Identification of Volatile Organic Compounds (VOC) by Gas Chromatography coupled to Mass Spectrometry

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Introduction

Conservation of the planet has become important in people's mind. The reduction of air pollution, which makes the Earth's temperature rise, will have to be done by the improvement of air quality. In the European Union, the Accreditated Association for the supervision of the air quality carries out this mission. VOC have many origins. When we have too many VOC in the air, the ozone's disintegration cycle is unbalanced, and we notice an accumulation of ozone. Parts of these compounds are dangerous for the health, particularly 1.3 butadiene which is carcinogen. This article presents a method of separation of VOC.

Materials and methods

For this separation, an Automatic Thermal Desorber which allows the pre-concentration of VOC and their injection in the GC-MS was used. Vector Gas used was Helium. The separation column used wasan Elite MS of length L=60m, internal diameter id=0.25mm and thickness film tf=1µm. An Electronic Impact source combined with a quadruple analyzer were used. For the identification, the 2005 NIST base was selected.

The air is collected in a trap composed of active coal, set to -30°C. After 40 minutes of sampling, the temperature of the trap is increased to 300°C for approximately one minute. Compounds are desorbed and separated in the gas chromatograph with the next programmed temperature. Then, compounds are identified by their fragmentation spectra.

GC					MS	
T_1 (°C)	T_f (°C)	Gradient slope (°/min)	Keeping time (min)	Time analysis (min)		m/z
0	30	0	4	4	Start	29
30	60	4	0	11.5	End	200
60	110	8	0	17.75	Scan Time	0.35
110	200	12	10	35.25	Interscan	0.15

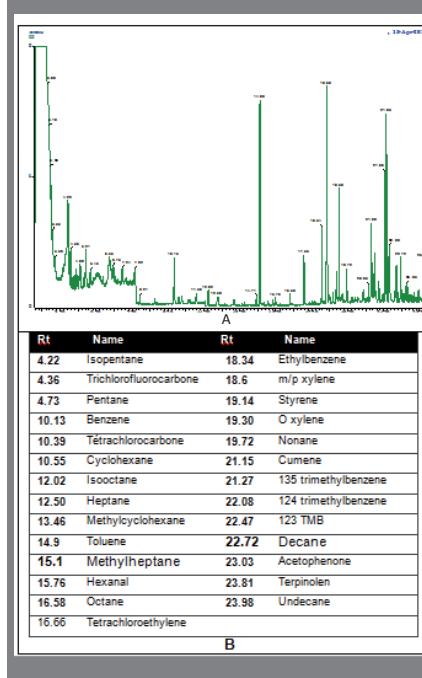Table 1: GC-MS Method for the VOC separation.

Results and discussion

Results are shown in figure 1, we can identify 27 compounds.
With this method, compounds with an aliphatic chain superior to C_6 can be separated and identified , other compounds are not sufficiently separated to be identified without ambiguity. Compounds in very low concentrations can be seen; the limit of detection is approximately 0.02 ppb.

Conclusion

To conclude, this method allows the identification of many VOC with a correct resolution and selectivity. Mass spectrometry actually is the best tool to identify these compounds. This technique can be useful to have a better knowledge of pollutants.

Figure 1: Lyon's air analysis : A :chromatogram, B: compounds name in elution order

Rt	Name	Rt	Name
4.22	Isopentane	18.34	Ethylbenzene
4.36	Trichlorofluorocarbone	18.6	m/p xylene
4.73	Pentane	19.14	Styrene
10.13	Benzene	19.30	O xylene
10.39	Tétrachlorocarbone	19.72	Nonane
10.55	Cyclohexane	21.15	Cumene
12.02	Isooctane	21.27	135 trimethylbenzene
12.50	Heptane	22.08	124 trimethylbenzene
13.46	Methylcyclohexane	22.47	123 TMB
14.9	Toluene	22.72	Decane
15.1	Methylheptane	23.03	Acetophenone
15.76	Hexanal	23.81	Terpinolen
16.58	Octane	23.98	Undecane
16.66	Tetrachloroethylene		

B