Determination of benzene and its analogues in ambient air by an Agilent 7667A mini Thermal Desorber and an Agilent 7820A GC System

ENVIRONMENTAL

The HJ 583-2010 standard method expanded target compounds from five to eight and emphasized the carryover performance in quality control. Following this standard, a total solution, developed by Agilent, based on a robust Agilent 7820A GC System and a reliable Agilent 7667A mini Thermal Desorber system, not only meets the requirements of HJ 583-2010, it also demonstrates the Agilent legendarily high quality through superior repeatability, low carryover, and excellent linearity.

Key Benefits

- An Agilent 7820A GC System configured with an Agilent 7667A mini TD provides good sensitivity for BTEX analysis in ambient air, meeting the requirements of HJ 583.
- High quality items such as O-ring seals inside of the system help the Agilent 7667A mini TD deliver very low carryover after injection of high concentration samples.
- Accurate electronic pneumatic controlling ensures good repeatability and excellent linearity.

Experimental

Eight target compounds, benzene, toluene, ethylbenzene, *p*-xylene, *m*-xylene, *o*-xylene, styrene, and isopropylbenzene, were purchased from J&K Scientific Ltd. Purity for each chemical was 99.5%. Methanol was used as the solvent.

The liquid standard solutions were prepared following the standard method HJ 583-2010. The final five calibration concentration levels for each compound were 5 ng, 10 ng, 20 ng, 50 ng, and 100 ng.

Table 1. Optimized Instrument Conditions for TVOCs Analysis

Agilent 7667A mini TD		**Agilent 7820A GC System**	
Tube sorbent	Tenax TA	Inlet	150 °C
Tube temperature program	40 °C (0 minutes), 310 °C (3 minutes) at 500 °C/min	Carrier	N_2, 2 mL/min
		Split ratio	20:1
Injection start time	1 minute	FID temperature	300 °C
Leak detection	Yes	Oven program	50 °C (3 minutes), 135 °C (0 minutes) at 5 °C/min, 240 °C (10 minutes) at 10 °C/min
Purge	50 mL/min for 0.5 minutes		
Transfer line	150 °C		
Valve box	150 °C	Column	DB-WAXetr 30 m × 0.32 mm, 1 µm (p/n 123-7334)
Cleaning time	200 mL/min at 320 °C for 4 minutes		

Results and Discussion

The chromatogram of 5-ng liquid standards in a Tenax tube, (Figure 1) proved that the 7820A GC System configured with a 7667A Mini TD had the sensitivity to meet the requirements of HJ 583. To fulfil the carryover criteria, emphasized in the standard HJ583-2010, the Tenax tube was desorbed again after injection of high concentration standards. The secondary desorption result showed no peaks of target compounds which means no carryover, (Figure 2).

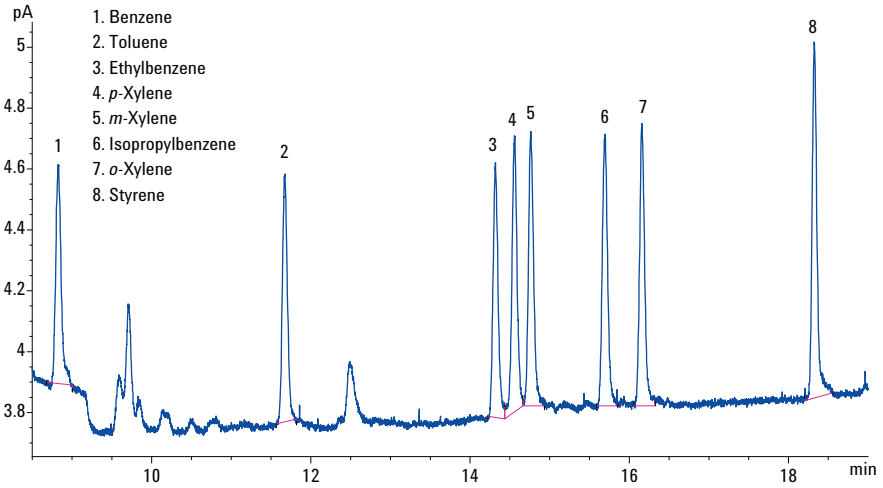

Figure 1. Chromatogram of 5-ng liquid standards on Tenax tube.

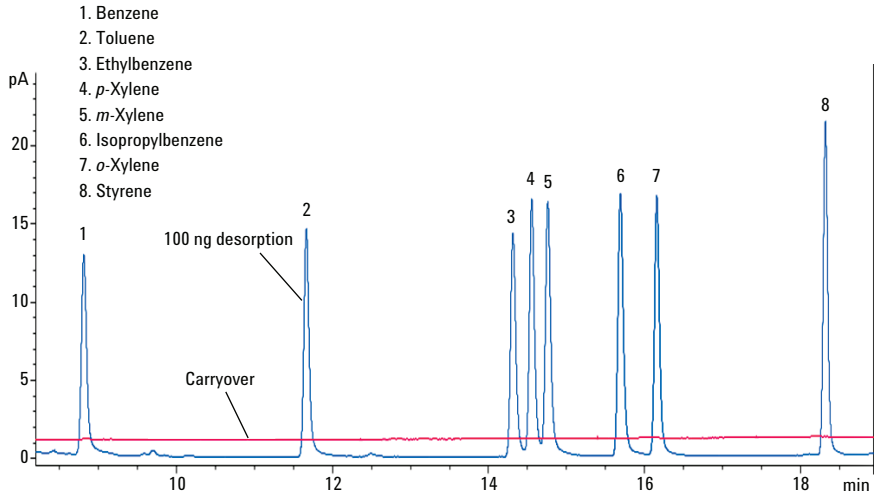

Figure 2. Overlapped chromatograms of 100-ng standards desorption and carryover.

Figure 3 shows excellent repeatability with seven runs of liquid standards loading and desorption. Table 2 lists all of the detailed information of the target compounds regarding retention time, calibration linearity, and RSD(%) results.

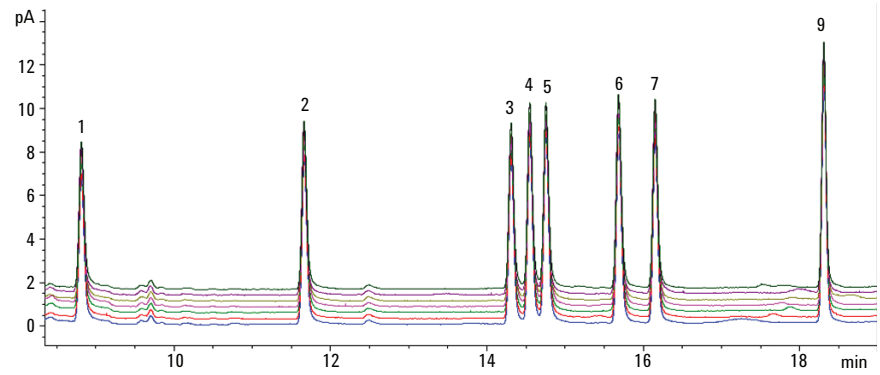

Figure 3. Overlapped chromatograms of seven runs with 50-ng standards desorption.

Table 2. Retention Time, Linearity and Repeatability of Target Compounds

No.	Compounds	R.T. (min)	Linearity (R^2)	Area RSD (%)	R.T. RSD (%)
1	Benzene	8.81	0.9993	1.60	0.020
2	Toluene	11.66	0.9994	1.37	0.021
3	Ethylbenzene	14.31	0.9998	1.58	0.011
4	*p*-xylene	14.54	0.9997	1.69	0.016
5	*m*-xylene	14.75	0.9992	1.81	0.011
6	Isopropybenzene	15.68	0.9996	1.53	0.012
7	Styrene	16.15	0.9995	1.36	0.012
8	*o*-xylene	18.32	0.9996	1.45	0.012

Figure 4 shows the chromatograms of real ambient air sample and carryover.

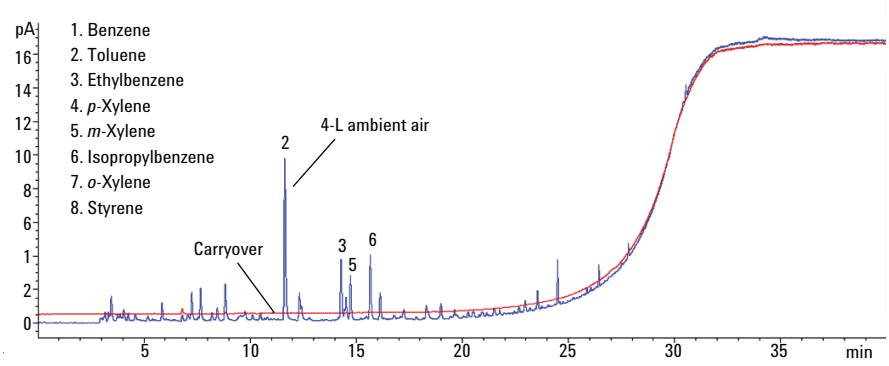

Figure 4. Overlapped chromatograms of 4-L ambient air and secondary blank desorption.

Reference

1. HJ 583-2010 Ambient air—Determination of benzene and its analogues using sorbent adsorption thermal desorption and Gas Chromatography.

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