Replacing Helium with Purified Hydrogen for Gas Chromatography

By Stuart Bestrom

The continuing worldwide helium shortage has led to higher prices and uncertain supply for many helium users. Gas suppliers have been forced to limit shipments to contracted customers and even cut off supply to non-contract customers. One result of this supply shortage is the increasing trend to replace helium with purified hydrogen for carrier gas applications in gas chromatography. Gas chromatography (GC) is a widely used analytical method in the chemical, pharmaceutical, petrochemical, food, environmental, electronic, and medical industries as well as the industrial gas supply industry. Sales of gas chromatographs exceed $1 billion per annum worldwide.

Helium, nitrogen, or hydrogen can all be used as the carrier gas for most gas chromatography. Hydrogen is also used as a fuel gas for the flame ionization detectors that are used in some GC applications.

PH2d Hydrogen Purifier, from Power and Energy, is typically used for purification of GC carrier gas.

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Of the three gases, hydrogen has the highest linear velocity and lowest viscosity allowing for fast, low temperature analysis and higher instrument throughput. The faster elution times can lead to lower GC column temperatures and a reduction of acidic sites within the GC column. These improvements will increase laboratory productivity and extend GC column life. Hydrogen is compatible for use with all detector types except for DID (Discharge Ionization Detector).

While hydrogen has been shown to be the best performing carrier gas in most applications, many labs have shied away from hydrogen in favor of helium as helium is an inert gas. Now, the limited supply and increasing cost of helium is leading laboratories to revisit their choice of carrier gas, and increasing numbers are turning to a point-of-use hydrogen purifier downstream of hydrogen cylinders or generators.

Sensitive analytical instruments require high purity carrier gases to ensure that impurities in the carrier gas do not cloud the results of the analysis. Hydrogen from any source can contain part-per-million levels of oxygen, moisture, and carbon. For example, industrial grade hydrogen (99.99% purity) has 100 ppm total impurities. Even the highest commercially available grades of gas require additional purification in the lab before they can be used in analysis. Hydrogen generated by lab scale generators using electrolysis technology can have high moisture levels that need to be removed or accounted for. Cylinder sources are available in a range of purities, but there is purity variance in each cylinder, and the incremental cost for higher purity significantly increases lab operating costs. As a result, laboratories install purifiers in their carrier gas feed systems. A typical installation may include several different adsorbers or traps, each targeting a specific class of impurity. These systems are complex, requiring careful design and operation to ensure safety and gas purity. As the traps and adsorbers saturate over time, they need constant monitoring and periodic replacement.

There is now a simpler and lower cost alternative. Power and Energy (P+E) (*powerandenergy.com*), a supplier of hydrogen purifiers and analyzers, has recently introduced a new hydrogen purifier specifically designed for laboratory use. The PH2d hydrogen purifier removes all impurities in a single unit providing outlet purity with < 0.001 ppm (<1 ppb) total impurities. Models are available for various flow rates suitable for single GC's or as a centralized purifier for multiple instruments. When used in combination with low cost industrial grade cylinder gas, the PH2d provides the lowest cost, highest purity carrier gas available today. In fact, when compared to helium, the financial payback time for switching to PH2d plus industrial hydrogen can be less than 12 months.

P+E's patented micro-channel palladium technology removes all impurities in a single package. The purifier isolates and vents impurities, so there are no columns or traps to replace. High levels of impurities in the feed gas will not reduce the life of a P+E purifier. With no parts to replace or regenerate, the purifier will provide years of uninterrupted purification to maximize lab productivity.

With the worldwide supply shortage of helium set to continue into 2013, the conversion to hydrogen carrier gas is expected to grow in the coming year. The PH2d hydrogen purifier from Power and Energy, combined with low-cost hydrogen, will provide lower lab costs, stable gas supply, and improved gas purity. ■

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