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Service Note

11-003A
22 March, 2011

COMPARING THE 330NM AND THE 360NM FILTERS IN SO2/H2S/TRS ANALYZERS

I. PURPOSE:

This is a general informative note on the differences between using the 330nm filter and the 360nm filter in the SO_2/H_2S/TRS analyzers.

The SO_2 analyzer uses 214nm light to fluoresce SO_2 gas producing 330nm light. A 330nm filter then filters out most of the other wavelengths of light before allowing it to be detected by the photomultiplier tube (PMT), see the operator's manual for a more detailed description. The main interferant in an SO_2 analyzer is NO gas. With a standard 330nm filter we see about a 50:1 rejection ratio for NO fluorescing and being read as SO_2 by the analyzer. This is due to the fact that at 214nm of UV light, NO will have a small amount of fluorescence. This can be seen in Figure 1 below. Sampling gas that contains high levels of NO will greatly affect the SO_2 reading of the analyzer.

Installing a 360nm filter in place of the 330nm filter will greatly reduce the effects that NO has on the analyzer. It increases the rejection ratio of NO gas in the analyzer by a factor of 5 to approximately 250:1. Figure 2 shows us the fluorescence spectra of SO_2 and NO gas. I have notated the two filters that we use in the analyzer, 330nm and 360nm, on this chart. You can see that changing from the 330nm filter to the 360nm filter causes less of the NO produced light to reach the PMT. Unfortunately the draw back to this is it also causes less of the SO_2 light to reach the PMT as well. This loss of light striking the PMT is calibrated out when performing a hardware calibration on the analyzer. It typically causes the analyzer's LDL to double.

Below are the specifications for the two types of filters used in the SO_2 analyzers.

360nm Filter
PEAK TRANSMISSION. .360nm (90%)
50% TRANSMISSION . .@ 323nm TO 380nm
10% TRANSMISSION . .@ 312nm TO 390nm
0% TRANSMISSION . .< 300nm & 400nm - 700nm

330nm Filter
PEAK TRANSMISSION. .330nm (>85%)
50% TRANSMISSION . .@ 250nm TO 390nm
10% TRANSMISSION . .@ 245nm TO 405nm
0% TRANSMISSION . .< 220nm & 450nm - 660nm

If you take a look at the above numbers you can see that the 330nm filter can attenuate the UV light that we are looking for by up to 15%. Then you look at the 360nm filter and its attenuation of the 330nm light wavelength is about approximately 45%. The key to changing from the 330nm to the 360nm is to move the peak transmission of the filter away from the peak fluorescence of NO gas at about 275nm, see figure 2.

Figure 7 is included in this document as it shows how lack of O_2 in the sample stream can greatly increase the amount of NO interference. O_2 acts as a quencher for NO florescence, preventing the light from striking the PMT. With 0% oxygen in the sample stream you get almost a 1:1 interferant ratio for NO being read as SO_2 gas by the analyzer. Any O_2 concentration above about 4% should be adequate for quenching the NO florescence.

The following three figures are referenced from the below source. The red markings are for the wavelengths utilized in the API sulfur analyzers.

Determination of Sulphur Dioxide by Pulsed UV-Fluorescence

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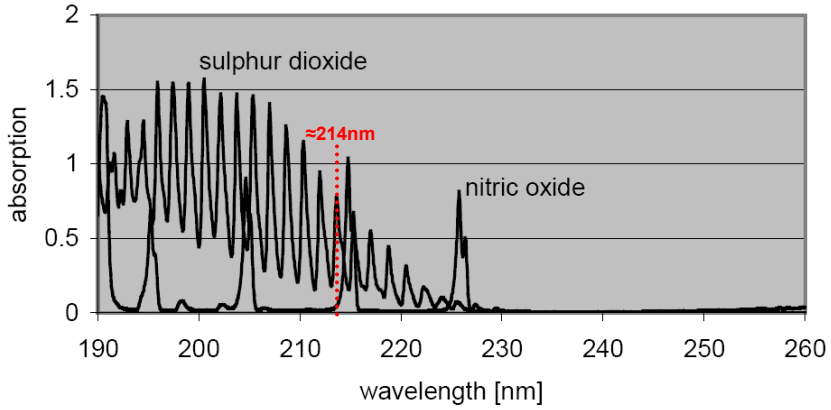

Figure 1: Absorption spectra of SO_2 (5% in N_2) and NO (30% in N_2) (spectral bandwidth 0.2 nm)

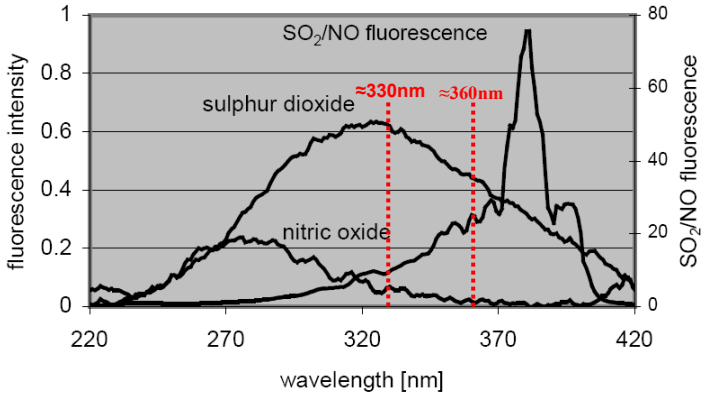

Figure 2: Fluorescence spectra of SO_2 (1.1% in N_2) and NO (0.9% in N_2) (excitation and emission slits 10 nm) (excitation wavelength 215 nm) and the ratio of SO_2 to NO fluorescence

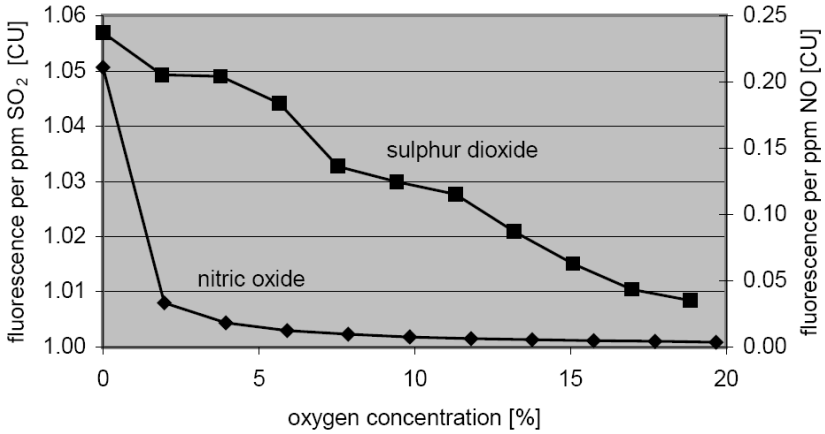

Figure 7: Quenching of sulphur dioxide and the nitric oxide fluorescence at different oxygen concentrations (CU: calibration units; i. e. relative to a SO_2 standard with an oxygen content of 21 %)