)-851-5515

Methodology Note : 95/1
Trace ammonia in water

Summary

Ammonium in effluent samples is determined by injecting the sample into a sodium hydroxide stream (pH 12) to form NH_3 which moves across a gas-permeable membrane into a collector stream containing bromothymol blue (BTB) at pH 6.3. Collection of NH_3 into the BTB raises the pH producing a change in the color of the indicator from green to blue. This blue color is monitored spectrophotometrically at 630 nm using a LED photometer fitted with a red LED.

Application

This method is suitable for the determination of ammonium in effluent samples in the concentration range 0.1 to 2 mg/l. Higher levels can also be accommodated by including a dilution system into the manifold. The precision of the method, as determined by the relative standard deviation (s_r), is 0.01 at the 0.5 mg/l level. A sampling frequency of 30 measure-ments per hour is obtained. No major interferences are anticipated.

Equipment

Global FIA, Inc. will configure an analyzer suited to your application. This could either be a Bench top, Field Portable, At-line Analyzer, or On-line Analyzer.

Reagents

1. Sodium hydroxide solution 0.02 M: Dissolve 0.8 g NaOH in 1 liter water. **C**
2. Bromothymol blue solution: Dissolve 0.1 g BTB in 1 liter of distilled water. Adjust the pH to 6.3 by drop-wise addition of NaOH **BTB**
3. Ammonium stock solution: 5000 mg/l. Dissolve 22.2 g NH_4NO_3 in 1 liter water. Working standards are prepared by suitable dilution of this stock solution. **S**

Optimum conditions

Pump flow rate: 1.0 ml/ min.
Reaction coil 1: 50 cm **RC**
Injection loop: 100 µl **SL**

Procedure

1. Assemble the manifold as set out in the diagram.
2. Prepare the reagents according to the procedure described above.
3. Program FlowTEK™ with the desired Procedures.
4. Ensure that the FlowTEK™ Method described has been defined.
5. Pump the reagents through the manifold for about 20 minutes in order to attain stable flow conditions and allow the detector to warm up.
6. Filter the sample and dilute it to within the analytical range.
7. Ensure that the selection valve is selecting the correct line. Either a standard for a calibration, or the sample.
8. Run the Main Procedure and allow FlowTEK™ to calculate the sample concentration.

FlowTEK™ method

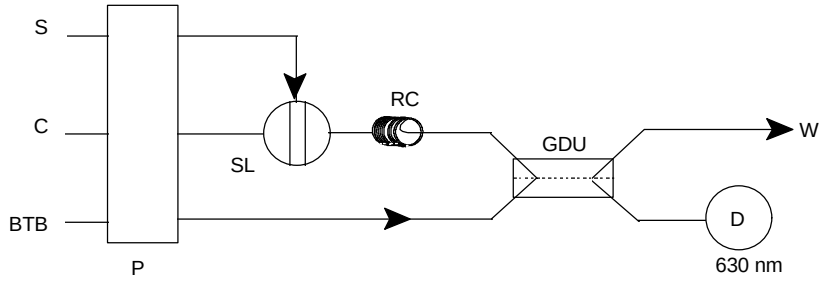
Expt Time: 120 sec

0 sec	Inject, Pump forward
5 sec	AutoZero
30 sec	Load
120 sec	Pump Off

Figures of merit

Working Range, mg/ l	0.1 - 2
Precision, s_r	0.01
Sampling rate, h^{-1}	30

Flow Injection manifold



Notes

Assembly of the gas-diffusion unit (GDU):

1. Carefully place a piece of pre-cut hydrophobic membrane over the diffusion channels.
2. Reassemble the unit making sure that no leaks are present and that the channels match up with one another.
3. Connect the sodium hydroxide and BTB streams to the GDU as shown in the diagram above.

Nov-95