Greenhouse analysis with the PlasmaDetek

The popularity to measure greenhouse gases (CH₄, CO₂ and N₂O) has increased considerably in the last years with the global warming concerns. Chromatography is the well known technique to measure them and different detectors are used to achieve this task. This application note will explain how we can effectively do it with a simple gas chromatograph configuration involving the PlasmaDetek detector.

> 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.

For this application, the detector system is configured to be selective on all three impurities with two dedicated outputs signal:

- Output 1 : N₂O
- Output 2 : CH₄ and CO₂

> CHROMATOGRAPHY CONFIGURATION

Typical configuration to make such measurement requires methanizer, FID and ECD detectors, H₂ Fuel, make up gas and air supply.

![Figure 1: PlasmaDetek detector](image)

![Figure 2: Typical configuration for greenhouse measurement](image)
With the PlasmaDetek, only one detector can be used to measure CH₄, CO₂ and N₂O in air. All three components elute in the same detector. That reduces cost and complexity of the system.

Another advantage is the use of argon or helium as carrier gas. Both carriers are suitable and give the performance desired.

Valve 1 is used for CH₄ and CO₂ measurement. The backflush to vent configuration vents out water from the sample with a HayeSep D 100/120 10’(column 1). Valve 3 is used to vent out air before going to the other HayeSep D 100/120 10’(column 3). This second column separates CH₄ and CO₂ from the remaining air.

Valve 2 is also configured in a backflush to vent with a HayeSep D 100/120 10’(column 2). A different sampling loop size is used to be able to measure N₂O. Valve 3 is used to vent out air and CO₂. N₂O is then brought to the detector by itself and can be measured in very low concentration.

> RESULTS AND PERFORMANCE

Figure 4 shows the chromatogram obtained with the LDetek configuration described above, with a 8 ppm CH₄, 50 ppm CO₂ and 10 ppm N₂O standard. This result was used to calculate the LOQ and LOD of each compounds shown in figure 5.

**Figure 4:** 8 ppm CH₄, 50 ppm CO₂ and 10 ppm N₂O in helium
All three components are measured without interference in air providing accurate and very sensitive detection. The LOD of N$_2$O ensures that its measurement in air is detected easily.

Those results and performances depend on the chromatographic system and conditions of operation.

**Figure 5**: LOQ and LOD calculation

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration (ppm)</th>
<th>Peak Height</th>
<th>Noise</th>
<th>S/N</th>
<th>LOD (ppb) S/N=3</th>
<th>LOQ (ppb) S/N=5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH$_4$</td>
<td>8</td>
<td>965</td>
<td>0,04</td>
<td>24125</td>
<td>1</td>
<td>1,65</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>50</td>
<td>143</td>
<td>0,04</td>
<td>3575</td>
<td>42</td>
<td>70</td>
</tr>
<tr>
<td>N$_2$O</td>
<td>10</td>
<td>671</td>
<td>0,04</td>
<td>16775</td>
<td>1,8</td>
<td>3</td>
</tr>
</tbody>
</table>

**Figure 6**: CH$_4$, CO$_2$ and N$_2$O in ambient air

All three components are measured without interference in air providing accurate and very sensitive detection. The LOD of N$_2$O ensures that its measurement in air is detected easily.

Those results and performances depend on the chromatographic system and conditions of operation.

> **CONCLUSION**

This technique is simple and cost effective compared to the most common configurations that can be found on the market. No make-up gas, fuel, air, FID and ECD radioactive detector are required to make this measurement. Only one PlasmaDetek detector with two outputs using argon or helium as carrier gas can be used to achieve level of sensitivity needed. The ease of installation and startup of the PlasmaDetek makes it perfectly suitable for this environmental application.