

APPLICATION NOTE

LD12-4

Analysis of nitrogen in hydrogen and oxygen bulk with the PlasmaDetek

Measuring nitrogen as impurity in low concentration is not an easy task. It is mostly the case in hydrogen and oxygen background. Even if the chromatography system is quite efficient, the remaining bulk gas could influence the reading of nitrogen.

The PlasmaDetek, configured to be selective on nitrogen, brings very good result for this measurement. This document will demonstrate how this technology can help to make better analysis on nitrogen with any gas chromatograph system.

> PLASMADETEK CONFIGURATION

The PlasmaDetek has the advantage that it can be configured to be more sensitive on some compounds than the others. This selectivity configuration helps the chromatography to be more effective and easier to setup.

By using proper optical system, the detector becomes selective on nitrogen. No need of doping gas or other devices to make it selective. There is no other such detector on the market that will give this nitrogen selectivity.

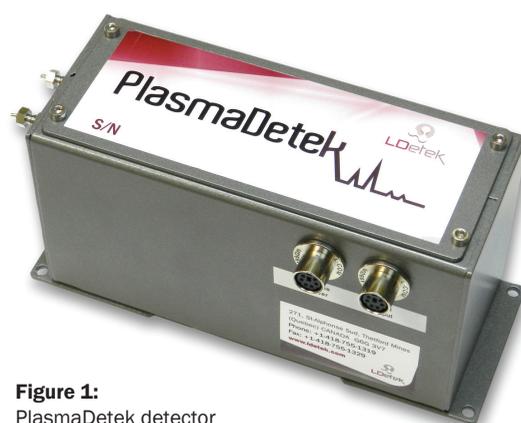


Figure 1:
PlasmaDetek detector

> CHROMATOGRAPHY CONFIGURATION

A simple backflush configuration is used to make the measurement of N_2 in H_2 or O_2 . Column 1 will initiate a separation of H_2 or O_2 from N_2 and bulk gas will be vented out as much as possible. Before N_2 goes out, the flow is directed to column 2. Both carrier gases can be used: argon or helium.

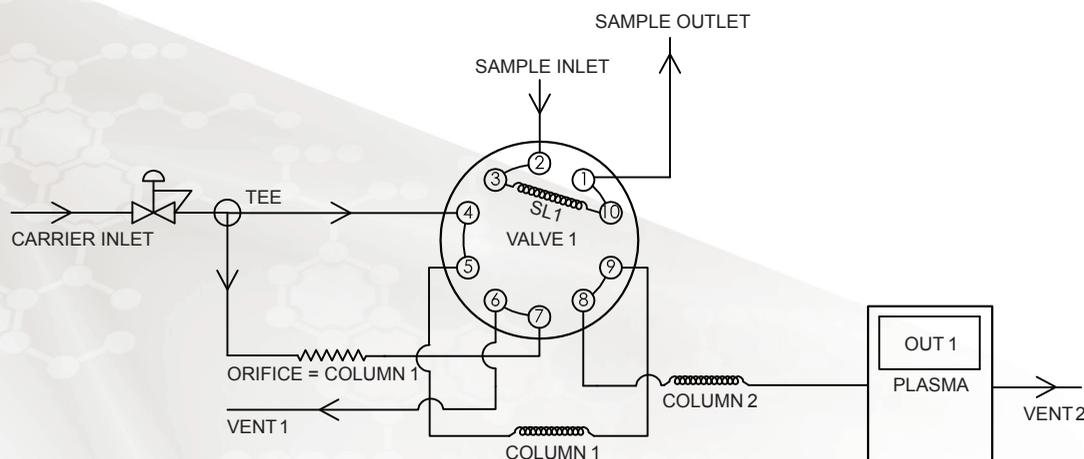


Figure 2:
Backflush configuration
with two columns

> RESULTS AND PERFORMANCE

Using a 5 ppm standard nitrogen in bulk hydrogen as sample, two chromatograms were generated with the chromatography configuration described above with a helium carrier. **Figure 3** is using a non-selective detector and **figure 4** the PlasmaDetek N₂ selective configuration. As it is clearly shown, the selectivity from the PlasmaDetek is improving the chromatogram. Almost no hydrogen is seen by the detector.

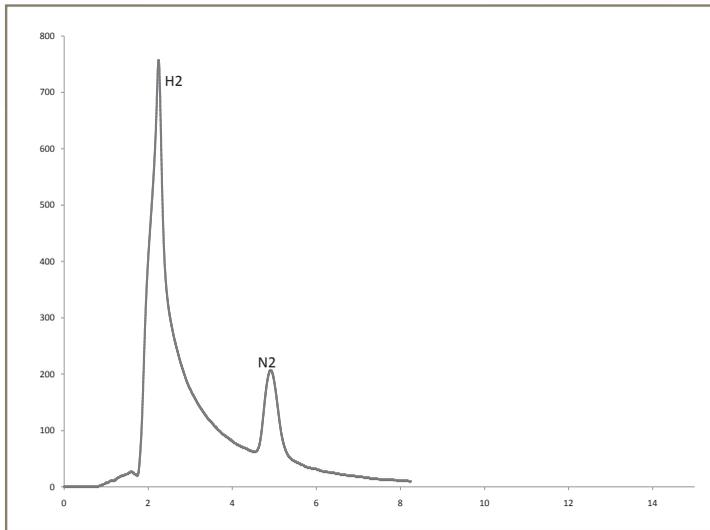


Figure 3: 5 ppm N₂ in H₂ with non-selective detector system

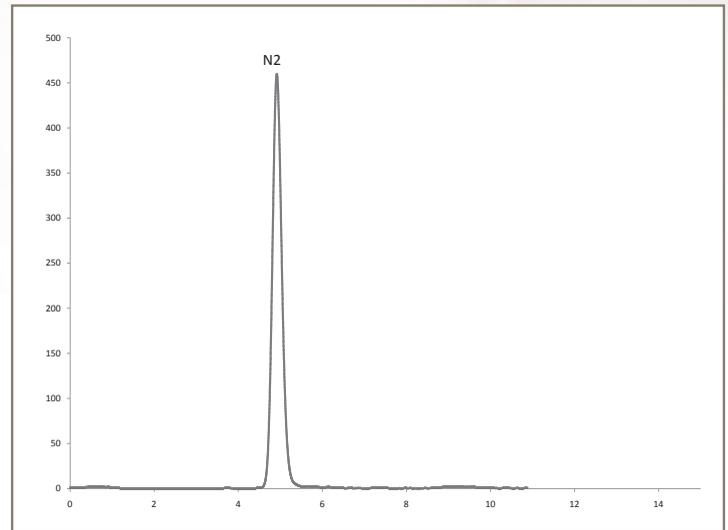


Figure 4: 5 ppm N₂ in H₂ with PlasmaDetek selective system

Same procedure was done with a standard of 420 ppb nitrogen in oxygen in similar backflush configuration with helium carrier. **Figure 5** and **figure 6** show the comparison with a non-selective detector and the PlasmaDetek N₂ selective configuration. It is also obvious in this case that selectivity helps to have better results and less drifting problem for the peak from remaining bulk.

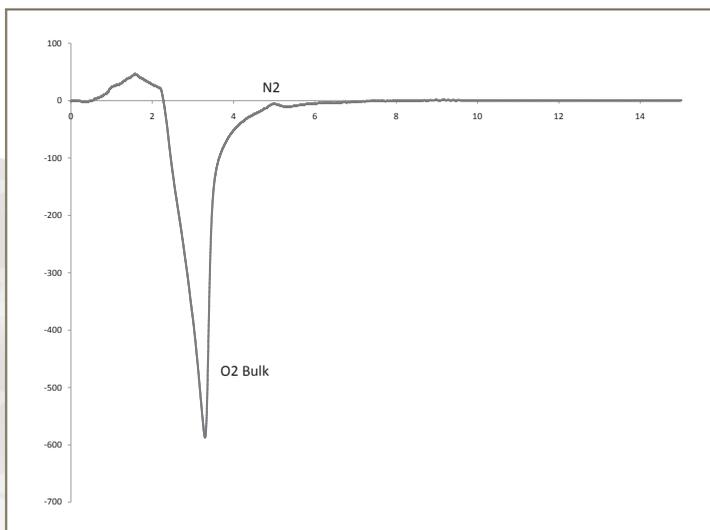


Figure 5: 420 ppb N₂ in O₂ with non-selective detector system

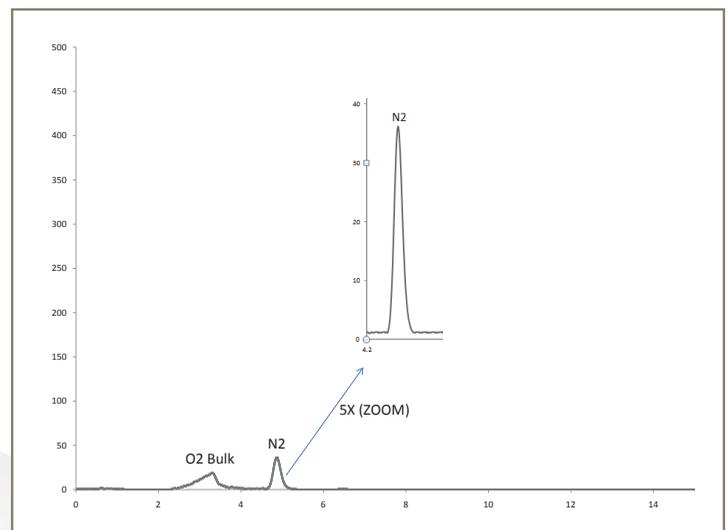


Figure 6: 420 ppb N₂ in O₂ with PlasmaDetek N₂ selective system

Having 79% of nitrogen in air, It is important to ensure that the chromatographic system is leak free. Low concentration nitrogen requires good hardware components to avoid any inboard and outboard leakages. It is even more the case, when measuring in pure H₂ or O₂.



Figure 7: High performance diaphragm valve

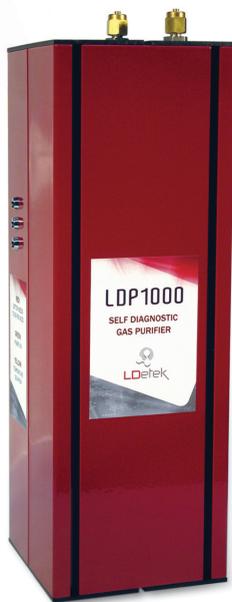


Figure 8: LDP1000 noble gas purifier

Good quality carrier gas is also mandatory to get analysis in low concentration. With its unique specific design, the LDP1000 noble gas purifier is a cost effective device for any gas chromatograph. It eliminates any contamination problems coming from the gas source.

In **figure 9**, we have evaluated the performance of both analysis. With the fact that the PlasmaDetek has a very low noise and a good response on the nitrogen, low concentration can be measured. LOD and LOQ can vary depending on sample volume or condition of operation. < 1 ppb LOD can also be obtained by optimizing the system.

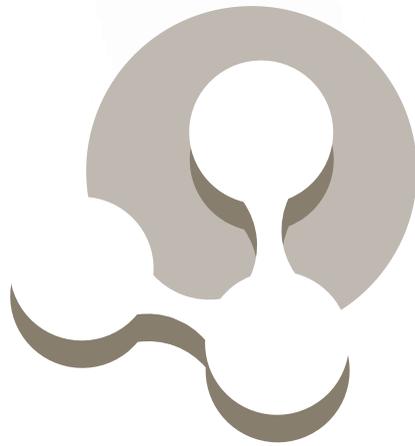
Component	Concentration (ppm)	Peak Height	Noise	S/N	LOD (ppb) S/N=3	LOQ (ppb) S/N=5
N ₂ in H ₂	5	455	0,038	11973	1,25	2,1
N ₂ in O ₂	0,42	38	0,038	1000	1,26	2,1

Figure 9: LOQ and LOD calculation

> CONCLUSION

This is the ideal configuration to measure nitrogen in different matrices. By having such selectivity, you can reduce analysis time and make fast chromatography. In some cases, consumables such as traps can be avoided. It becomes a cost effective solution, maintenance free system and can give better limit of detection by reducing residual background effect.

The PlasmaDetek can also be configured with multiple selective outputs to allow measurements of different compounds. Please contact LDetek for more information.



LDetek

Where innovation leads to success!

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