ACTA CHEMICA IASI, **19**, 137-141 (2011)

A Gas Chromatographic Method to get Reliable Sulphur Hexafluoride Model Validation Data

Mirela Goanta [a*]

[a]*Departament of Chemistry, "Al.I. Cuza" University Iasi, 11 Carol I Bd, Iasi 700506, Romania*

Abstract: One notorious difficulty in measuring SF6 concentration is that gas chromatographs usually have a very small linear range only. For the tracer experiment carried out in August/September 2003 at Tharandt (Dresden, Germany) a gas chromatographic method was applied which allowed SF6 measurement in a broad linear range from 25 ppt to 1 ppm. SF6 concentration was measured with a gas chromatograph using an electron capture detector whit a capillary column.

Keywords: sulfur hexafluoride, tracer, gas chromatography

Introduction

Tracer techniques are widely applied for determination of dispersion and dilution patterns of atmospheric pollutants. The technique consists of injecting a particular gas, the tracer, into atmospheric system to be investigated and then detection the concentration of the tracer at various places with a variety of sampling and analysis tools. Subsequently, models

[*] Correspondence to:
Dr. Mirela Goanta, tel: +40 232 201288, fax: +40 232 201313, e-mail: goanta@uaic.ro

are used to quantify or to draw inferences as to the physical and chemical nature of the processes studied. Atmospheric tracers must be safe for humans and the environment. They must be stable in air (non-depositing, non-scavenged, non-reactive), with a low background and detectable with a high sensitivity.

Field tracer experiments investigating atmospheric dispersion are essential for understanding the air pollution, toxic contaminant dispersal.[1] Results from field studies are used to identify and understand the physical processes governing dispersion and formulate mathematical equations describing the processes. Field data are necessary to evaluate and validate computer models that simulate atmospheric dispersion.[2]

This paper refers to an application of the gas chromatograph with electron capture detector. Study was focused both on the optimum condition of tracer gas analysis and on their calibration method. It was consequently found that the introduction of GS-GASPRO capillary column could analyse the tracer gas.[3, 4] The calibration method by the use of electron capture detector is able to apply to the quantitative analysis of sulphur hexafluoride. It also appeared that the lower limit of detection of SF6 was 25 ppt (part per trillion, vol/vol).

Results and discussions

The following procedure was established to calculate the tracer concentration: using the peak area on the chromatogram and the peak area for the run standard, the amount of sampled SF_6, in femtolitres (fl), was obtained. The concentration in fl/l was calculated by dividing by the injected volume. A complete calibration curve has been run using the prepared standards. The calibration curve obtained is displayed in figure 1.

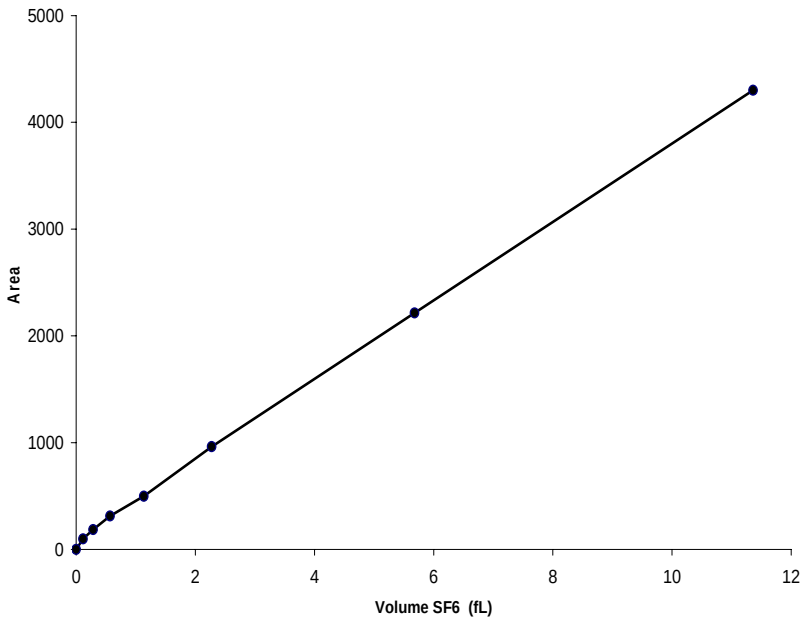

Figure 1. Calibration curve for SF_6

The measured of SF_6 fL per Litre detection has significantly advanced the ability to perform atmospheric transport experiments. The data obtained from such studies will provide a valuable resource for modellers.

Experimental

The analytical instrumentation consisted of a gas chromatograph (GC) with an electron capture detector (ECD). To detect the concentrations of SF6 at the fL L^{-1} level with high precision, therefore, requires a sample volume of several µl of air. The small volume of the air is transferred to the capillary column with negligible band broadening

Table 1. Details of the gas chromatograph used for the SF_6 analysis

Gas chromatograph	Manufacturer Type	Hewlett Packard 5890 Series II
Separating column	Length	30 m
	Diameter	0,32 mm
	carrier gas	nitrogen 6 ml/min.
Detector	Type	Electron capture
	source	2 mCi Ni^{63}
	purge gase	none
The measured of SF_6 fl per Litre detection has significantly	Temperature	Isothermal 70°C

Conclusions

Using electron capture (ECD) gas chromatographic techniques we are able to detect very low concentrations of SF_6 in air samples. The GC/ECD, that is equipped a with a GS-GASPRO capillary column. We estimate the minimal detectable SF_6 concentration in air as 25 ppt based on chromatographic signals. The analytical system was utilized for the study a tracer experiments at Tharandt (SW of Dresden, Germany). The study was carried out as part of tracer field experiment performed in August-September 2003.

Acknowledgements

The author acknowledge the financing of this study by the European Union, Marie Curie Host Fellowship EVK2-CT-2000-56124

References

1. Clark, J.F., *Environ. Sci. Techno*, **31,** (1), 308 (1997).
2. Mc Ginn, SM, Beauchemin K.A., Iwasa A.D., *J. Environ. Qual.*, **35,**, 1686 (2006).
3. Dietz, R.N., Cote E.A., *Environ. Sci. Technol*., **7**, 338 (1973).
4. Maiss M., Stelel L.P., Francey R.J., Fraser P.J., Langenfelds R.L., Trivett N.B.A., Levin I., *Atmospheric Environment,* **30,** (10/11), 1621 (1996).