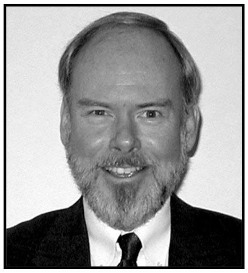
Analyzing for Trace CO and CO_2 using a Total Hydrocarbon Analyzer



by Hank Braly, Questar Baseline Industries, Lyons, Colorado

The purity of Specialty Gases is determined by the measurement of various contaminants including Total Hydrocarbons. Low level measurements of carbon monoxide (CO) and carbon dioxide (CO_2) can be included in the analysis by adding a reduction catalyst, known as a methanizer, to an existing technology.

The analyzer most commonly used for total hydrocarbon measurement is based on a flame ionization detector (FID). Hydrogen fuel and air are used to support the flame. There are several reasons for the FID's universal appeal in this application including:

- Low detection limits, in the sub parts per million (ppm) range.
- A broad linear range up to percent levels.
- Its response is specific to hydrocarbons.

A technology, not as commonly known, can extend the analytical capabilities of the FID to include CO and CO_2. When a sample of an inert gas is passed through a methanizer in a hydrogen-rich atmosphere, CO and CO_2 are converted to CH_4 (methane). Once the conversion takes place, the advantages of the FID's low levels of detection for hydrocarbons can be utilized for CO and CO_2 as well. The reaction takes place as follows;

$$CO + 3\,H_2 = CH_4 + H_2O$$
$$CO_2 + 4\,H_2 = CH_4 + 2\,H_2O$$

Since the actual amount of sample gas going to the detector is low, and hydrogen is already being used to support the FID, there are no additional support gas requirements. Typical sample gases include argon, helium, hydrogen and nitrogen. Sample gases should contain only trace amounts of oxygen. The presence of oxygen will react with hydrogen in the methanizer and create an excessive amount of water.

Applications that require a combined reading of hydrocarbons, CO and CO_2 to be below a certain level can leave the methanizer in line with the FID until the level has been exceeded. At that point, the methanizer can be manually switched off line to determine what portion of the reading can be attributed to hydrocarbons.

Having a microprocessor-based analyzer may necessitate several analysis steps beyond that of a manual configuration. The microprocessor can automatically calibrate the instrument and automatically switch the methanizer in and out. This permits the analyzer to directly read total carbon (TC) as well as total hydrocarbons (THC). The analyzer can then mathematically determine the CO, CO_2 concentration.

$$TC = THC + (CO + CO_2)$$

Using a methanizer with a FID has definite advantages. One benefit is that the initial cost and ongoing expenses are reduced since there are fewer pieces of equipment involved with the analysis. Alternately, in applications where multiple analyzers are in place or necessary, a methanizer with a FID can be used to confirm results or serve as backup to existing equipment. SGR

Hank Braly is based in Connecticut. He is Sales Manager for Questar Baseline Industries, Inc,. located in Lyons, Colorado. He has been with the company since 1984. Questar Baseline manufactures Hydrocarbon Analyzers and Gas Chromatographs for industrial and environmental applications. Prior to Baseline, Braly managed a certified environmental laboratory in Waldoboro, Maine, and was employed as a chemist for Envirite, formerly Liqwacon, an industrial environmental chemical company in Thomaston, Connecticut.
hbraly@baselineindustries.com