

APPLICATION NOTE

LD23-06

PST
PROCESS SENSING
TECHNOLOGIES


LDetek
A PST BRAND

Analysis of trace impurities in ethylene and propylene for polyolefins production plants



Polyolefins are the world's mostly produced and fastest growing polymer family because modern polyolefins cost less to produce and process than other plastics or conventional materials. The polyolefins are available in many varieties. They range from rigid materials such as might be used for car parts to soft materials such as flexible fibres. Some are as clear as glass; others are completely opaque. Some, such as microwave food containers, have high heat resistance while others melt easily

The polyolefin family includes polyethylene (PE) and polypropylene (PP).

Different analyzers are used in polyolefin plants ranging from simple sensor type monitors to gas chromatographs. The list typically includes · gas chromatographs · Continuous gas analyzers (paramagnetic oxygen analyzers, NDIR analyzers, total hydrocarbon content analyzers) · Analyzers for moisture and O₂ traces and others.

The ethylene or propylene gases are required in the gas-phase polymerization, where it is contacted with a solid catalyst material intimately dispersed in an agitated bed of dry polymer powder that is used to finally produced solid olefins.

LDETEK SOLUTION

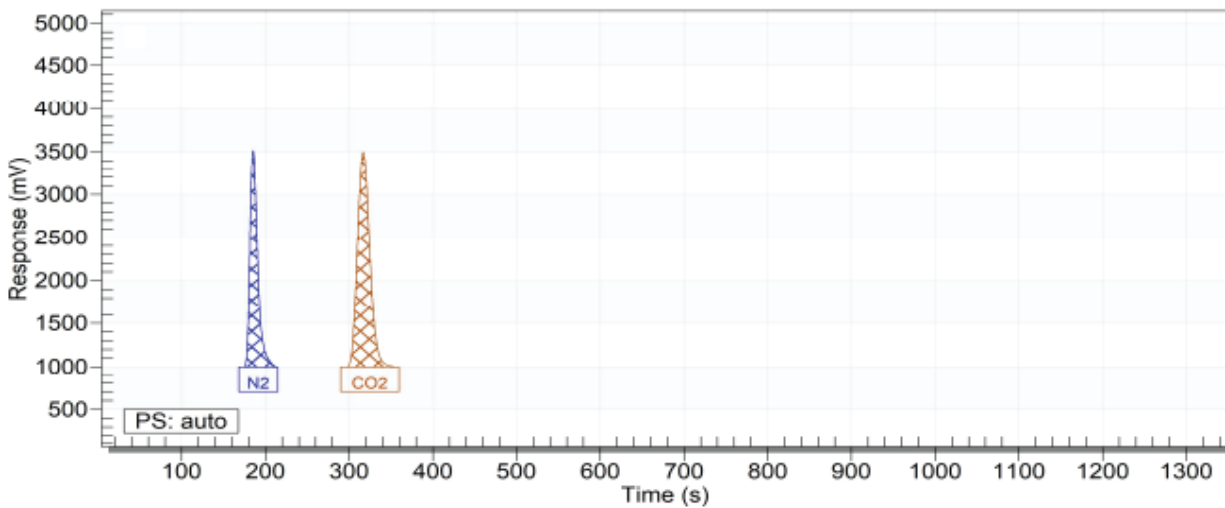
Our solution shows here the results obtain to control/monitor the gas production quality of ethylene and propylene used as first step in polyolefins production.

The MultiDetek3 gas chromatograph has been configured with the PED (plasma emission detector) to offer the trace analysis of impurities such as H₂-O₂-N₂-CH₄-CO-CO₂-PH₃-AsH₃ in pure ethylene and propylene.

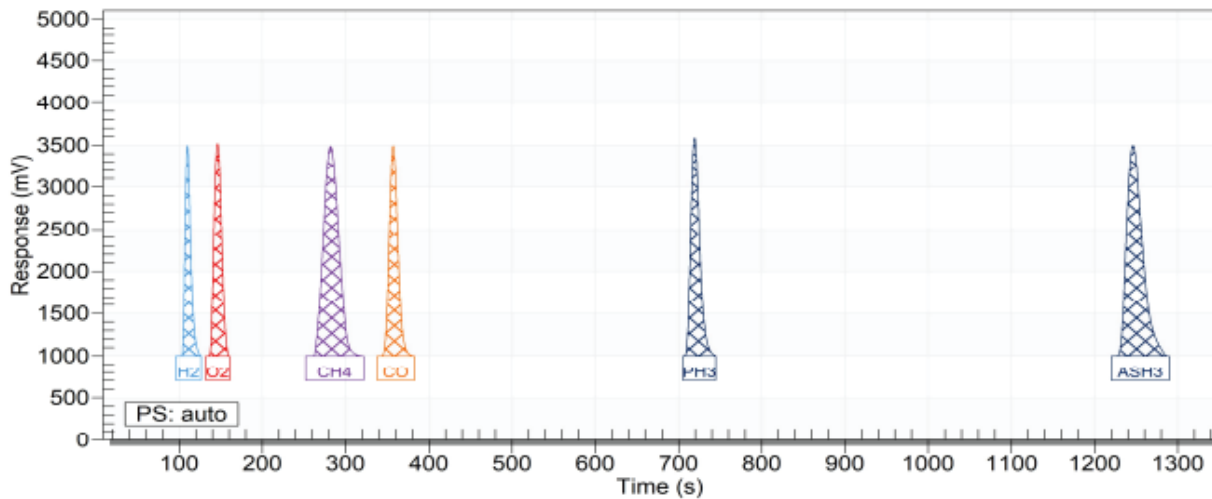
A measuring range of 0-5ppm with ldl set at 5ppb is obtained for each impurity.

RESULTS

Chromatograms (Span calibration) of trace impurities H₂-O₂-N₂-CH₄-CO-CO₂-PH₃-AsH₃ in balance gas Ethylene (C₂H₄). The same results apply to propylene (C₃H₆)



Peak	Unit	Calibration Value	_Area Counts
N2	ppm	5.00	13443
CO2	ppm	5.00	4306



Peak	Unit	Calibration Value	_Area Counts
H2	ppm	5.00	3706
O2	ppm	5.00	20734
CH4	ppm	5.00	9770
CO	ppm	5.00	4075
PH3	ppm	5.00	8090
ASH3	ppm	5.00	7617

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

Linearity: Based on the GC standards. A linear curve having its R2 at a value between 0.998 and 1.00.

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

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

COMPONENTS	CONCENTRATION (ppm)	PEAK HEIGHT	NOISE	LDL (3X NOISE)
H2	5.0	2500mV	0.7mV	4.2ppb
O2	5.0	2500mV	0.8mV	4.8ppb
N2	5.0	2500mV	0.6mV	3.6ppb
CH4	5.0	2500mV	0.8mV	4.2ppb
CO	5.0	2500mV	0.8mV	4.8ppb
CO2	5.0	2500mV	0.8mV	4.8ppb
PH3	5.0	2500mV	0.8mV	4.8ppb
AsH3	5.0	2500mV	0.8mV	4.8ppb

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

CONCLUSION

The MultiDetek3 configured with PED offers a compact and robust solution required by the petrochemical industry for the quality control required in the production of ethylene and propylene used in the polyolefins production process. Depending on the zone requirement, our analytical instrument can be configured as a standard rackmount gas chromatograph or in our process gas chromatograph configuration.

