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Shimadzu solutions for helium shortage in GC/GC-MS

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Helium crisis

- Global demand is increasing
- Maintenance work in existing plants
- Delayed opening of new plant

- Significant price increase
- Unavailability

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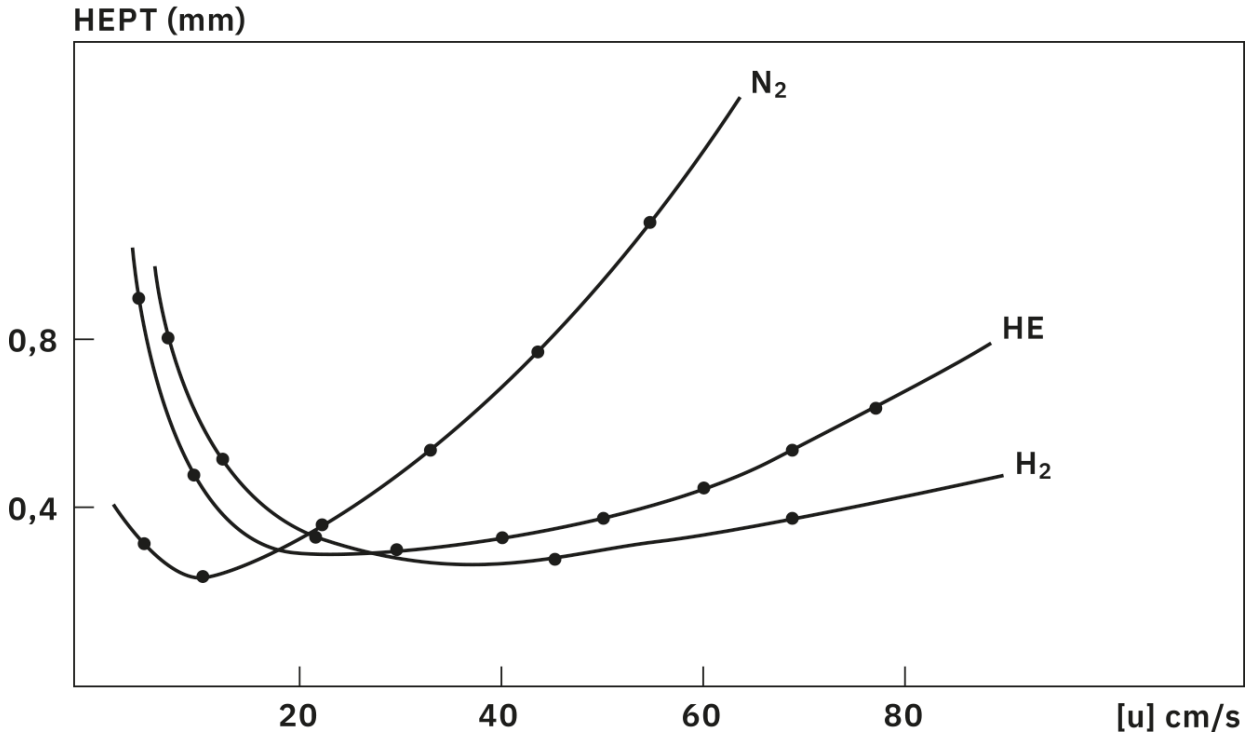
Gases in gas chromatography

Carrier gases Pros (+) / Cons (-)

	Helium	Nitrogen	Hydrogen
Diffusivity	+	-	+ +



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Gases in gas chromatography

Carrier gases Pros (+) / Cons (-)

	Helium	Nitrogen	Hydrogen
Diffusivity	+	-	+ +
Viscosity	-	-	+
Cost	- -	+	+
Availability	- -	+	+
Inertness	+	+	-
Others	For some detection techniques (e.g. BID) it is the only solution	Peak resolution worsens with increasing velocities	Cannot be used with some detectors, explosion risk (!)
Conclusion	Ideal carrier gas	Alternative to helium for easy to separate components	For many applications, good results and faster

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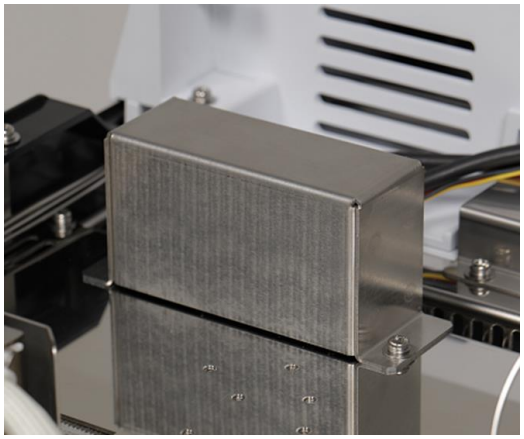
Safe GC operation with Hydrogen

Safety features of Shimadzu GCs

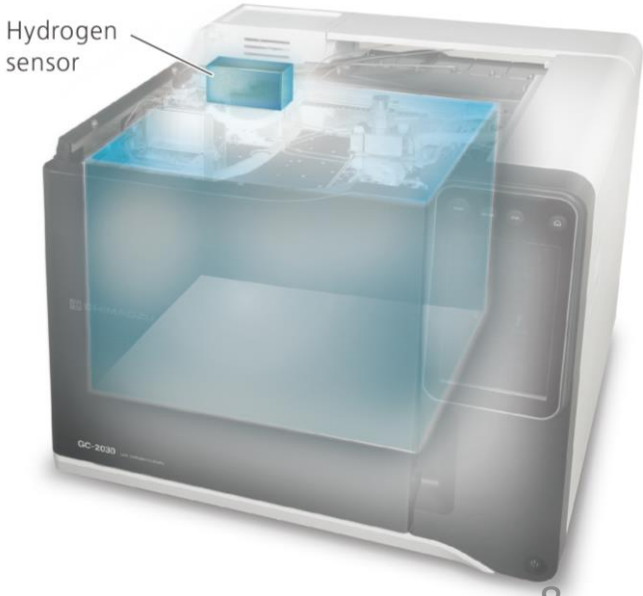
1. Dangerous leaks are automatically detected by **fast responding AFC**
2. Smaller leaks affecting GC result are detected by **automated leak check**
3. Additional safety by **AFC/APC hydrogen option** – reduces maximum hydrogen flow/pressure – and **optional hydrogen sensor** – continuous monitoring of hydrogen content in oven air – .



GC-2030 built-in hydrogen sensor:

Hydrogen concentration in GC oven:
1 % ⇒ Error Message, AFC flow stop
2 % ⇒ System shuts down

Explosion level of hydrogen is 4% in air



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Application examples with Hydrogen

- **Pesticide Residue Analysis with GC-MS/MS**
  - 120 pesticides, 5 - 500 ppb
  - Apple extract, QuEChERs for calibration

- **40 % time saved with good resolution**

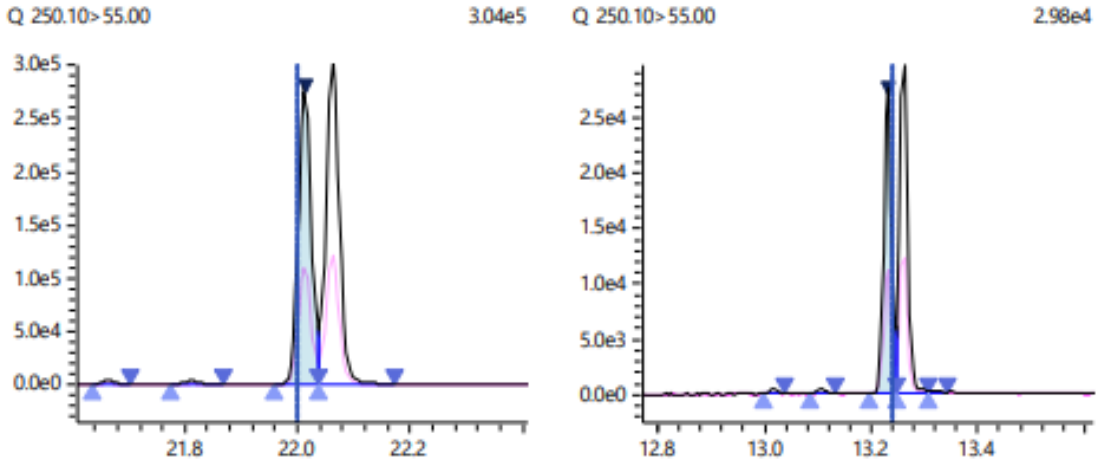

Figure 2: Fluvalinate-1 and -2 signals for helium (left) and hydrogen (right)

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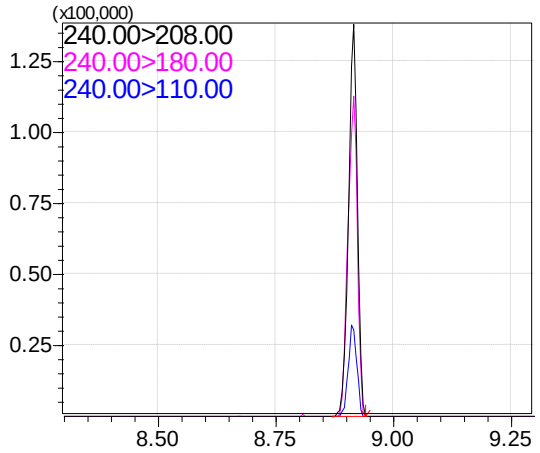
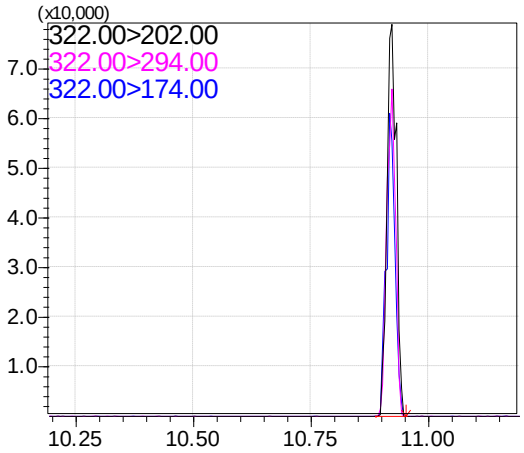
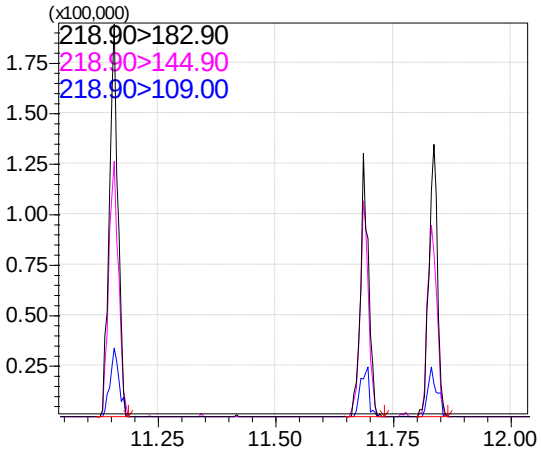
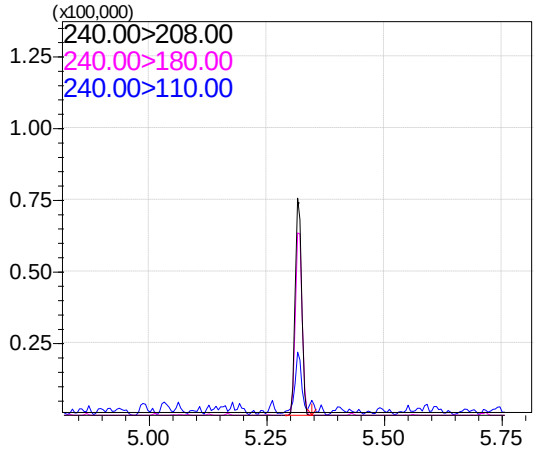
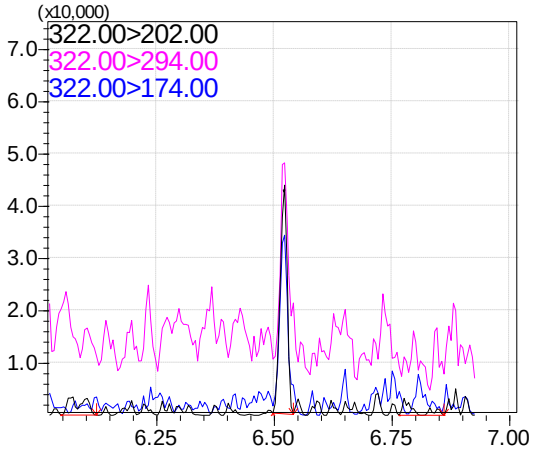
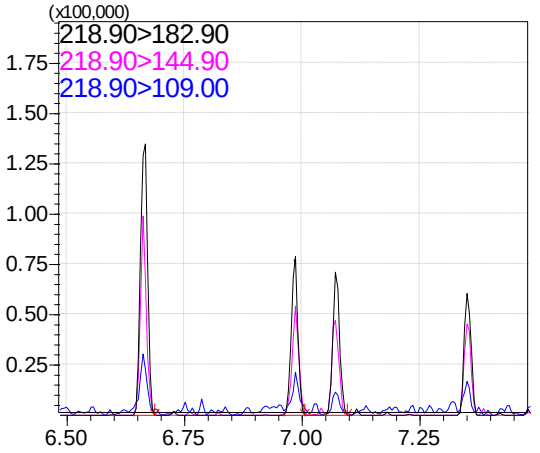
Application examples with Hydrogen

- Enough sensitivity at 5 ppb, Intensity drop compound dependent

	Methacrifos	Sulfotep	alpha-HCH
He			
H_2			

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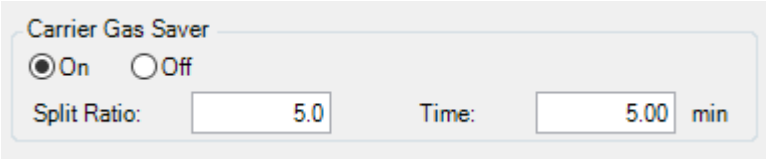
Cost reduction with Gas Saver and Ecology Mode

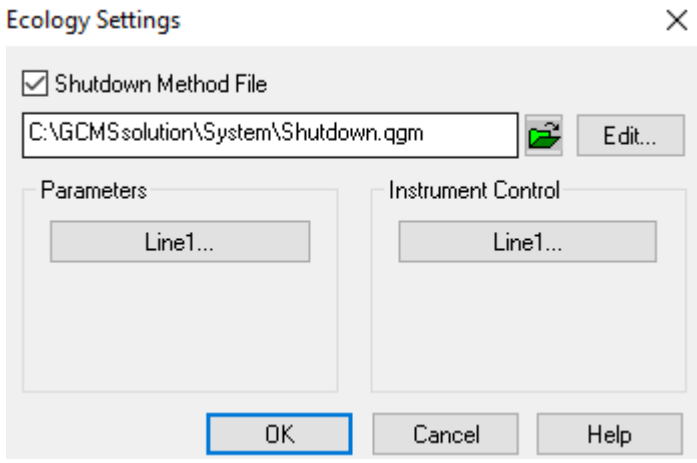
Gas Saver:

- In the method file, after a set time, the split ratio can be reduced to save carrier gas



Ecology Mode:

- A shutdown method file can be set with, e.g. lower temperatures and flows
- Several temperatures can be turned off
- Ecology mode can be activated:
  - Manually at any time
  - Automatically at the end of a batch



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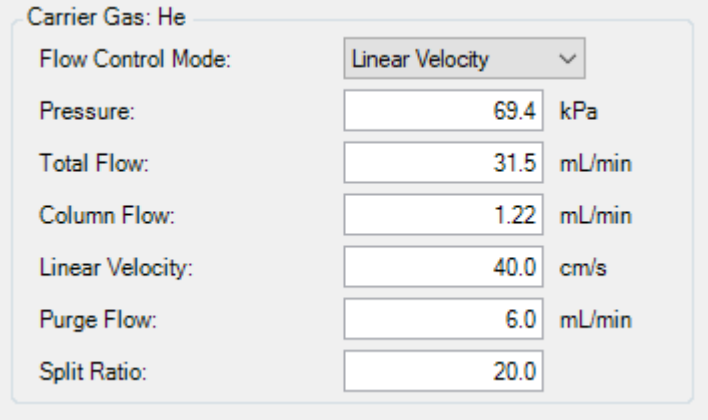
Cost reduction with Gas Saver and Ecology Mode

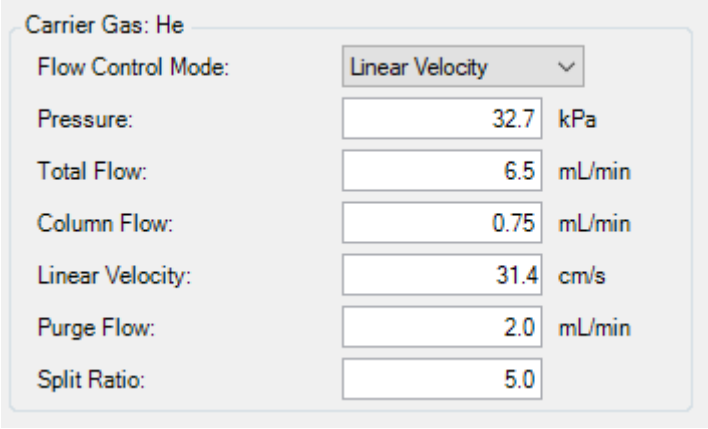
Savings example:

Normal Method



- Total Flow = 31.5 mL / min
- 50 L He Bottle (200 bar)
- Total “run” time = 220 days

Ecology Method

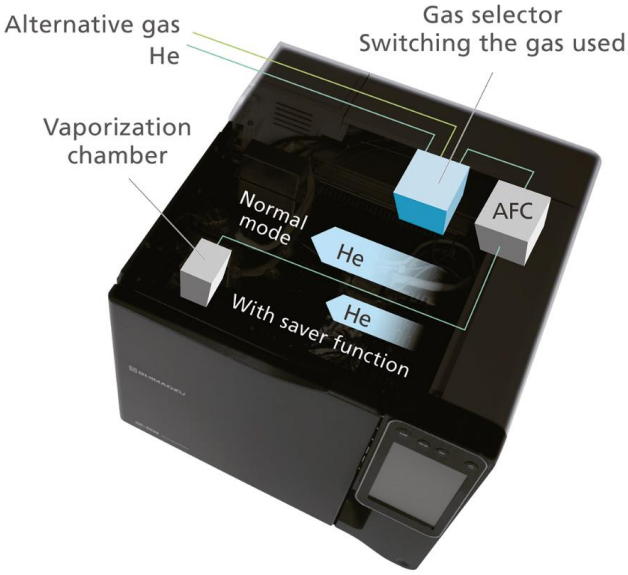


- Total Flow = 6.5 mL / min
- 50 L He Bottle (200 bar)
- Total “run” time = 1068 days

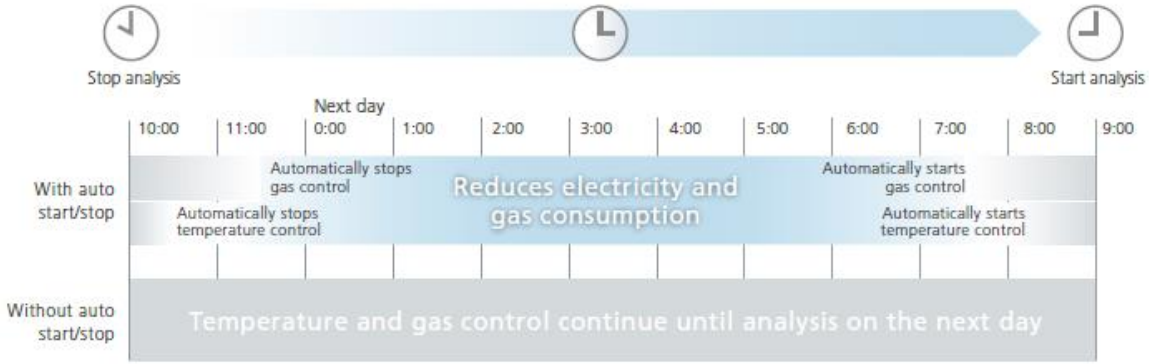
If used 10 h a day, 7 days a week the “lifetime” of the He bottle **doubles**!

Cost reduction with Gas Selector

Gas Selector:



- The gas can be switched with a **few clicks** in the software
- Either gas can be used for the analysis
- After the analysis, the GC can **automatically switch** to the alternative carrier gas
- The system can **automatically shutdown/re-start**
- Due to efficient purge function, **10 minutes** are enough for GC to restart with full helium separation performance



Automated shutdown and restart function of GC-2030

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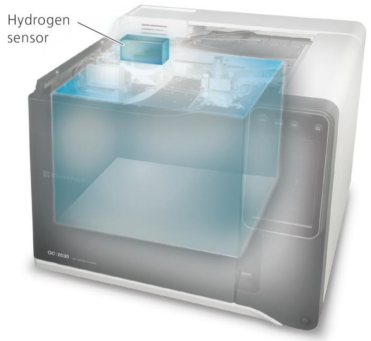
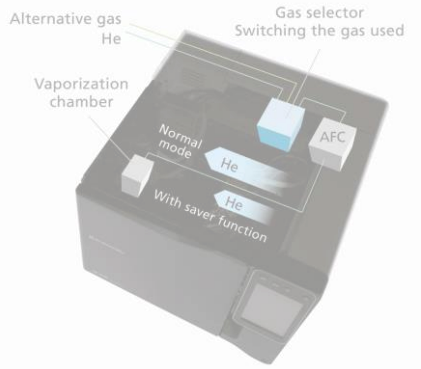
Conclusion

- Shimadzu offers several measures for the Helium Crisis:
  - Use of alternative carrier gases
  - Be safe while using Hydrogen thanks to:
    - Fast responding AFC
    - Automatic leak check
    - Hydrogen Sensor
    - AFC/APC Hydrogen option
  - Reduce Helium consumption thanks to:
    - Gas saver
    - Ecology Mode
    - Gas selector





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Resources

Carrier Gas Theory

Short on helium? Consider the carrier-gas alternatives

Countermeasures and Solutions for Helium Gas Supply Shortages

Alternative GCMS Carrier Gas

Hydrogen as carrier gas

Gas Chromatograph Hydrogen Gas Safety

Nexis GC-2030


Thank you for your attention!!
Questions?
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