

APPLICATION NOTE

LD15-03

Measurement of part per billion N₂O in air



▲ MultiDetek-2

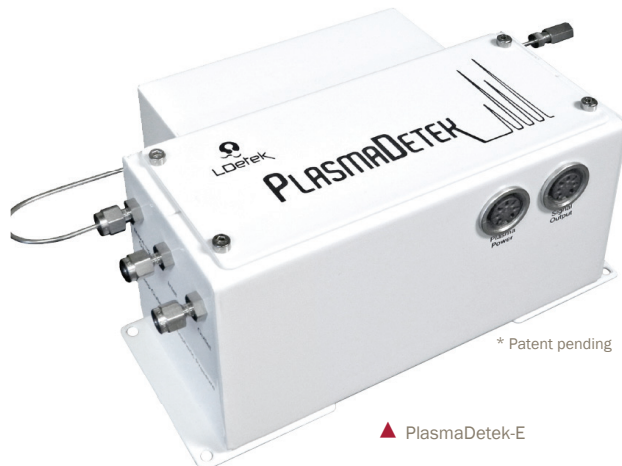
With the global warming concerns, it is more and more critical to measure the nitrous oxide (N₂O) concentration in the ambient air. This application note will demonstrate how efficient the use of the PlasmaDetek-E is for the measurement of extremely low concentration of N₂O in ambient air without interference.

LDETEK SOLUTION:

It is well known that the measurement of N₂O can be achieved with different kinds of detectors using specific chromatography techniques. The ECD, HID and conventional PED are the mostly used type of detectors for this greenhouse application. The radioactive source coming from the ECD makes this detector less attractive due to the latest worldwide regulations about radioactivity, even for low source of radioactivity. The HID and conventional PED are relatively good detectors for such analysis, but create more chromatography challenges caused by lack of selectivity and sensitivity. With the LDetek PlasmaDetek-E, the enhanced sensitivity and selectivity make it extremely low concentration N₂O in ambient mostly coming from the high concentration carbon dioxide and moisture

The improved operation's mode and the optical design of the PlasmaDetek-E combined with the right chromatography configuration in the MultiDetek-2 compact GC remove the interference usually coming from the carbon dioxide and moisture.

The MultiDetek-2 system is configured with one injection diaphragm valve V1, which is used for injecting the sampling volume into the chromatography system. A first packed Shincarbon column is combined with a heartcut diaphragm valve V2 and a second packed Shincarbon column to catch the desired N₂O peak and flush to vent the undesired interference gases. The N₂O peak is then going to the PlasmaDetek-E where proper analysis is performed.



* Patent pending

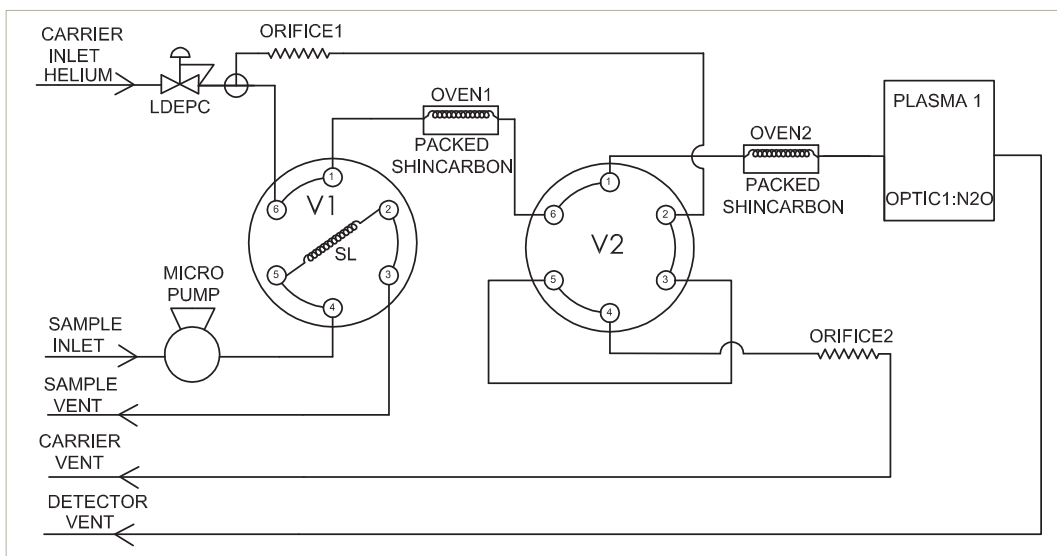
▲ PlasmaDetek-E

This combination makes it ideal to measure extremely low concentration N_2O in air without having the N_2O peak integrated in the high concentration CO_2 tailing. This technique has been tested up to 5000ppm CO_2 for measuring as low as 1ppb N_2O as demonstrated in the chromatograms.

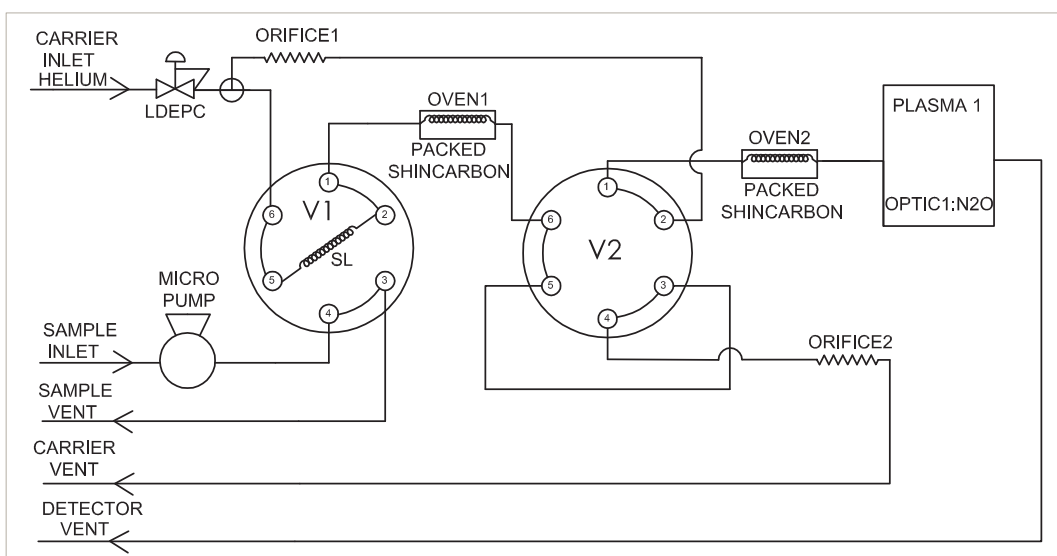
The MultiDetek-2 can be configured with different sampling mode to get the sample gas ready for analysis. The drawing of this application note shows the use of a micro pump that is mounted just before the sampling loop. The pump is fully controlled from the software interface and can be switched On/Off adequately for a specific period of time to allow proper sample gas quantity going to the sampling loop mounted on the diaphragm valve V1. This way, the loop is filled just before running an analysis. This technique allows to minimize the sample gas volume required for analysis since in many cases, the sample gas comes from bags, balloons, canisters or others. It is then critical to minimize the sample gas volume for every analysis.

An optional sample line purge system can also be added to the sampling mode of the MultiDetek-2. This system uses the carrier gas to purge the sample line prior to pump the sample gas from its source. This way, the sample flow path and sampling loop are totally purged with N_2O free gas since the carrier gas used as purge gas comes from the heated LDetek, model LDP1000 getter that removes N_2O down to 0.01ppb level.

The MultiDetek-2 can also have an injector system with septum for syringe injection mode. The system is directly mounted on the injection diaphragm valve V1.



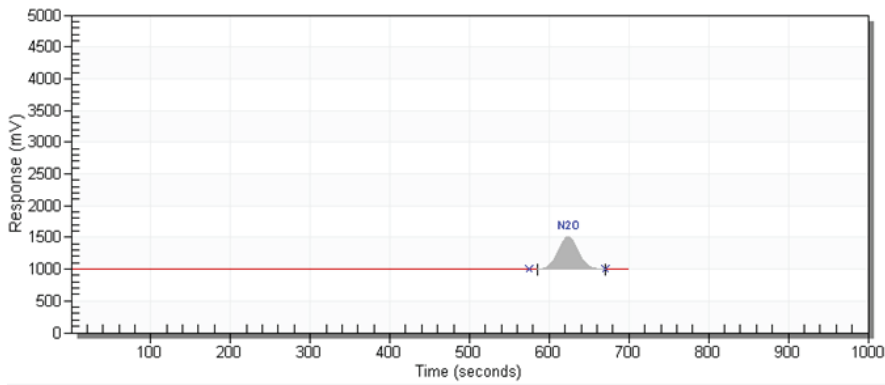
MultiDetek-2 configuration diagram #1 » V1 position OFF: Filling sampling loop
V2 position OFF: Catches N_2 peak from the first packed Shincarbon in oven #1 to the second packed Shincarbon in oven #2



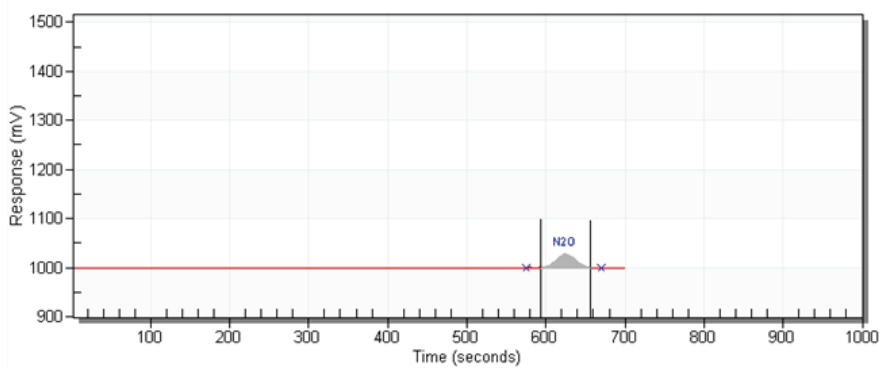
MultiDetek-2 configuration diagram #2 » V1 position ON: Injecting sampling loop
V2 position ON: Flushes to vent the interference gases (air, carbon dioxide, moisture and others) coming out from the first packed Shincarbon in oven #1

RESULTS:

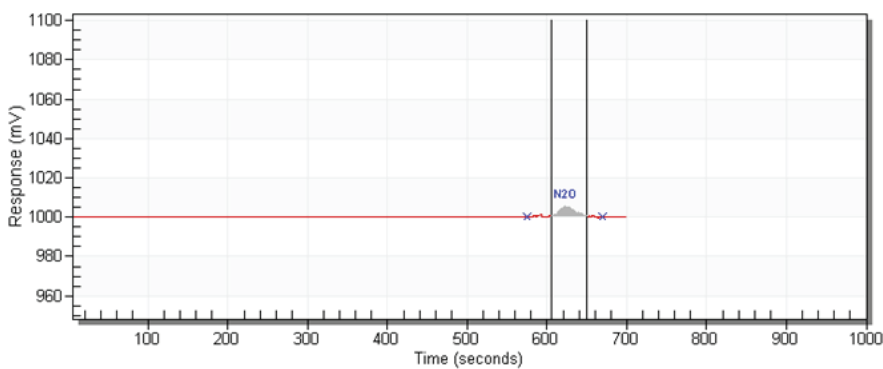
Low ppb Chromatogram examples



Chromatogram of 140ppb N₂O in air



Chromatogram of 7ppb N₂O in air



Chromatogram of 1ppb N₂O in air

LDL calculation

COMPONENT	CONCENTRATION	PEAK HEIGHT	NOISE	LDL (3X NOISE)
N ₂ O	1ppb	6 mV	0.2 mV	0.1ppb

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

CONCLUSION:

With its user-friendly interface and the simple configuration of this compact GC, the MultiDetek-2 is a perfect fit for this greenhouse application. The enhanced sensitivity and selectivity of the PlasmaDetek-E allow extreme low limits of detection. This new measurement technique combined with the integrated purged low volume sampling gas system brings this technology over the existing conventional measurement methods and systems.



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