SHIMADZU
Excellence in Science

Gas Chromatography

Solutions for Helium Shortage


SHIMADZU
Nexis GC-2030

Solutions for Helium Shortage

When it comes to Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (GCMS), high purity gas is essential. Helium is the preferred choice due to its inertness, safety, high resolution and speed, and excellent sensitivity, making it the go-to carrier gas for most GC and GCMS applications. However, Helium resources have been depleting over the years, as it is extracted from natural gas and escapes our atmosphere, which has resulted in significant price increases over the past 20 years.

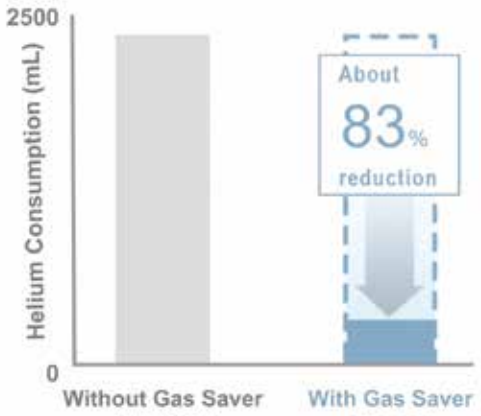
To address this issue, Shimadzu is committed to finding alternative gas options and mitigating the effects of the helium shortage and rising costs.

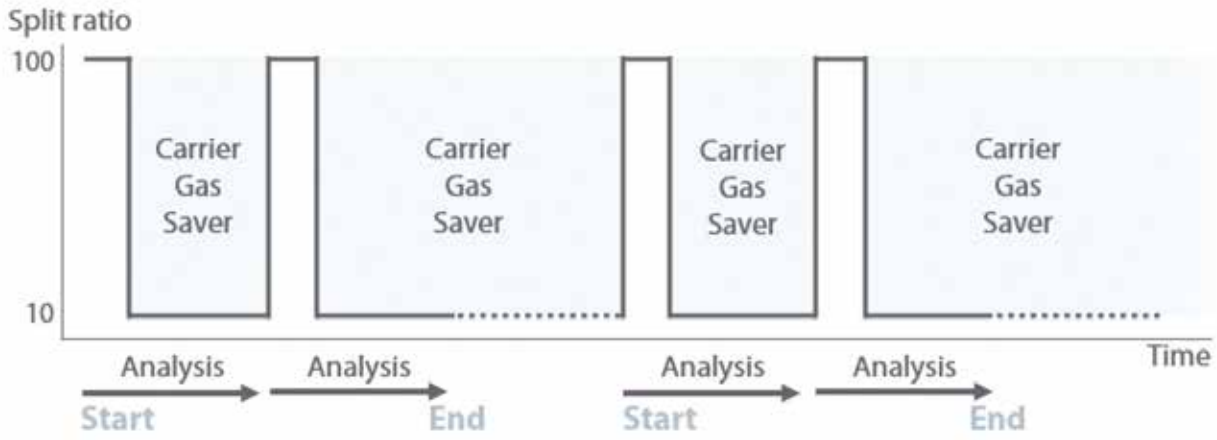
Reducing Helium Consumption

This section highlights various strategies for helium conservation, such as the use of carrier gas selector valve, automated software features and column dimension optimisation. These measures not only help laboratories save helium but also enhance analytical performance and reduce operational costs.

Carrier Gas Saver Function

For split analysis, a large split ratio does not need to be maintained after the sample enters the column. The carrier gas saver function reduces the split flow rate at a specified time after analysis starts until the next analysis starts.

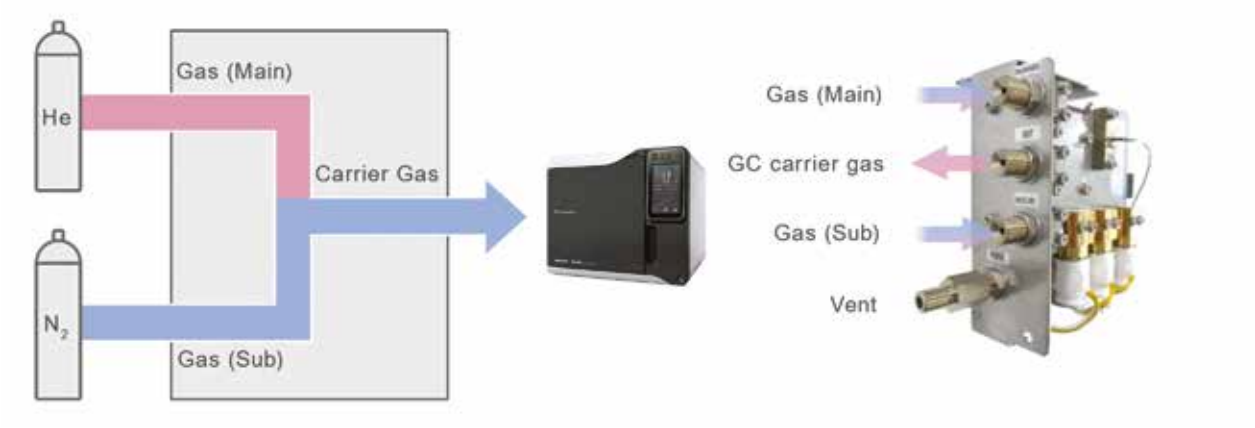




Even after analysis stops, it keeps saving carrier gas until the next batch analysis starts.

*The amount of reduction varies depending on the conditions.

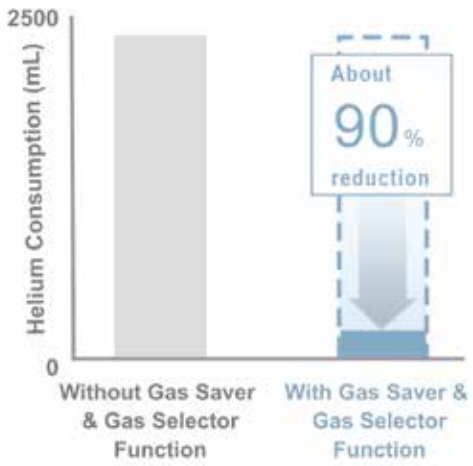
Gas Selector

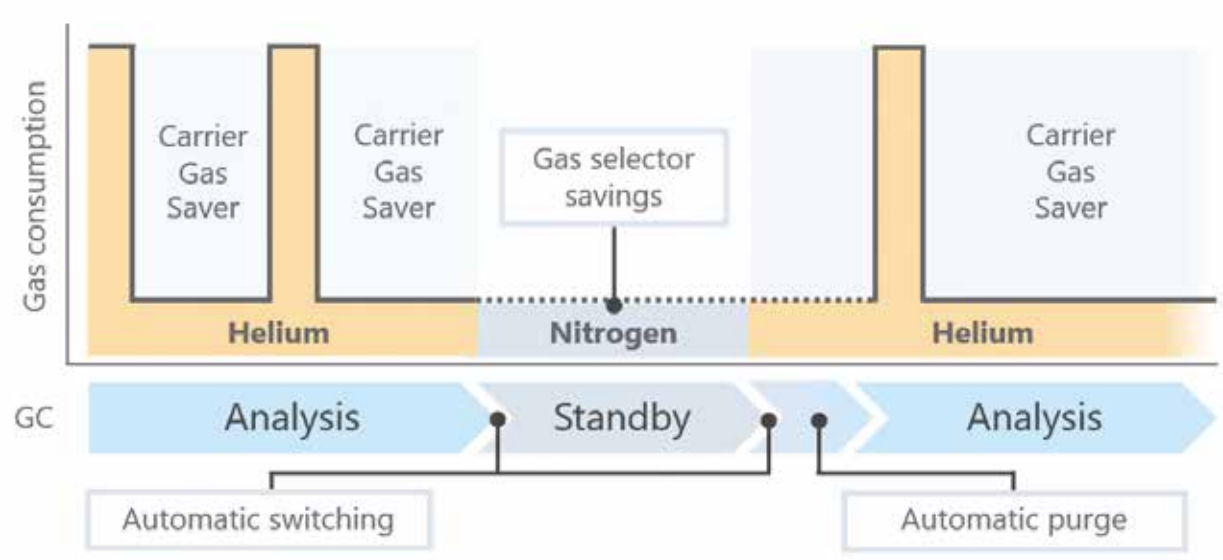


Installing a gas selector significantly reduces helium gas consumption by automatically switching to an alternative gas after analysis, for example Nitrogen.

The system continues to use Helium during analysis - when finished, it switches to alternative gas.

This process is fully automated and has no negative effects on sample running time and quality of the data.





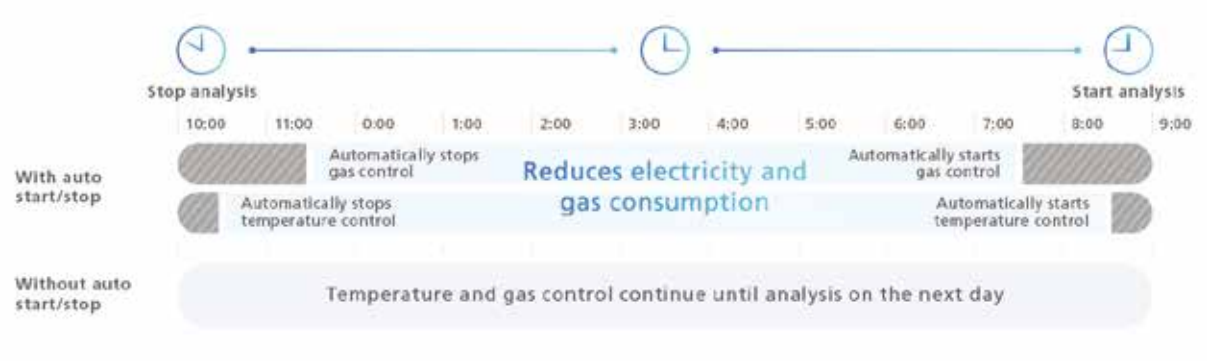
*The amount of reduction varies depending on the conditions.

The gas selector adds additional functionality by automatically switching between methods with different carrier gases, without user intervention.

Automated Start/Stop

Shimadzu instrumentation can be scheduled to automatically start-up and shutdown. This prevents the waste of helium when not analysing any samples.

Keep your GC ready at all times. Set your GC to sleep when not in use and immediately wake your GC when you need it. For GCMS systems running is an 'always on' environment, the instrument is capable of running in Eco Mode, to automatically minimise gas consumption once analysis is complete.



Narrow-bore Columns

One of the key elements in the reduction on carrier gas consumption, is the move to new narrow bore style columns. These offer higher levels of separation whilst simultaneously, vastly reducing the quantity of gas required. Even whilst using Hydrogen, which typically requires higher velocities, the rate of gas consumed can be significantly reduced with this technology. Shimadzu offer a wide range of narrow bore columns for many different applications.

Column flow comparisons:

Carrier gas	Column A (30 m, 0.25 mm ID, 0.25 um)	Column B (20 m, 0.18 mm ID, 0.18 um)	Column C (10 m, 0.1 mm ID, 0.1 um)
He at 40 cm/s	1.23 mL/min	0.82 mL/min	0.35 mL/min
H_2 at 60 cm/s	1.24 mL/min	0.83 mL/min	0.35 mL/min

Alternative Gas Options

In addition to helium-saving techniques, alternative carrier gases present laboratories with viable options in the absence or shortage of helium. In this section we provide comprehensive information on the benefits, limitations, and best practices for utilising other gas options, including hydrogen and nitrogen. By leveraging these alternatives, laboratories can achieve reliable and reproducible chromatographic results.

Alternative Gases Comparison

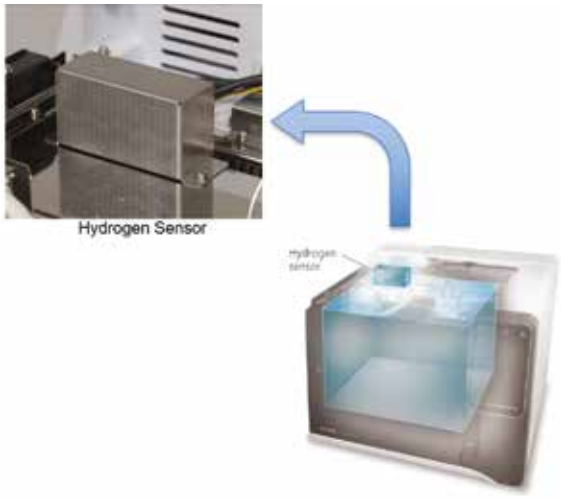
Shimadzu is committed to finding alternative gas options and mitigating the effects of the helium shortage and rising costs. Use this table for information about the pros and cons of alternative carrier gases.

	Helium	Hydrogen	Nitrogen
Speed	Good, mid-range analysis speed possible due to its good diffusivity. Achieves best peak resolution with medium linear velocity.	High-speed analysis possible due to superior separation ability. High diffusivity; achieves best peak resolution with higher linear velocity.	Low linear velocity required for optimum separation, leading to longer analysis times.
Separation	Gives good resolution.	Equivalent separation to helium can be achieved, often without method review.	Separation will likely be poor compared to helium, methods will require optimisation. Better separation achievable with isothermal GC analysis.
Sensitivity	Suitable for high-sensitivity analysis for all detectors. Only carrier gas solution for detectors such as BID.	Lower sensitivity, but compound and detector dependent. Where possible, comparative analysis is recommended.	Lower sensitivity than H_2 and He due to increase in noise.
Cost and Availability	Expensive, with rapidly increasing prices. Non-renewable, limited natural resource. Long lead times.	Affordable and renewable. Can use gas generator.	Cheap and renewable. Readily available, can use gas generator. Large natural supply.
Safety	Inert and non-flammable. Standard safety concerns with pressurised gas cylinder use apply.	Explosive/flammable gas. Safety considerations & additional measures recommended. Shimadzu instruments have H_2 leak detector and safety measures. Explosion risk is minimal at volumes used for GCMS.	Non-explosive gas. No safety concerns compared to H_2. Standard safety concerns with pressurised gas cylinder use apply.
Spectral Impact (GCMS)	No spectral impact due to inertness.	Due to its reducibility H_2 may react with measured compounds and affect results.	No spectral impact.
Columns	GC applications support up to 0.53 mm column diameter. Can be used with packed columns. GCMS applications support up to 0.53 mm column I.D.	GC applications support up to 0.53 mm column diameter. Can be used with packed columns. GCMS applications: column I.D. of 0.25 mm or smaller recommended.	GC applications support up to 0.53 mm column diameter. Can be used with packed columns. GCMS applications: column I.D. of 0.25 mm or smaller recommended.

For further information and to check if your system is compatible with alternative carrier gases, visit:
www.shimadzu.co.uk/gas-options

Using Hydrogen as a Carrier Gas

Safety First – Nexis GC-2030 helps to ensure hydrogen carrier gas is used safely. Hydrogen can be a safe and highly effective carrier gas, with correct safety considerations and additional measures. All of Shimadzu's new GC and GCMS models include a built-in software-controlled hydrogen sensor which constantly monitors the hydrogen concentration inside the GC oven and maintains a safe standby mode for early detection of potential leaks.



When a leak is detected, the system will automatically shut off gas flow and lower the temperature, switching to a safe standby mode.

Copper piping has a safety risk when using hydrogen as a carrier gas due to hydrogen embrittlement. In Shimadzu GCs, stainless steel material is used in the entire flow path so hydrogen can be used with no additional modifications to the main unit.

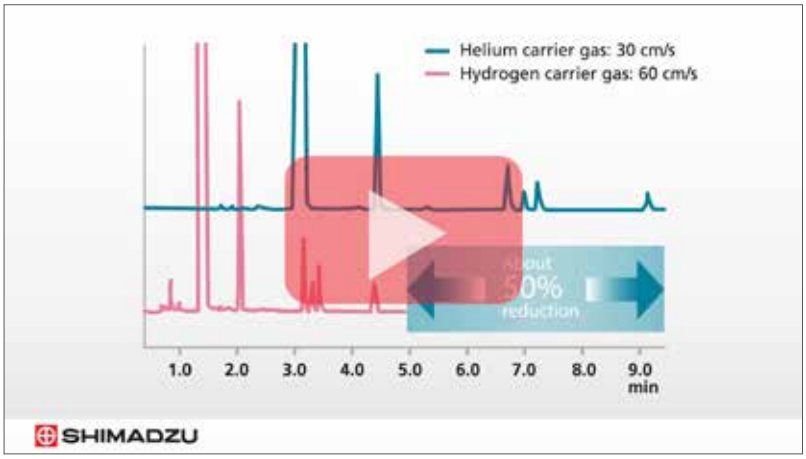
The importance of turbo molecular pump while using alternative carrier gas

In the current climate, most GCMS analysis utilises helium as the carrier gas. Shimadzu's high capacity dual-inlet turbo molecular pump, helium column flows up to 15 mL/minute can be achieved with our single-quadrupole range and up to 10 mL/minute with our triple quadrupole range.

Hydrogen carrier gas offers good separation efficiency, high speed, low cost and is more freely available, but it presents unique challenges in high-grade MS analysis due to its reduced viscosity. However, the vacuum in Shimadzu's GCMS system can be readily achieved and efficiently calibrated to use hydrogen as a carrier gas thanks to the powerful turbo molecular pump.

Maximum column flow	Shimadzu GCMS systems
15 mL/min	QP 2020 NX (EI, CI, NCI)
10 mL/min	TQ 8050 NX (and NXNC)
10 mL/min	TQ 8040 NX (and NXNC)
4 mL/min	QP 2010 SE

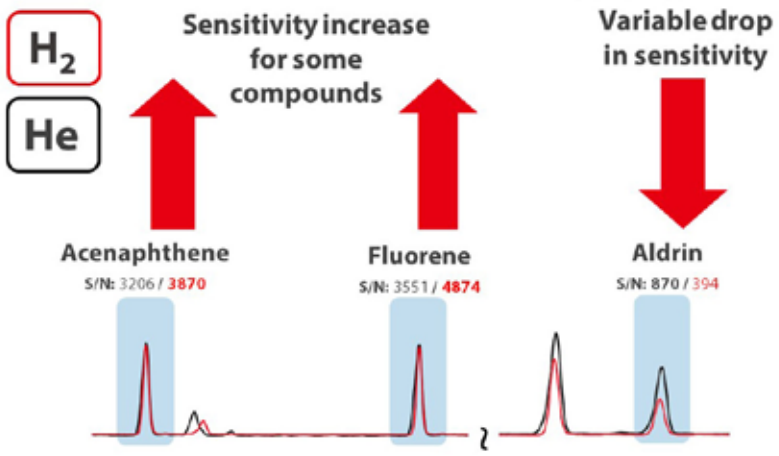
Video: Converting GC Methods from Helium to Hydrogen



Scan QR code to view the video or go to
www.shimadzu.co.uk/gas-options#using_hydrogen

Compound Dependent Sensitivity

Furthermore, it is essential to note that the variations in sensitivity when employing hydrogen as a carrier gas depend on the nature of compounds being analysed. In some cases, hydrogen can perform equally well as helium, highlighting its potential as a carrier gas of choice. However, undertaking comparison studies when considering the transition is recommended.



Webinars

The price of helium is soaring and deliveries can be erratic! Learn how to save time and money in your lab by reducing helium consumption or swapping it for a different carrier gas entirely with our two on-demand webinars.

Webinars cover:
- how to reduce helium carrier gas consumption
- how software can automate shutdown and start-up to save gas and power consumption
- solutions for making it safer to operate with H_2 carrier gas
- the potential to reduce analysis times significantly by switching to H_2 carrier gas.

Helium Part 1 – GC: Save it or Swap it!

Helium Part 2 – GCMS: Save it or Swap it!

https://www.shimadzu.co.uk/gas-options#webinars

Contact Us

To further support laboratories in their transition towards helium conservation and alternative gas options, Shimadzu offers comprehensive training, technical support, and application guidance. Our team of experts is dedicated to assisting customers in implementing sustainable practices and achieving optimal chromatographic performance.

Contact us directly to discuss the options available in more detail. By embracing helium conservation strategies and employing alternative carrier gases, your laboratory can drive scientific progress while minimising the environmental impact and operational costs associated with helium usage:

GC/GCMS Support:
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Nexis GC-2030
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