

Maximizing instrument uptime using ion chromatography

Introduction

The University of Michigan Biological Station (UMBS), located in the Great Lakes Basin, focuses on terrestrial, aquatic, and atmospheric research. In particular, UMBS studies how climate change impacts our ecosystems.

Tim Veverica, an analytical chemist at UMBS, analyzes soil, plant, ground/surface water, and air samples for academic researchers, undergraduate and graduate student projects, and non-governmental organizations (NGOs). His lab is dedicated to providing timely and high-quality results for his clients, with an emphasis on using environmentally friendly chemistry techniques wherever possible.

Challenges using segmented flow analysis methods

Veverica's lab was using primarily segmented flow analysis methods to analyze anions in surface and ground waters. On average, the lab receives about 650 samples per month. The requirement to frequently change reagents, start up, calibrate, and shut down dedicated autoanalyzers on a daily basis consumed valuable instrument time.

For example, a wetland research group might be interested in a panel of inorganic anions (chloride, nitrate, phosphate, sulfate), and a dozen short-chain fatty acids for a given sample. Analysis of these core anions using segmented flow methods requires considerable lab technician time because each analyte must be tested separately using an autoanalyzer. Only chloride and nitrate can be run in parallel.

Water analysis

Challenges

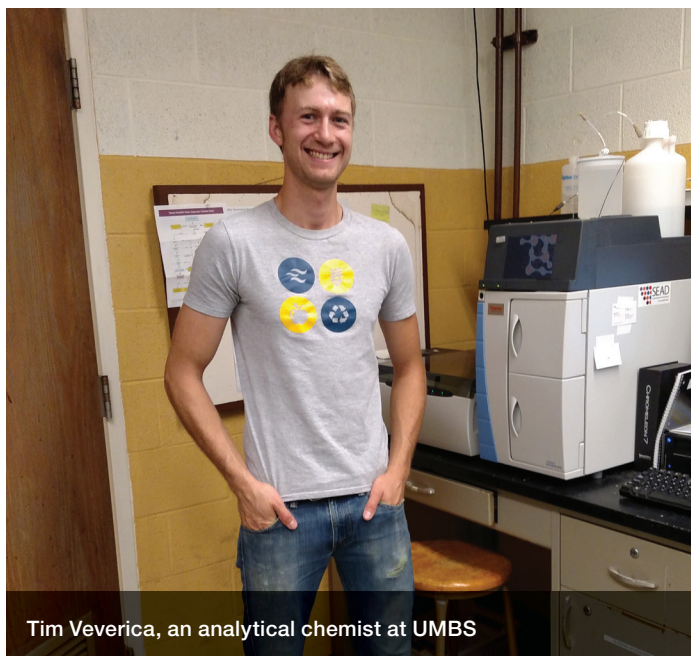
The UMBS was originally using time-consuming segmented flow analysis methods to analyze anions in surface and ground waters. In a typical eight-hour day, a technician spent nearly three hours preparing samples to be run on an autoanalyzer.

Solution

UMBS started using an ion chromatography (IC) system. The Thermo Scientific™ Dionex™ Integron™ HPIC™ system enables:

- Reduced hands-on technician time in preparation to use the system
- Minimal system downtime using automated consumables tracking
- Faster reporting of results using Thermo Scientific™ Chromeleon™ 7.2 Chromatography Data System (CDS) software

The lab can run a sample every hour, which meets their throughput requirements.



Additionally, the technician must start the autoanalyzer system, rinse it with surfactant, and allow it to come to chemical equilibrium. Because the instrument is usually off prior to starting an analysis, a fresh calibration curve is prepared and validated with every run. After the run, the technician must pump surfactant through the lines of the autoanalyzer to cleanse any residual chemicals before shutting the analyzer off.

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In search of a more throughput and eco-friendly solution, Veverica's lab recently purchased a Thermo Scientific™ Dionex™ Integrion™ HPIC™ system, which has significantly decreased the turnaround time from sample drop-off to delivery of results to his clients. The lab can run a sample every hour, which meets their throughput requirements. The stability of the Dionex Integrion HPIC system enables Veverica's technicians to stretch calibration across several days with appropriate validation measures.

Table 1 illustrates the difference in system analysis time between IC and segmented flow analysis. In a typical eight-hour day, a technician spends nearly 3 h preparing to use an autoanalyzer as opposed to just a little over half an hour to use an IC system.

The Dionex Integrion HPIC system also enables eco-friendly operation. In the past, the lab generated about 330 lbs of regulated hazardous waste per year when performing segmented flow analysis. About 30 lbs of the waste contained mercury. By switching to ion chromatography, the lab has completely eliminated mercury from the waste stream.

Table 1. System analysis time comparison.

	Autoanalyzer	IC System
Hands-on Technician Time	Time (min)/Sample	
Standards preparation	2	2
Calibration/validation	90	20
Reagent preparation	15	—
Loading time	—	15
Instrument rinse	60	—
Total	167	37

“Our Dionex Integrion HPIC system is very robust, easy to operate and has an intuitive flow path. The Consumables Device Monitor helps us ensure that IC consumables are ordered well before they are needed, minimizing system downtime. This feature also helps us anticipate potentially time-consuming maintenance requirements (e.g., rebuilding a pump) in advance of inconvenient malfunctions.”

The Chromeleon CDS software enables real-time reporting for experiments that require process monitoring.

Faster data processing, reviewing, and reporting

Veverica's lab uses the Thermo Scientific™ Chromeleon™ 7.2 Chromatography Data System (CDS) software to control its IC, gas chromatography, and high-performance liquid chromatography systems. The Chromeleon CDS software enables real-time reporting for experiments that require process monitoring. This feature becomes especially important for recalibration purposes during a run when a set of samples are beyond range. The lab technicians say the user interface is sleek and the report generator is easy and straightforward to use, once they are familiar with it.

Overall, the lab is now spending far less time preparing samples for analysis, processing, checking, and reporting results, which has increased laboratory productivity tremendously.

"Data analysis is easy using the Chromeleon CDS software. Ascribing peak identities takes two clicks, moving a baseline requires one. The auto tool takes a little adjustment to get used to, but is wonderful once the operator is oriented. The peak finding algorithm using Cobra Wizard is decidedly less buggy than some others I've used (none are ever perfect, after all). The Report Designer is straightforward once you get used to it. Task queuing is easily accomplished and adds flexibility to our daily routines (e.g., switching between gradient and isocratic runs overnight, unattended). Smart Startup/Shutdown meets compliance standards set by the University of Michigan directive to maintain a green lab."



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