Entech Applet 3742-01E
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Performance Comparison - Volatiles Analysis of Samples with Elevated CO2 & Methane Levels. 7200 Packed-Trap Preconcentrator vs 7200CTS Capillary Column Trap Preconcentrator

250cc 10ppb TO15 with 50% CO2

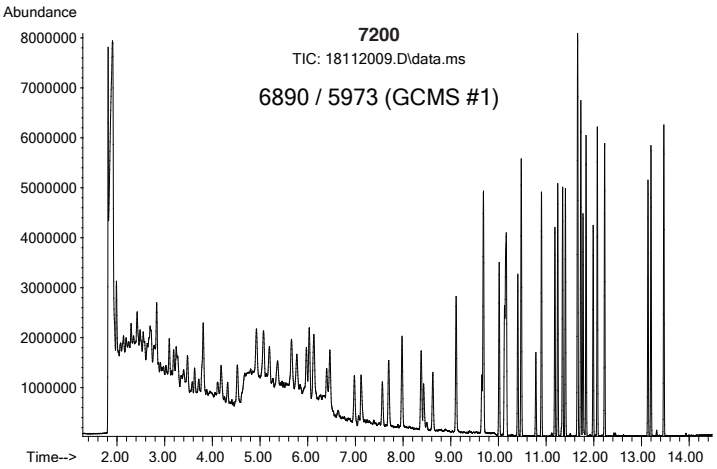

Figure 1

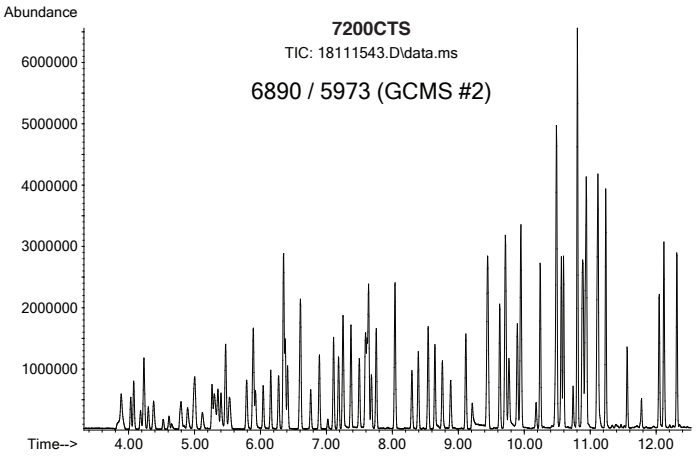

Figure 2

Summary

High CO2 and Methane samples have been problematic on TO15 preconcentration systems due to both the error in volume determination using mass flow controllers that were calibrated for air, and for the upset to the baseline that results due to the incomplete elimination of the sample matrix before injection. This is due mostly to the inability of the relatively large adsorbent particles used in packed traps (35/60, 60/80, 80/100 mesh) to completely release the Methane and CO2 prior to desorption into the MS. During Cryogenic Focusing, any residual Methane will mostly be eliminated, but the remaining CO2 will also be retained in the focusing trap, creating a huge background in GCMS chromatogram. Even systems that use a secondary micro trap based on "packed trap" technology will suffer for excess CO2 release into the GCMS.

Figure 1 shows a 10 PPB TO15 standard that was created using 50% Nitrogen and 50% CO2 as the balance gas. The classical TO15 preconcentrators with packed traps definitely show a tremendous amount of background which is obviously creating suppression in the mass spectrometer. However, **Figure 2** shows this same standard as preconcentrated on a 7200CTS Preconcentrator that uses a Multi-Capillary Column Trapping System (MCCTS) to preconcentrate and focus the TO15 standard without the use of Liquid Nitrogen. As can be seen, the CO2 background has been completely eliminated prior to injection. The ability to do this stems from the use of adsorbent particles on the walls of the capillary traps that are much smaller than those used in packed columns. Just a difference in diameter of 10x between the particles in a packed trap compared to those on the walls of the capillary trap results in internal volume differences of 1000x, considering the equation $4/3\pi R^3$. Particles with internal volumes that are thousands of times smaller will outgas fixed gases and water far faster and more

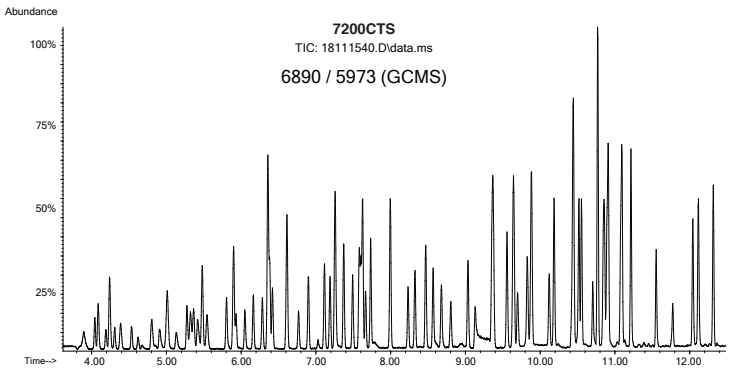

Figure 3

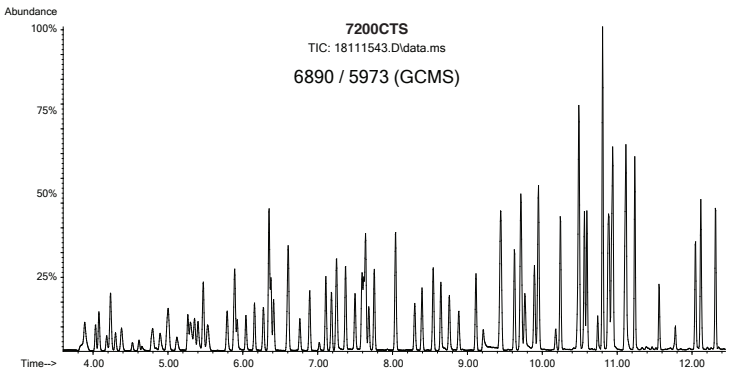

Figure 4

completely than the larger packed trap particles, allowing a much higher performance when analyzing soil gas, landfill gas, or stack gas with elevated CO2 and Methane levels. For the LN2 based system, the back end appears to be higher than with the capillary trapping system, but this is an illusion, as the mass spectrometer was still in the process of recovering from the high amounts of CO2 that were injected, and the sensitivity kept increasing through the run, making the back end look very large. This creates a huge problem with quantitation, as the use of only 3 or 4 Internal Standards is only valid if the sensitivity of the MS is staying relatively constant throughout the run. If the sensitivity is increasing dramatically because of a large suppression created by injecting large amount of CO2 at the start of the run, then quantitation will be very poor throughout the entire run, except perhaps for those compounds eluting very close to the Internal Standard that is used to perform quantitation.

Figure 3 shows a TO15 Chromatogram created using a 100% N2 balance gas, while **Figure 4** shows the Chromatogram of the same mixture, but instead using 50% N2 and 50% CO2 as the balance gases. There is very little difference between the two chromatograms. Any difference should be tracked and accounted for by the co-injected internal standards. The performance enhancement of the 7200CTS can be a lifesaver when routinely analyzing samples with elevated CO2 and Methane concentrations.

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