Development and validation of on-line auto-GC for the analysis of trace level biogenic VOCs for a field measurement campaign
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To cite this version:
Fanny Bachelier, Damien Bazin, Benoit Grosselin, Véronique Daële. Development and validation of on-line auto-GC for the analysis of trace level biogenic VOCs for a field measurement campaign. Analytics 2022, Sep 2022, Nantes, France. hal-03862158

HAL Id: hal-03862158
https://hal.science/hal-03862158
Submitted on 20 Nov 2022

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Introduction

Context:
- Volatile Organic compounds (VOCs) play a major role on atmospheric pollution
- VOCs emitted in the atmosphere from natural or anthropological sources
- Biogenic VOCs (BVOCs) = hydrocarbons, isoprene, terpenes & oxygenated compounds
- These molecules are found in ambient air from ppt to ppb levels that require sensitive analytical systems

Problem:
- Usually laboratory instruments involving one off-sampling and analysis
- Need for continuous on-site monitoring systems and allowing automatic data reprocessing

Goal:
- Evaluate suitability of continuous and automatic thermodesorption Gas chromatograph with Flame ionization Detector (FID) and Mass Spectrometer (MS) in parallel for BVOCs measurement in ambient air

Method validation

- To validate the system, certified gas mixtures PAMS 58 and T015 (Takachiho, Japan) at 100 ppb(V) were used
- Linearity, limit of detection, precision and accuracy calculated according to the Chinese Norm for ambient air measurements for 4 aromatic hydrocarbons, 11OVOCs and 1 terpene
- 4 OVOCs not quantified by FID → coelutions

Results

Development of automatic reprocessing

Interest of dual detection FID and MS in continuous and on-site measurements:

<table>
<thead>
<tr>
<th>FID</th>
<th>MS</th>
</tr>
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<tbody>
<tr>
<td>Good reliability</td>
<td>Sensitive</td>
</tr>
<tr>
<td>+ Stable, linear, identification (NIST database)</td>
<td>Allows</td>
</tr>
<tr>
<td>- Non selective</td>
<td>Time drift</td>
</tr>
</tbody>
</table>

Algorithm and validation parameters implemented in data reprocessing software:

- If [FID] = [MS] < CST_GAP
- If [FID] - [MS] < PCENT_C_GAP
Then FID value selected Otherwise MS value

Algorithm efficiency evaluation

- R² of 0.9829 – 0.9992
- Limits of detection: 0.035 – 0.325 ppb
- Precisions at 4 ppb (RSD%): 0.65% - 5.79%
- Accuracies at 4 ppb (RSD%): 0.62% - 18.2%
- R² of 0.9871 – 0.9995
- Limits of detection: 0.048 – 2.110 ppb
- Precisions at 4 ppb (RSD%): 0.66% - 10.6%
- Accuracies at 4 ppb (RSD%): 0.33% - 21.4%

In field measurement campaign

- ACROSS campaign: Atmospheric ChemistRy Of the Suburban Forest (15 June – 25 July)
- Location: 3 sites in Paris including Rambouillet Forest (80 km from Paris)
- Aim: Understand physico-chemical interactions of urban and biogenically air masses
- TD-GC-FID/MS objective: Measurement of Biogenic compounds above the trees

Conclusion

- Performance studies of TD-GC-FID/MS were evaluated to quantify 16 VOCs:
- 4 aromatic hydrocarbons, 11 OVOCs and 1 terpene in ambient air
- Algorithm optimized to simplify data reprocessing and select accurate result between FID and MS
- 3 potential BVOCs identified and quantified with the method during the ACROSS campaign in Rambouillet site

Perspectives:
- Performance studies with an internal standard
- Data analysis and comparison with other instruments deployed during the Rambouillet campaign

Acknowledgements

Acknowledgements to the Mass Spectrometry French Society (SFSM) for providing me the opportunity to participate to the Analytics 2022 congress
This work was carried out as part of a thesis with a CIFRE #2019/1563 agreement from the National Association for Technical Research (ANRT)

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