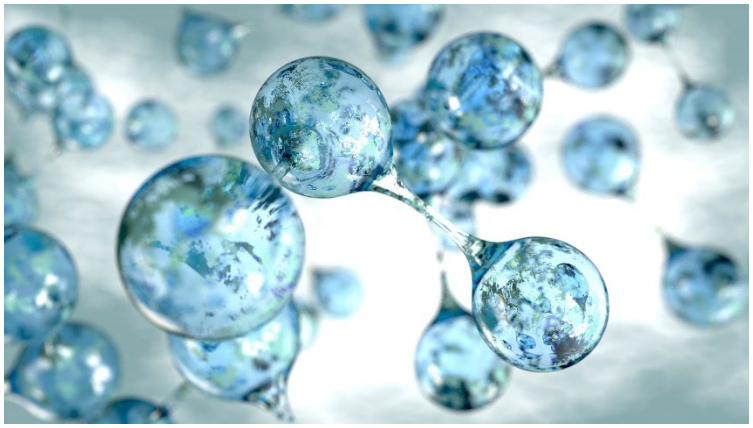
LabTech

# Addressing Helium Shortage using LabTech Hydrogen Generators.

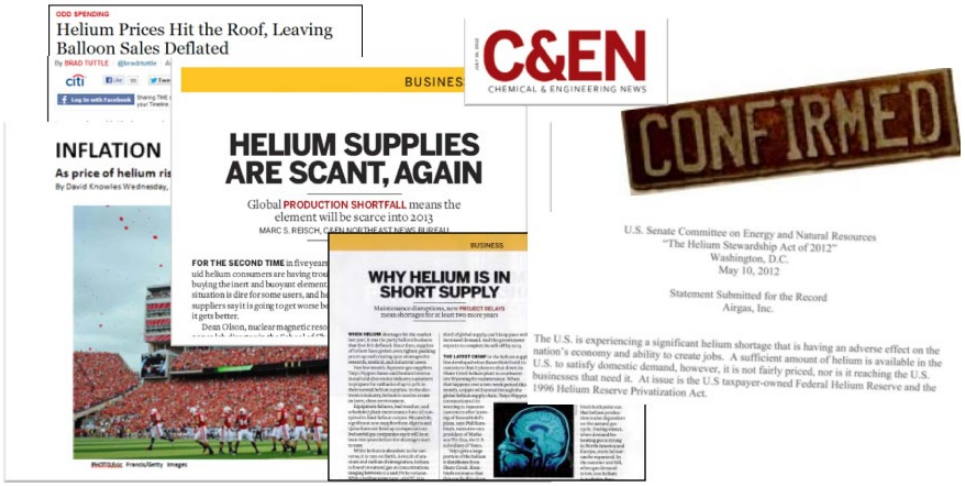
Helium is the second most abundant gas in the universe, the result of nuclear fusion reaction inside stars across cosmos, over million Celsius degrees temperature and plenty bars of pressure. Considering this, it is a quite rare gas to find on planet Earth.



However, it is possible to find helium on earth, despite the amount is very limited. The type of helium gas that can be found is helium-4, produced naturally underground by the radioactive decomposition and decay of certain elements like uranium and thorium. These reactions of decomposition and decay of heavy elements result in some alpha-particles containing two neutrons and protons that collect electrons from their surrounding and consequently create helium-4.

Helium-4 is a very light gas that tends to make its way through the crust of the earth and all the way up to the space, but part of it remains trapped and mixes with the natural gases among the layers beneath the earth's surface.

The method to extract the helium-4 is through drilled wells in order to release it. The amount of helium gas that can be found in the natural gas varies from almost negligible to 4% by its volume. The natural gas containing helium-4 then undergoes a process of cryogenic distillation to obtain the helium particles.




Once separated from natural gas, helium-4 goes through another process of refining after which it is brought to 99.99+% purity for market sale.

Helium is a type of gas that cannot be recovered after use due to its very light weight. Also, the global demand for helium increased a lot through the years because of the investment in chips production that requires a lot of this gas in its process. Consequently, a high demand together with finite resource causes

inevitably a shortage of helium; a problem that cannot be solved short time. Especially, if we consider that natural gas fields that have a high concentration of helium are limited to just three areas: Ras Laffan Industrial City in Qatar, ExxonMobil in Wyoming and the National Helium Reserve in Texas.

For these reasons, the helium-4 is becoming more and more expensive and a strategic resource for countries, in fact it was added to the EU Critical Raw Materials List in 2018.

Plenty of applications across industries that can replace helium to another solution, have already started doing so, and gas chromatography is one of such applications, using other gases as carrier gas instead of helium.

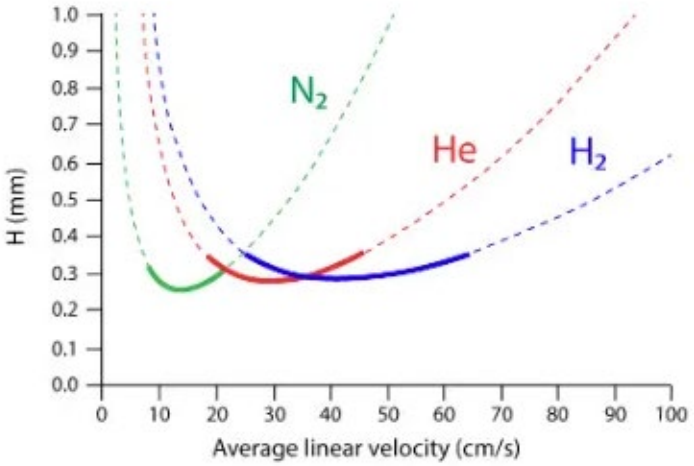
Although the choice of carrier gas depends on the content of the sample, hydrogen gas is one of the main contenders as substitute for helium. Having very low viscosity, hydrogen gas can provide the highest mobility rate of all carrier gases, reducing time for sample analysis.
However, due to the safety aspects, lot of laboratories are not allowed to have pressurized cylinders of hydrogen. In this case, the best solution is producing the hydrogen on-site thanks to generators.

LabTech hydrogen generators are equipped with safety detectors which ensure the system is shut down in the event of a leak and by doing so, the risks are reduced to the bare minimum.
Besides the economic aspects, a change from helium to hydrogen gas for GC brings plenty of benefits because it is more reliable and convenient producing hydrogen on site rather than depending on an external supplier.

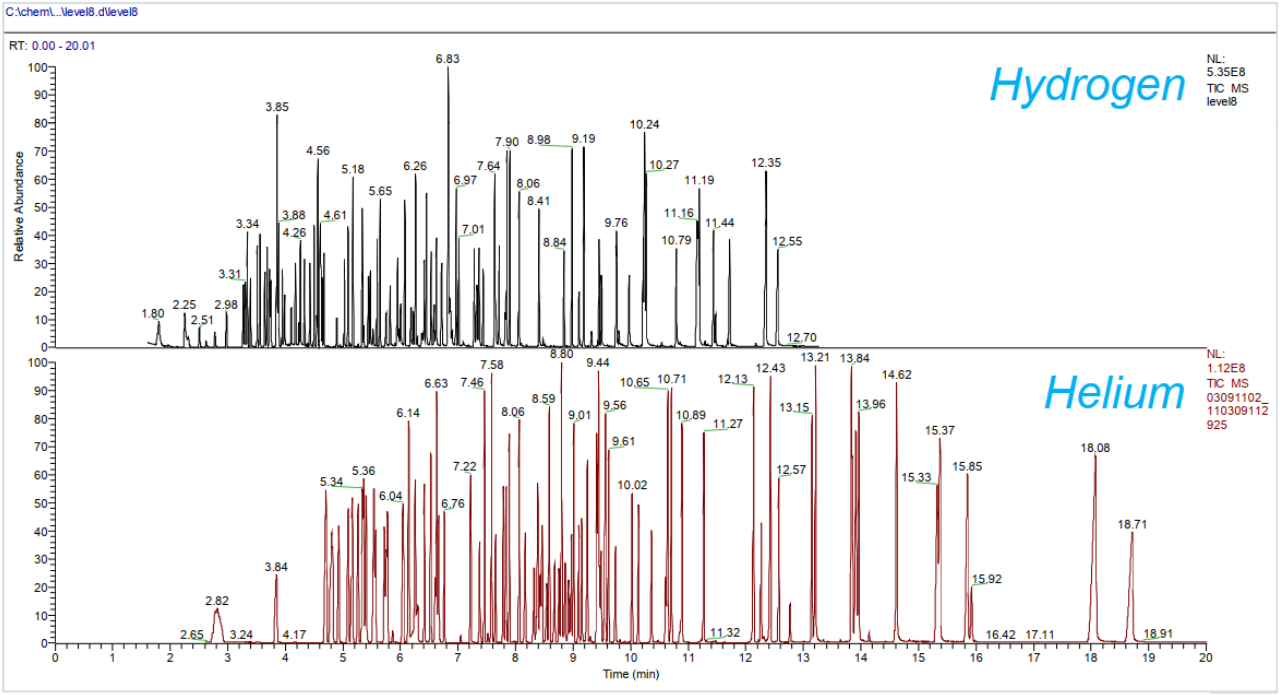
In addition, it is also an environmentally friendly solution as the process uses only deionized water plus electricity, in contrast to the energy-intensive process of steam reformation methane, which is the most common method of obtaining hydrogen cylinders. Also notable the reduction of the carbon footprint considering the production on-site, giving up on cylinders deliveries.

Another important aspect is the shorter run times in methods. Hydrogen gas has in fact a higher optimal linear velocity than helium, therefore in many cases increases a lab throughput by improving analysis speed.

We can therefore state that LabTech hydrogen generators represent the perfect solution for applications that need to replace helium with hydrogen.




Comparison of Hydrogen to Helium Run Times for EPA Method 8270D; the analysis time was shortened thanks to hydrogen carrier gas. Since hydrogen gas can flow gas at a lower supply pressure than helium, it is suitable for high-speed analysis using a narrow bore capillary column.




ISQ™ Single Quadrupole GC-MS + TRACE™ 1300 Series GC

Standards

- Prepared in ethyl acetate
- Calibration (1.0, 2.0, 5.0, 10, 50, 100, 200 ug/mL)

Inlet

- S/SL: 350 °C
- Split Mode: 15:1
- Carrier: 1 mL/min $H_2$/He
- Column: TG-5 SilMS 20m x 0.18mm x 0.36 µm

MS

- Source 325 °C
- EC: 15 uamps
- Full Scan: 35-500
- Scan speed: 4,650 amu/sec

**LabTech Hydrogen Generators**

*LMH & LMHPLUS Series*

The LMH & LMHPLUS series use an electrolytic cell with a polymeric membrane (PEM) to produce pure hydrogen gas. The innovative gas-drying system of the LMHPLUS series is completely maintenance free and can run operations 24 hours a day. The exclusive electronically controlled gas/liquid separator automatically checks for internal leaks when the unit starts. Furthermore, the constant control of the operating parameters guarantees maximum safety, and the LCD touchscreen interface provides a simple and user-friendly management of all the unit functions without requiring the operator's presence.

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| | LMH180 | LMH350 | LMH520 | LMH180PLUS | LMH350PLUS | LMH520PLUS | LMH700PLUS | LMH1000PLUS | LMH1200PLUS |
|---|---|---|---|---|---|---|---|---|---|
| **▪ GENERAL DATA** | | | | | | | | | |
| Electrolytic cell | PEM technology | | | | | | | | |
| $H_2$ purity | >99.9995%[1] | | | >99.99999%[2] | | | | | |
| Outlet pressure (bar) | 8 (115psi) | | | 12 (174psi) - Optional 16 (232psi) | | | | | |
| Max flow rate (cc/min) | 180 | 350 | 520 | 180 | 350 | 520 | 700 | 1000 | 1200 |
| Dimensions (LxWxH cm) | 56x45x19 | | | | | | | | |
| Net weight (kg) (water tank empty) | 20 | | 22 | 20 | | 22 | | 25 | |
| **▪ COMMUNICATION** | | | | | | | | | |
| RS232 | • | • | • | • | • | • | • | • | • |
| RS485 | - | - | - | • | • | • | • | • | • |
| USB | - | - | - | • | • | • | • | • | • |
| **▪ SOFTWARE FUNCTIONS** | | | | | | | | | |
| Parallel mode capability | • | • | • | • | • | • | • | • | |
| Auto refill tank function | • | • | • | • | • | • | • | • | |
| **▪ WATER** | | | | | | | | | |
| Quality | Deionized, ASTM II, <0.1µS | | | | | | | | |
| Internal tank capacity (L) | 1.1 | | | | | | | | |
| External tank capacity (L) | 5 or 10 | | | | | | | | |
| **▪ ELECTRICAL REQUIREMENTS** | | | | | | | | | |
| Power supply voltage | 100-240V 50/60Hz | | | | | | | | |
| Max power consuption (W) | 280 | | 450 | 280 | | | 450 | 560 | |
| Fuse rating (A) | 4 | | 6.3 | 4 | | | 6.3 | | |
| **▪ CONNECTIONS** | | | | | | | | | |
| Hydrogen outlet | 1/8" Compression Fitting | | | | | | | | |
| Water | Quick release push-in fitting | | | | | | | | |
| **▪ OPERATING CONDITIONS** | | | | | | | | | |
| Temperature (°C) | 5 to 35 (41° to 95°F) | | | | | | | | |
| Humidity (°C) (Max, non condensing) | 80% at 25 (77°F) | | | | | | | | |
| Noise (dB) | <25 | | | | | | | | |
| IP rating | 20 | | | | | | | | |

[1]Referred to $O_2$, DewPoint < -50°C - [2]Referred to $O_2$, DewPoint < -75°C