Prism FTIR Gas Analyzer Applications

MLS Post 1, December 9, 2011

Fundamentals – Beer's Law

To get this group started, I thought we could start with some fundamentals as a refresher for us all and to further educate the new users before we get to the more esoteric stuff. For the FTIR experts and there are many in this group we will get to the deep stuff soon enough.

FTIR is now widely utilized to perform qualitative and quantitative gas analysis routinely. Yet, we including myself worry whether the quantitative results are correct from our automated or manual analysis.

Beer's Law is certainly at the heart of any spectroscopic quantitative analysis including FTIR.

A = a b c

A is the measured absorbance at a specific wavelength or frequency

a is the absorptivity coefficient at a specific wavelength (frequency), temperature, and pressure (sometimes called the analyzer calibration)

b is the path length of the gas cell

c is the gas concentration present in the gas cell

If **a** and **b** are constants then the measured absorbance **A** should allow us to easily calculate the gas concentration by rearranging the equation.

c = A / (a b)

If our analyses were that easy, we should get the correct concentration every time. So, why don't we get the correct answer every time? I list some reasons below that we will go into more depth on future posts.

1. Gas Temperature & Pressure
2. Instrument Spectral Resolution & Spectral Frequency Precision
3. Detector Non-linearity & Beer's Law Non-linearity
4. Sampling Issues (many)
5. Matrix Interferences – spectral and chemical
6. Poor zeroing or background
7. Poorly designed automated methods or recipes
8. Varying isotopes
9. Varying bulk gas density or average molecular (atomic) weight
10. Numerous other more subtle spectral and electronic issues

We will cover these issues and how they relate to all the industries and groups that have joined this group.

Thanks for reading!!!