Landfill Gas Analysis using a 5890 Gas Chromatograph and the Advanced Industrial Chemistry DBD Helium Ionization Detector

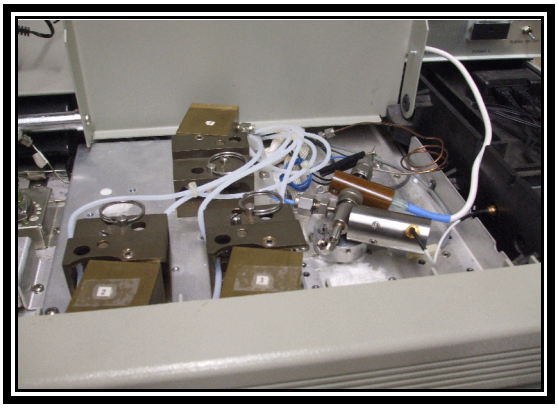
Introduction:

Landfill gas is generated as the materials contained within a landfill decay. Typically, landfill gas consists of many of the same constituents generated in the process of synthesis gas production such as methane, hydrogen, carbon monoxide and carbon dioxide. Since landfill gas is often highly flammable, it is useful to monitor the composition of the landfill gases being generated. Typically the fixed gases, such as those contained in landfill gas, are measured with a thermal conductivity detector (T.C.D.) sometimes in conjunction with a flame ionization detector (F.I.D.) However, the measurement of hydrogen and the other fixed gases with the same T.C.D. can be especially challenging due to the differences in thermal conductivity for hydrogen relative to the other fixed gases. In the past, the solution for this predicament would have been to build a G.C. system using a T.C.D. with nitrogen or argon carrier for measuring hydrogen, a second channel with a T.C.D. operating with helium carrier for measuring the other fixed gases such as CO and nitrogen/oxygen, and, sometimes, an FID for measuring the methane nor other hydrocarbons. This results in a complex (and expensive) G.C. system with multiple carrier gases, multiple valves, multiple columns, and multiple detectors.

A customer inquired about the possibility of using a Dielectric Barrier Discharge (D.B.D.) Helium Ionization Detector (H.I.D.) as an alternative to the use of dual TCD's to measure landfill gas constituents. Based on previous experience measuring pyrolysis gases using the D.B.D. H.I.D. it was suggested that this detector would be an ideal solution to this application. The customer had a used Hewlett Packard (HP) 5890 Series II GC equipped with dual packed port injectors, multiple valves and single flame ionization detector (FID) which we agreed to retro-fit.

Configuration:

We took the HP 5890 GC and pulled the FID detector. We then installed a standard AIC DBD HID using the heating cartridge for the FID detector. We modified the existing FID electrometer by removing the signal bar and replacing it with the standard HID cable. For reaction gas, we hooked up helium to the make-up gas port from the HP FID fuel gas block and ran the gas line to the HID detector. We then re-plumbed one of the valves to a standard 6-port gas sampling configuration with a 25 microliter gas sampling loop.
A short transfer line was installed from the gas sampling valve into the GC oven where we connected a 2 meter X 1/16" Restek ShinCarbon column which is connected to the detector via a second, short, 1/16" transfer line. The system is not run with Grade 5 helium and does not employ an getters. The column temperature program was set at 50^{0}C /4 min. /12 ^{0}C min $^{-1}$/220 ^{0}C / 5 min.



In order to simplify the system, we chose not to use a backflush valve for this application. This means that, when performing any kind of ambient gas sample analysis, the end user needs to be aware of the fact that water will eventually elute from this column (see the hydrogen in ground water application note.) In this particular application it is advisable to bake the column out at the end of each run to ensure that water does not elute on a subsequent run.

When we checked in with him recently, the customer remarked, "The HID is working well. I wish my other instruments worked as well."

Results:

The DBDHID is designed for simple and rugged detector for fixed gas and difficult to ionize species. It's unique design and powerful plasma yields a detector that can be installed onto current G.C. systems without major gas purification systems and without major modifications to the existing plumbing.

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