

New AirmoVOC C₂C₆ expert

Chromatotec[®]



General introduction

Ambient air quality monitoring (outdoor)

The distinguishing feature of the environmental market is that its emergence and growth has been largely driven by government intervention, via regulation and pricing policies.

→ Component EU Directive ozone precursor mixture : PAMS 56 cylinder, 31 COV cylinder...





The challenges:

- Analyze precisely ambient air composition in different locations (town, mountains...)
- More and more compounds
- Lower limit of quantification 25/02/2014



objective of the study

- > Optimal volume of trapping determination : breakthrough volume
- Linearity study
- Product developed by the laboratory research and development :

new FID detector 10 more sensitive

- → New BS : around 40000 instead of 4000
- \rightarrow validation and new FID detector parameters determination.



Outline

- I. Operating principle of the C_2C_6 analyseur
- II. Breakthrough volume study
- III. Linearity study
- IV. Classical FID with expert FID comparison
- V. Conclusion





I. Operating principle of the C₂C₆ analyseur

• First stage : Sampling step



Second stage : Injection step





II. Breakthrough volume study

The breakthrough volume is the trapped sample volume for which the compounds are no longer trapped quantitatively \rightarrow Trapped volume for which there is loss mass

Trapped volume (ml) = sample flow (ml/min) * sampling time (min)



Schematic diagram of the three phases trap



Results \triangleright



 \rightarrow N-Butane is trapped without loss mass until 20 min sampling





 \rightarrow N-Pentane is trapped without loss mass until 20 min sampling





 \rightarrow Ethane is trapped without loss mass until 16 min sampling



Ethylene breakthrouhg curve







 \rightarrow Ethylene is trapped without loss mass until 11 min sampling



Acetylene breakthrough curve





 \rightarrow Acetylene is trapped without loss mass until 11 min sampling



VOC	Breakthrough volume (ml)	Sampling time (min)
Ethane (C ₂)	176.26 ± 0.01	16
Ethene and acetylene (C ₂)	121.20 ± 0.14	11
C ₃ until C ₆	until 219.76 ± 0.03	until 20

Breakthrough volume study

→ With a 11 ml/min sampling flow, a 10 min sampling time allows a quantitative VOC trapping from C_2 to C_6

→ With a 11 ml/min sampling flow, a 20 min sampling time allows a quantitative VOC trapping from C_3 to C_6



III. Linearity study

<u>Linearity</u> : Capacity (in a given range) to get dosing results directly proportional to the concentration or amount of sample analyte

Method used :

- Sample flow around 11 ml/min
 Sampling time : 10 min
- 5 concentration levels for each compound studied \rightarrow two Mass Flow Controller used for the 31 COV cylinder dilutions in the zero air
- Analysis repeated 6 times at each level



>

Operating principle of the MFC





➢ MFC calibration





► MFC calibration



\rightarrow The MFC are perfectly linear in their flow range









25/02/2014





 \rightarrow R² > 0,997 for all the compounds studied \rightarrow The linearity test is validated in the ranges of the study.



IV. Classical FID with expert FID comparison

→ New detection system : the expert FID

 \rightarrow Theoretically expected sensibility gain : 10

Validity criteria :

- \rightarrow The short-term noise must not be increased
- \rightarrow The baseline shape needs to enable integration



\rightarrow Limit of quantification calculation :

$$LOQ (ng/m^3) = \frac{LOQ (ppt) * M (g/mol)}{V_m (24.04 \text{ l/mol at } 20^{\circ}\text{C})}$$



Short-term noise \succ





Detection system :	Classical FID	Expert FID
BS (N-Butane) Amplification 3	3870	37407
Short-term noise	5,8	6
Minimum area	25	25
LOQ (ng/m ³)	60,4	6,1
LOQ (ppt) _{N-Butane}	24,99	2,54

Classical FID with expert FID comparison (sample flow : 11ml/min ; sampling time : 10 min)

 \rightarrow Sensibility gain approximately equal to 10 without short-term noise damage



Chromatogram example

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Trend for low chemical concentrations

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> <u>Application example</u>

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<u>New substance</u>

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25/02/2014



V. Conclusion

Sample flow	Optimum sampling time (min)	FID expert LOQ
(ml/min)	for c ₂ to c ₆ compounds	(ng/m ³)
11	10	6.1 (= 2,54 ppt)

• FID expert sensibility gain equal to 10: validated

•without short-term noise damage

•Linearity verified

• C_3 to C_6 compounds : possibility of trapping until 20 min \rightarrow LOQ lowering factor 2

 \rightarrow LOQ = 3.05 ng/m3





Thank you for your attention !