Bruker Daltonics

Application Note # MS-12

On-site Analysis of Volatile Organic Compounds in Soil and Air with E²M

Ground pollution caused by industrial processes can effect the health of the people in the surrounding area of the contamination. Classical investigations and analysis to determine the local distribution of a contaminated site are time consuming and expensive. With the mobile GC/MS system E²M fast and inexpensive monitoring of ground pollution with volatile compounds can be carried out. This application note demonstrates the time saving determination of volatiles in the ground or in chemical dumps by measuring their concentrations in the soil or chemical dump air with the GC/MS system E²M in the thermodesorption (TD) mode.

Sampling procedure

Soil and chemical dump air samples can be taken easily by the enrichment of defined volumes on sampling tubes (TENAX®) by means of a hand-held gas detection pump (e. g. Dräger ACCURO®), an electric pump or a gas syringe. Soil/air samples can be taken directly from the boreholes of the ramming core drillings on the contaminated ground while chemical dump air can be taken directly from the duct covers of the dumps.

Figure 1: Derelict building with ground pollution at a fur-manufacturing company using chlorinated hydrocarbons for fur-degreasing.

Chromatogram and appropriate mass spectra from soil air sample

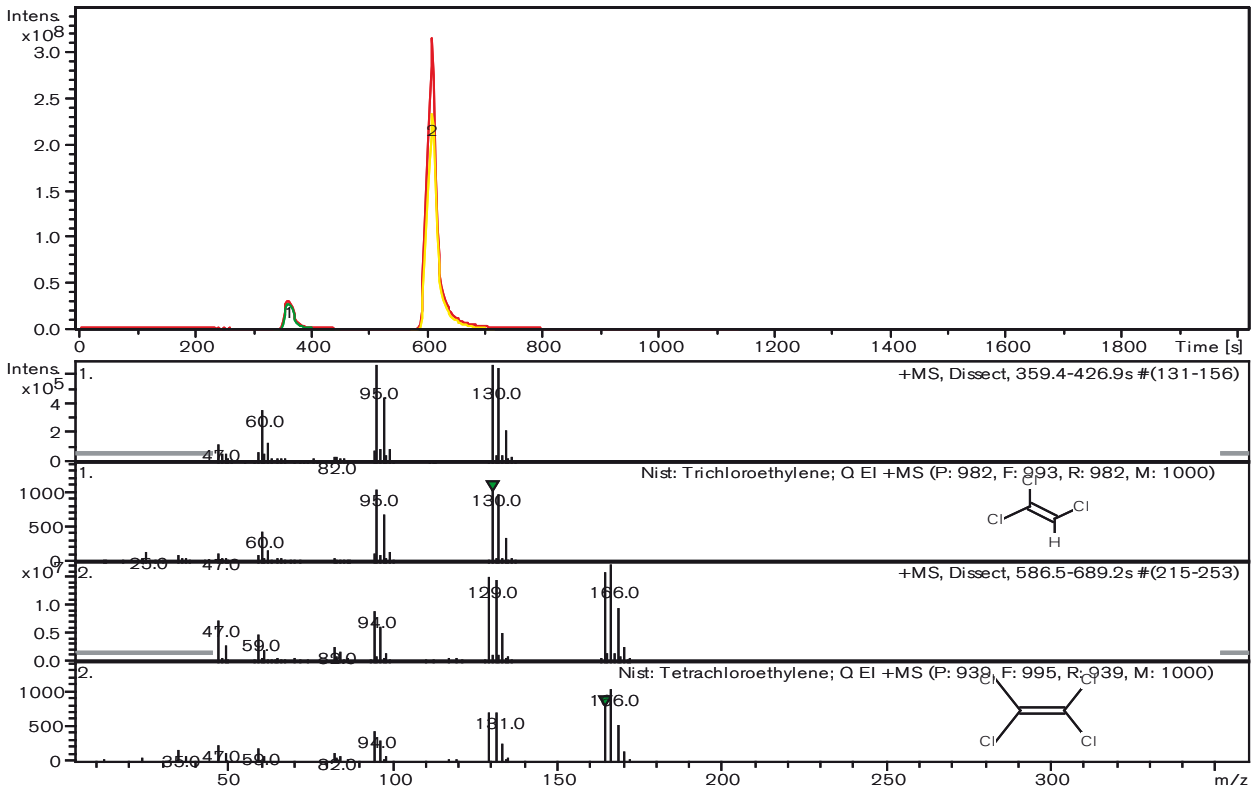

Figure 2: TD-GC/MS run: 100 ml soil air adsorbed on TENAX®-Tube; determined concentrations: 240 mg/m³ Tetrachloroethylene, 12.9 mg/m³ Trichloroethylene

Analytical conditions

E²M with mounted GC in thermodesorption mode, 15 m DB-1, 0.32 mm ID, 5 µm film. Desorber stand-by temp. 45°, thermodesorption at 240°, hold-time 30s, charging time 10s, pressure during charging 600 mbar, GC Temp.-program: 45° to 120° at 10°/min, to 180° at 20°/min, to 220° at 35°/min (hold: 100s), carrier gas ambient air at 1.5 ml/min. MS Scan 46 – 350 u, integration time 5 ms/mass.

Identified susbtances soil air

#	RT [s]	Area	Compound Name	Library	CAS#	Purity'
1	365.1	545080091	Trichloroethylene	Nist	79-01-6	985
2	610.3	5053466991	Tetrachloroethylene	Nist	127-18-4	918

Conclusions

With the mobile GC/MS system E²M volatile compounds in air samples (here: soil air; chemical dump air) can be identified and quantified directly on-site at polluted areas within 10 – 15 min in the low ppb range. The operation of the system is reduced to the lowest possible level so that non-chemists are able to run the system. In comparison to classical investigations (sampling on-site –laboratory measurements) of contaminated areas that are very time consuming an inexpensive investigation of a contaminated area can be done to determine the regional expansion of ground pollution very quickly. With this procedure the local distribution of halogenated VOC´s over a several thousand square-meters contaminated site has been determined within two working days. Therefore the GC/MS system E²M is a powerful analytical tool to save time and money.

Figure 3: Gas sampling from a dump with hand-held gas detection pump (Dräger ACCURO®)

Chromatogram from dump air sample

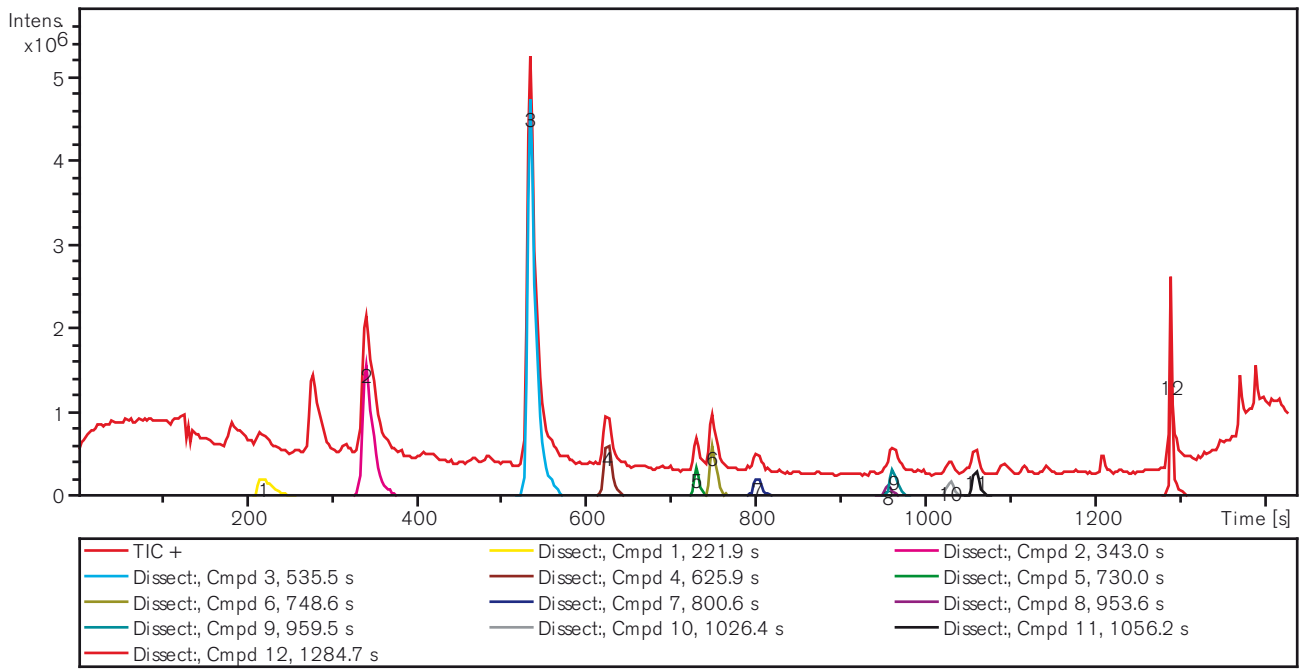

Figure 4:TD-GC/MS run: 300 ml chemical dump air adsorbed on TENAX®-Tube; determined concentrations: e.g. 0.7 mg/m³ Toluene (Peak 3)

Identified substances dump air

#	RT [s]	Area	Compound Name	Library	CAS#	Purity'
1	221.9	3739195	Carbon disulfide	Nist	75-15-0	979
2	343.0	23245934	Furan, tetrahydro-	Nist	109-99-9	816
3	535.5	56298844	Toluene	Nist	108-88-3	977
4	625.9	6321778	Tetrachloroethylene	Nist	127-18-4	960
5	730.0	2585451	Ethylbenzene	Nist	100-41-4	915
6	748.6	5263568	Benzene, 1,3-dimethyl-	Nist	108-38-3	996
7	800.6	2026941	p-Xylene	Nist	106-42-3	912
10	1026.4	1494777	Benzene, 1,3,5-trimethyl-	Nist	108-67-8	919
11	1056.2	2559744	Benzene, 1,3-dichloro-	Nist	541-73-1	948
12	1284.7	8775766	Naphthalene	Nist	91-20-3	986

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Onsite Analysis
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Ground pollution
Fast VOC detection

Instrumentation & Software
Mobile GC/MS System E²M
E²M Software Package

For research use only. Not for use in diagnostic procedures.

Figure 5: Mobile GC/MS system E²M

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