

APPLICATION NOTE

LD23-02

PST
PROCESS SENSING
TECHNOLOGIES



Analysis of trace impurities in UHP Carbon Dioxide



▲ PlasmaDetek2
patent US 9,310,308 B2

▲ MultiDetek3

Carbon dioxide is commonly used as a raw material for production of various chemicals; as a working material in fire extinguishing systems; for carbonation of soft drinks; for freezing of food products such as poultry, meats, vegetables, and fruit; for chilling of meats prior to grinding; for refrigeration and maintenance of ideal atmospheric conditions during transportation of food products to market; for enhancement of oil recovery from oil wells; and for treatment of alkaline water.

The most common operations from which commercially produced carbon dioxide is recovered are industrial plants:

- Chemical plants (for ammonia and ethanol)
- Refineries
- Hydrogen production
- Fossil fuel power plants
- Industries such as iron and steel, cement, pulp and paper, etc.

Instead of being vented in environment during the production process, the CO₂ can be captured, purified and liquified and then be re-used to a huge diversity of applications from horticulture and welding to cryogenic cleaning and carbonated drinks. Carbon recycling not only contributes to climate and environmental protection, but it also has the added bonus of low supply costs and immediate availability of the gas. Alternatively, the CO₂ can be sequestered (in other words, stored underground) to mitigate the climate impact of industrial processes that rely on the combustion of fossil fuels.

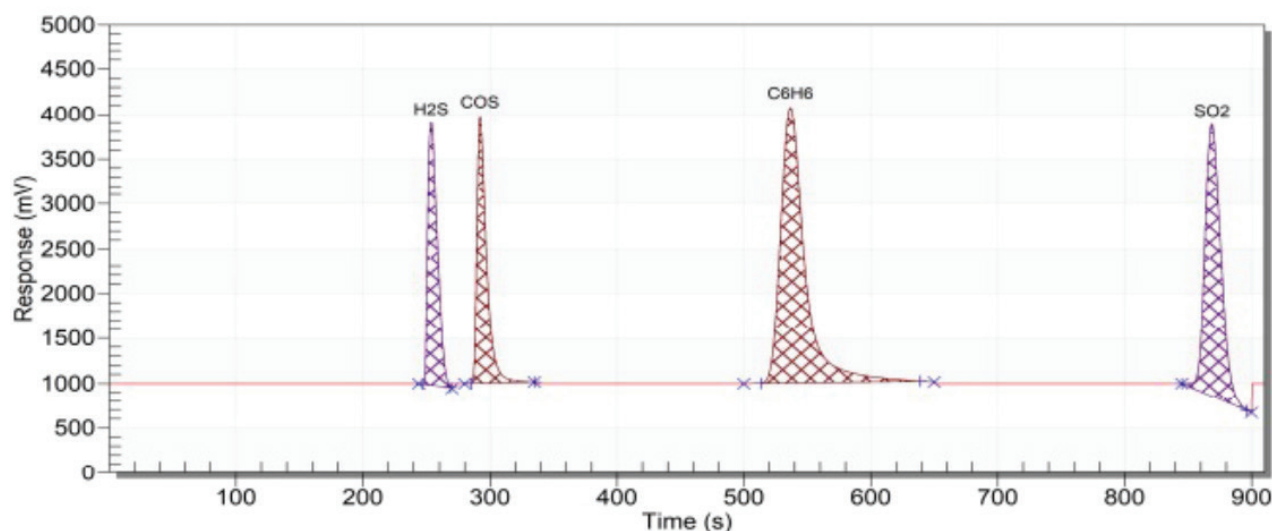
LDETEK SOLUTION

The purity CO₂ solution proposed here with the MultiDetek3 gas chromatograph is for the analysis of trace impurities H₂S-COS-C₆H₆-SO₂-CO-CH₄-C₂+. The PED with Helium carrier gas has been configured for the ppb/ppm trace analysis of sulfurs, benzene, and carbon monoxide. An additional channel configured with an FID is used for the analysis of THC/VOCs

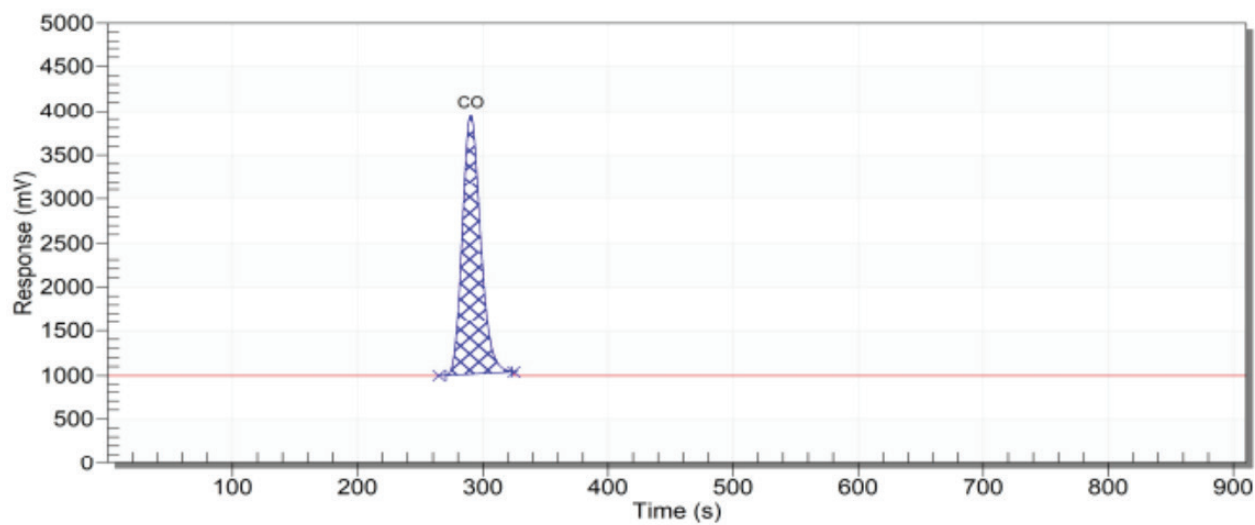
The MultiDetek3 CO₂ purity analysis system here has been configured with a range of 0-10ppm with IdI at 5-10ppb for sulfurs, benzene, and carbon monoxide with the PED. The FID channel used for THC/VOCs has been configured for 0-100ppm with IdI 25ppb. Other configurations are possible on request.

RESULTS

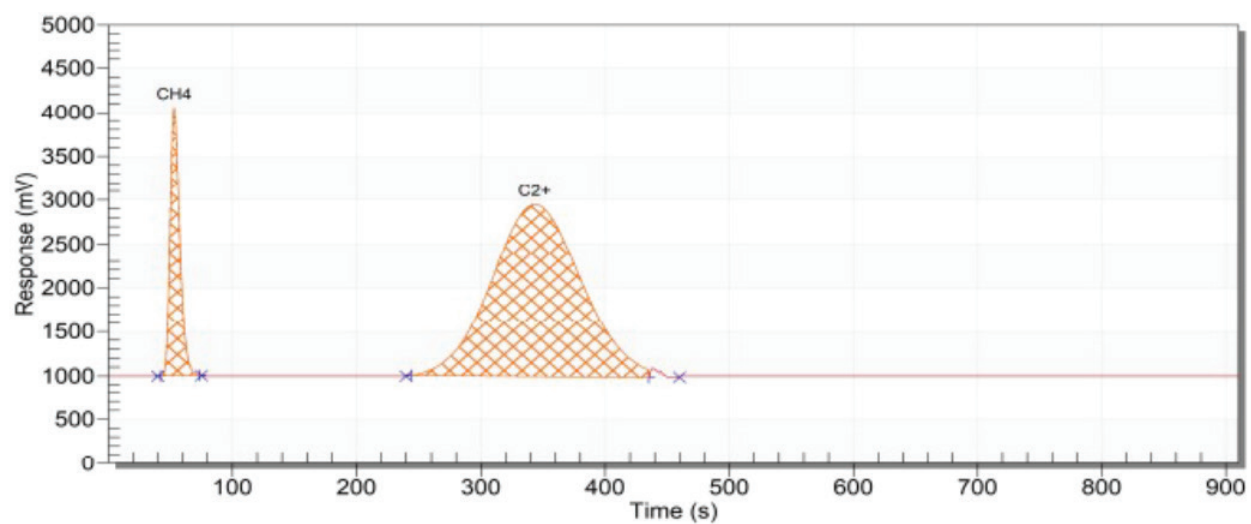
Chromatograms (Span calibration) of trace impurities H₂S-COS-C₆H₆-SO₂-CO-CH₄-THC in balance gas CO₂



Peak	Unit	Calibration Value	_Area Counts
H ₂ S	ppm	10.000	25601
COS	ppm	8.280	25748
C ₆ H ₆	ppm	10.000	67624
SO ₂	ppm	10.200	44059



Peak	Unit	Calibration Value	_Area Counts
CO	ppm	107.000	49123

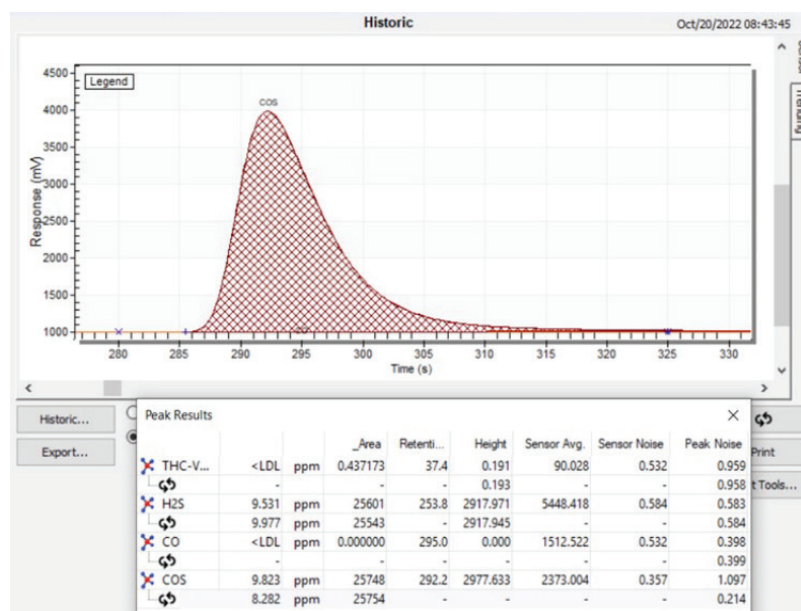
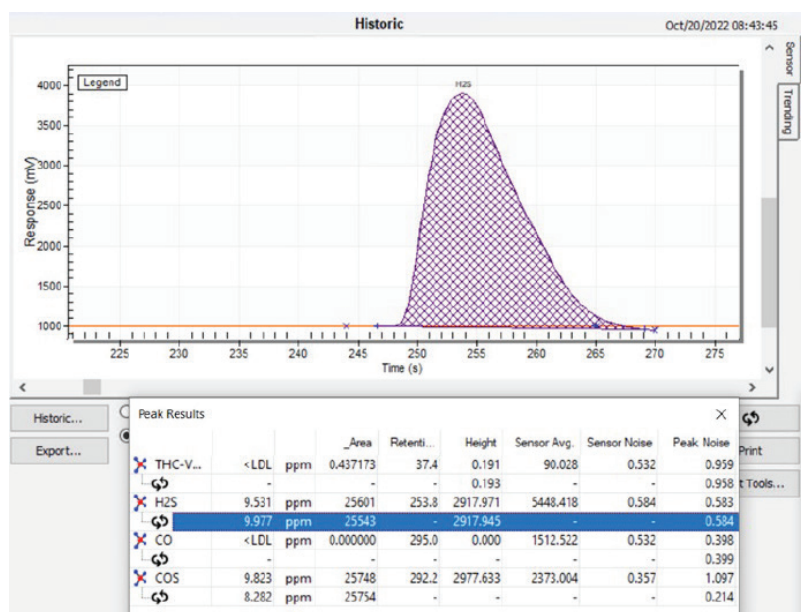


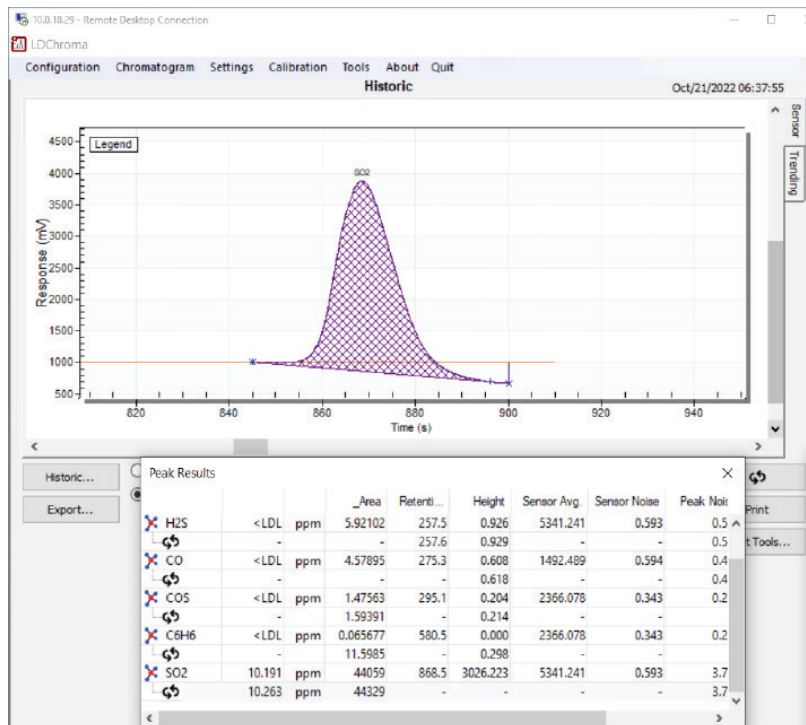
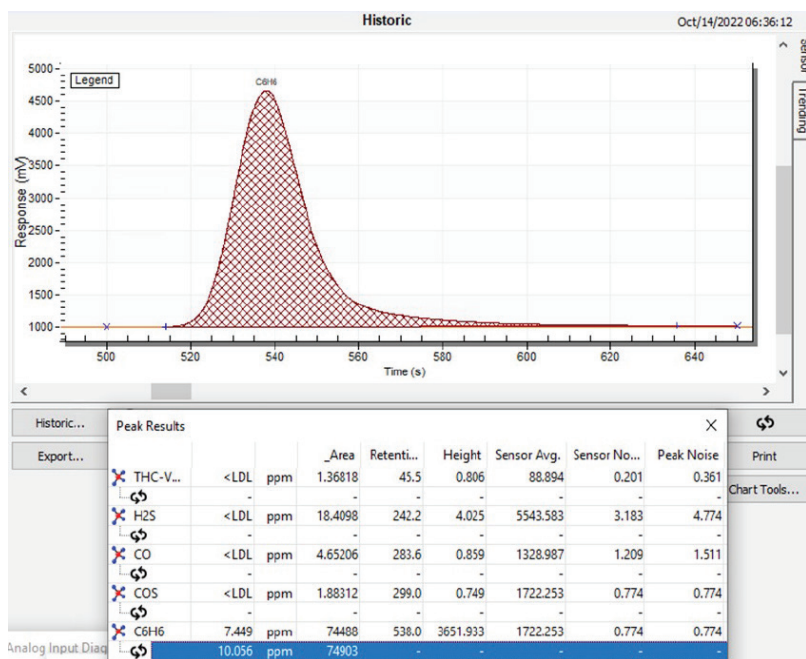
Peak	Unit	Calibration Value	_Area Counts
CH4	ppm	98.800	27413
C2+	ppm	100.000	159413

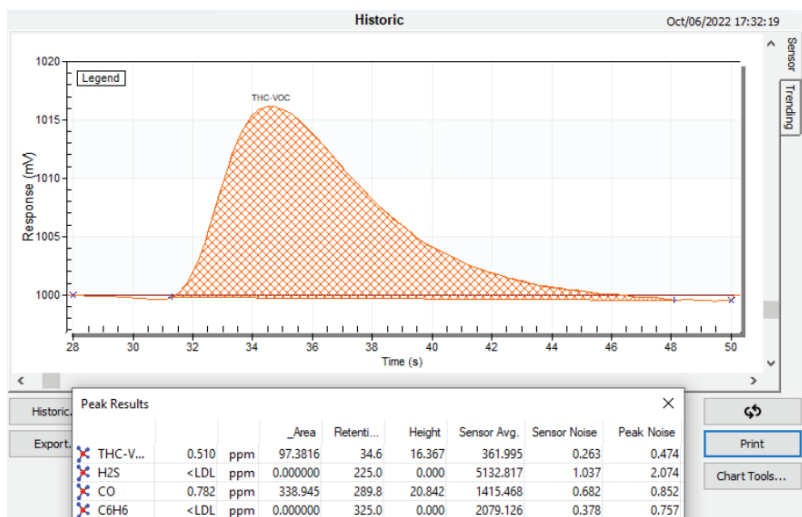
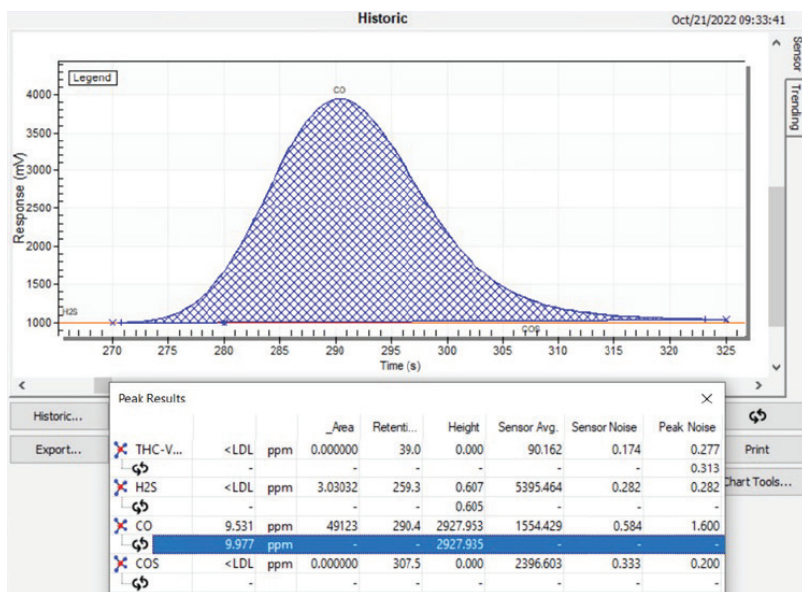
Limit of detection (based on 3 times the noise level from a blank)

COMPONENTS	CONCENTRATION (ppb)	PEAK HEIGHT	NOISE	LDL (3X NOISE)
H2S	9531	2918mV	0.58mV	6ppb
COS	9823	2978mV	0.36mV	4ppb
C6H6	7449	3652mV	0.77mV	5ppb
SO2	10191	3026mV	0.59mV	6ppb
CO	9531	2928mV	0.58mV	6ppb
CH4	98	20mV	0.42mV	6ppb
C2+ (THC/VOC)	510	16mV	0.26mV	25ppb

Note: other LDL could be obtained with different injection volume and chromatographic condition.







Repeatability: Based on the GC standards. Using 6 of 10 consecutive runs, being lower than 5% of $3 \times CV\%$

Linearity: Based on the GC standards. A linear curve having its R^2 at a value between 0.998 and 1.00.

Accuracy: Based on the GC standards. $\leq 1\%$ of error or IdI whichever is higher

CONCLUSION

The MultiDetek3 configured with PED and FID modules can offers a good analytical solution for trace ppb/ppm impurities for quality and validation of purity CO₂ required by the industry. The gas chromatograph is configured with standard industrial communication protocols and remote-control interface. The platform is modular to adapt any of additional requirement in terms of purity CO₂ production. The MultiDetek3 is a very robust gas analyzer configured for industrial market to run 24/7.