Conversion of GC/MS Methods From Helium to Hydrogen Carrier Gas

Bruce D. Quimby, Ph.D., Agilent Technologies Inc., Wilmington, DE, USA

Introduction

Concerns regarding the cost and availability of helium have resulted in many GC/MS users considering conversion to hydrogen as the carrier gas. This paper will discuss the steps required in this conversion and some of the limitations to be expected when using hydrogen as a carrier gas.

Safety and Gas Source

- **Hydrogen Safety:**
  - Check with your laboratory safety coordinator to make sure you are allowed to use hydrogen in your lab.
  - Make sure your GC/MS system is designed for use with hydrogen.
  - If there is any question, check with the manufacturer.
  - Review any safety documentation provided with the instrument.

- **Source of H₂ Carrier Gas:**
  - If possible, use a high purity (>99.999%) hydrogen generator.
  - Higher initial expense than cylinders, lower cost over time.
  - Very clean H₂, >99.999%, available.
  - Higher initial expense than cylinders, lower cost over time.
  - Make sure to buy a good one with a low spec for water and oxygen
  - More consistent purity
  - Make sure your GC/MS system was designed for use with hydrogen.

- **Diffusion pump:** 0.75 mL/min
- **Performance turbo:** 2 mL/min

Choosing a Column

Determine max flow of H₂ into MS that will give source pressure of 5 x 10⁻⁵ torr or less source pressure. This is your max column flow. Choose column dimensions at initial even temp of method to give:
- a flow 2 x max column flow for vacuum pump
- a flow that is at least 35 mm/sec average linear velocity
- an inlet pressure of at least 5 psi

Keeping a temperature ramp of the same number of °C/d is very good. This will give similar elution order. Use the Agilent method translator for this.

Method Translation Tool

Use the method translation tool to evaluate potential columns and conditions for the H₂ version.

Example Conversion

The example here is a forensic toxicology screening system. The setup uses post-column backflushing to reduce system maintenance.

Safety Time Locking and Mass Spectral Deconvolution (DRS) are used to greatly increase screening accuracy and productivity. Method translation was used for the conversion to preserve the retention times simultaneously as well.

Summary And Conclusions

- H₂ is not an inert gas, so check for inertness problems
- Use the lowest inlet temp that works to reduce reactions with H₂
- Use pulsed injection, especially with small bore columns
- Consider using an MMI (PTV) in cold splitless mode for fragile compounds
- Users should check the reference spectra for important targets to make sure they have not been changed
- Some compounds may disappear at low levels.
- Good news: Source cleaning will be needed much less frequently.