Strategies and Tools for the Environmental Laboratory

Improving Operational Efficiency and Return on Invested Capital

Agilent Technologies, Inc.

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Today’s Challenges
Expecting More from Less

Business Challenges
- Increasing cost of ownership
- Trace analysis in complex matrices

Resource Allocation
- Less time for method development
- Limited technical experience

Optimizing Efficiency
- Demands for higher throughput
- Quicker return on capital investment
Presentation Overview

- Cost of Operation - Helium Availability
- Reducing Maintenance & Enhancing Performance
- Rapid Deployment for Quicker Financial Returns
Market Situation
The most common carrier gas for GC is in short supply!

Unreliable supply of helium worldwide and increasing prices have laboratories seeking alternative carrier gas solutions
Carrier Gas Decision Tree
Method Translation or Helium Conservation

- Is the customer willing to convert to alternative gases?
  - No: He Conservation
  - Yes: GC

- Is the Application based on GC or GC/MS?
  - GC: Does the current GC method have more than enough resolution?
    - No: Consider migration to N$_2$
    - Yes: Consider migration to H$_2$
  - GC/MS: GC/MS specific H$_2$ considerations
Helium Savings Calculator
Extend supply and lower cost using conservation techniques

Carrier Gas Savings Calculator
Change values in gray boxes to calculate savings for your operating parameters

Method: Typical Split GC method
Column: 30m x 0.25mm x 0.25um

<table>
<thead>
<tr>
<th>Gas Flow Conditions</th>
<th>with Conservation</th>
<th>No Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>He Carrier Flow (mL/min)</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>He Split flow (mL/min)</td>
<td>190</td>
<td>190</td>
</tr>
<tr>
<td>Gas Saver Flow (mL/min)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Gas Saver On (min)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Run Time (min.)</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Gas Volume in Cylinder (L)</td>
<td>8000</td>
<td>8000</td>
</tr>
<tr>
<td>Runs per Day</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>He Cylinder Cost ($)</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>N2 Cylinder Cost ($)</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>No Conservation</th>
<th>With Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily He Usage (L)</td>
<td>276</td>
<td>25</td>
</tr>
<tr>
<td>He Cylinder Life (days)</td>
<td>29</td>
<td>320</td>
</tr>
<tr>
<td>Daily N2 Usage (L)</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>N2 Cylinder Life (days)</td>
<td>0</td>
<td>376</td>
</tr>
<tr>
<td>Yearly He Cost ($)</td>
<td>3,774</td>
<td>342</td>
</tr>
<tr>
<td>Yearly N2 Cost ($)</td>
<td>0</td>
<td>58</td>
</tr>
<tr>
<td>Yearly Total Gas Cost ($)</td>
<td>3,774</td>
<td>400</td>
</tr>
<tr>
<td>Savings vs. No Gas Saver ($)</td>
<td>0</td>
<td>3,374</td>
</tr>
</tbody>
</table>

- **Helium Conservation**
  - Helium cylinder life extended to ~12 months
  - Greatly reduces annual gas costs

- **Additional Benefit**
  - Reduces dependence on Helium deliveries
  - Ensures business continuity

System Maintenance
Greatest disruption to workflow and productivity

1. System venting and disassembly of MS source
2. Manual cleaning requires expertise
3. Reassembly and system re-equilibration
4. System offline for full day of operation
Self-Cleaning Ion Source
Using H₂ to Clean to MS Source

Very Dirty Source: Background Spectrum

After Cleaning with H₂

Expanded scale
Cleaning Restores Analyte (OFN) Detection
Comparative to manual cleaning?

Very dirty source before cleaning

S:N \approx 1 \text{ pk-pk}
> 2 \text{ rms}

After cleaning with H$_2$

S:N > 50 \text{ pk-pk}
> 200 \text{ rms}
Pre-Configured Analyzers
Increasing the Value Proposition

Common Components
- w/o Analyzer
  - App. optimized consumables
- Factory Configured with Chemical Testing
- Field Verification
  - System with application setup
  - Familiarization
  - Application report

Customer Configured
- Std. HW, SW
- Analyzer Solution

Focus your team on analyses; not method development!
The Value of Analyzers and Application Kits

Reduce the time required for system deployment

...Faster Application Startup with a Quality Method
Analyzers of Interest
Environmental Laboratory Focus

GC/MS/MS Solutions
• Polycyclic Aromatic Hydrocarbons (PAHs)
• Pesticides & Environmental Pollutants

GC/MS Solutions
• Pesticides
• Volatiles and Semi Volatiles
• Polycyclic Aromatic Hydrocarbons (PAHs)

GC Solutions
• Greenhouse Gases
Analyzer Value to Customers
Helping you enhance your competitive advantage

- Alleviate Resource Pressure
- Guaranteed Method
- Optimized Performance
- Advanced Technologies
- Quicker Deployment and Return
Thank you
Let’s Continue the Conversation

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Q&A
Question 1.

• Should end users, or the scientists in the lab, be looking to validate the results that they have obtained using a certain instrument?

• And do you think that, if they have used another instrument, they would be likely to get different results? Because we are sometimes talking about very trace amounts of material, or very low volumes of samples. So what is your recommendation when it comes to validating results?
• The next point I wanted to bring up was around sample prep. What are some of the trends that you're seeing in sample prep now, and how can it help with minimizing some of the current problems.
Question 3.

• Can you elaborate a little bit more on how you clean the ion source using hydrogen?
Question 4.

• What is Agilent’s approach to field testing?
Contact

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