Application Note 1708

APK2950W VOCs On-Line Monitoring System in Water

- Chinese Standard -

▣ INTRODUCTION

- Analysis of 23 compounds using APK2950W and GC/FID
- Applied Purge and Trap Method
- Relevant Standard Method : EPA 524.2

▣ OPERATING CONDITION

"APK 2950W"

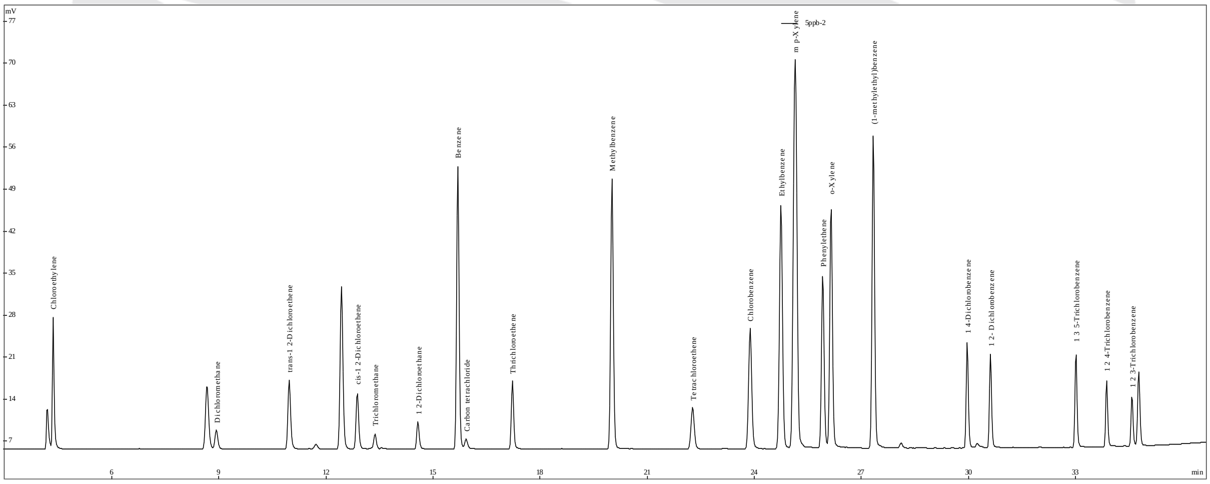
Part 1. TD	Part 2. GC
• Focusing Temperature : -20℃ • Focusing Trap : Single-Bed (Tenax-TA) • Purging Flow : about 100mL/min for 7min • Desorption : 250℃ for 1min • Injection to GC : 300℃ for 5min • Transfer Line Temperature : 150℃	• Oven temp. : 35℃, 8min → 7℃/min → 105℃, 5min → 10℃/min → 250℃, 5min • Column : Combined VB-1 (30m x 0.32mm x 3㎛) + (10m x 0.32mm x 1㎛) • Column Flow : 2 mL/min • Split Ratio 1 : 10 • Detector : FID

▣ RESULTS

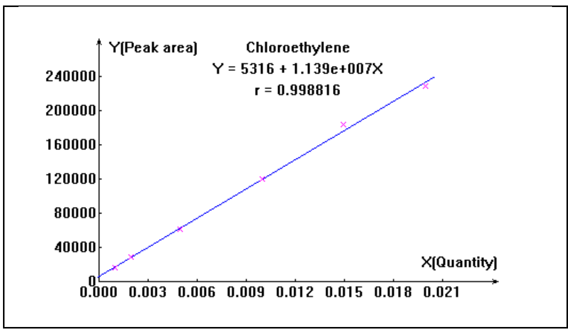
1. Target List

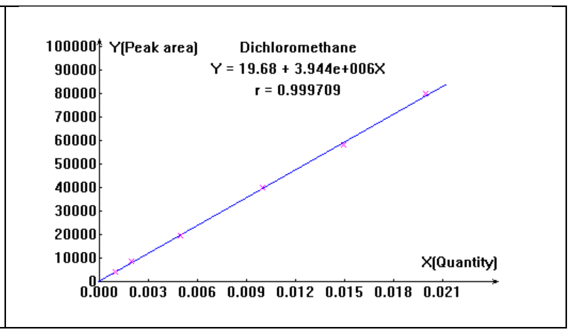
1. Chloroethylene	9. Trichloroethene	17. (1-methylethyl)benzene
2. Dichloromethane	10. Toluene	18. 1,4-Dichlorobenzene
3. trans-1,2-Dichloroethane	11. Tetrachloroethene	19. 1,2-Dichlorobenzene
4. cis-1,2-Dichloroethane	12. Chlorobenzene	20. 1,3,5-Trichlorobenzene
5. Trichloromethane	13. Ethylbenzene	21. 1,2,4-Trichlorobenzene
6. 1,2-Dichloroethane	14. m,p-Xylene	22. 1,2,3-Trichlorobenzene
7. Benzene	15. Phenylethene	
8. Carbon tetrachloride	16. o-Xylene	

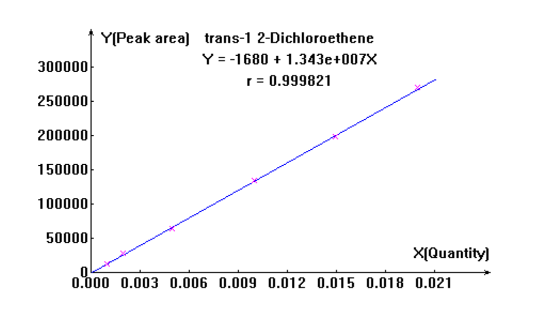
2. Chromatogram (STD 5ppb)

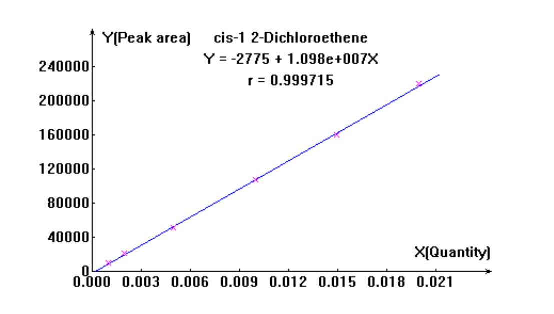


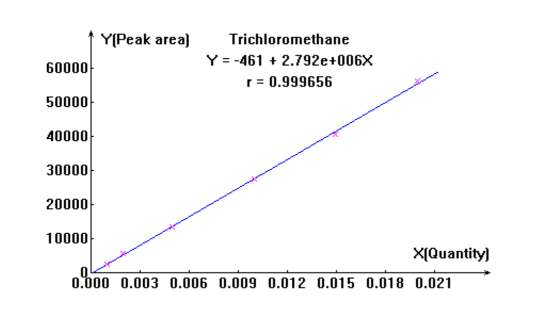
3. Calibration Curves : 1, 2, 5, 10, 15, 20 ug/L → 6 point

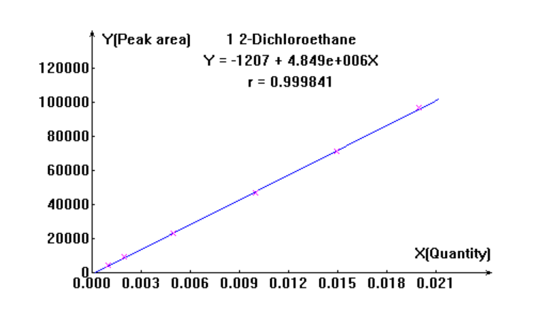


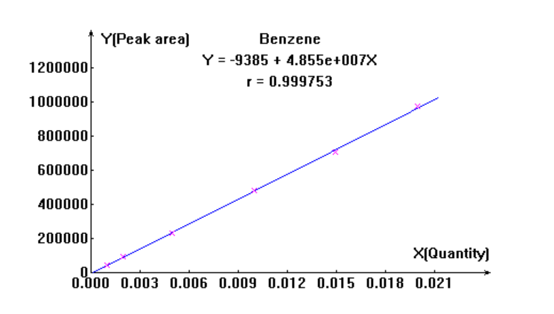


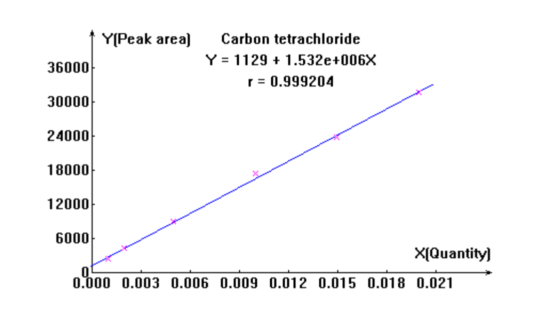

Y(Peak area)
trans-1 2-Dichloroethene
Y = -1680 + 1.343e+007X
r = 0.999821
X(Quantity)

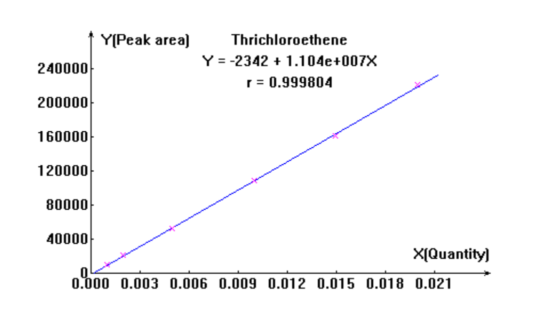

Y(Peak area)
cis-1 2-Dichloroethene
Y = -2775 + 1.098e+007X
r = 0.999715
X(Quantity)

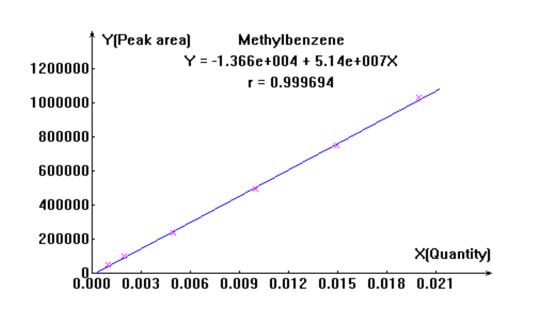

Y(Peak area)
Trichloromethane
Y = -461 + 2.792e+006X
r = 0.999656
X(Quantity)

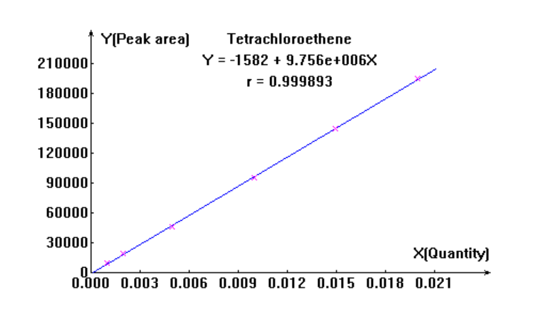

Y(Peak area)
1 2-Dichloroethane
Y = -1207 + 4.849e+006X
r = 0.999841
X(Quantity)

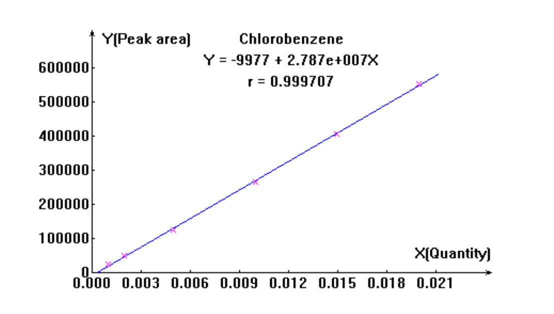

Y(Peak area)
Benzene
Y = -9385 + 4.855e+007X
r = 0.999753
X(Quantity)

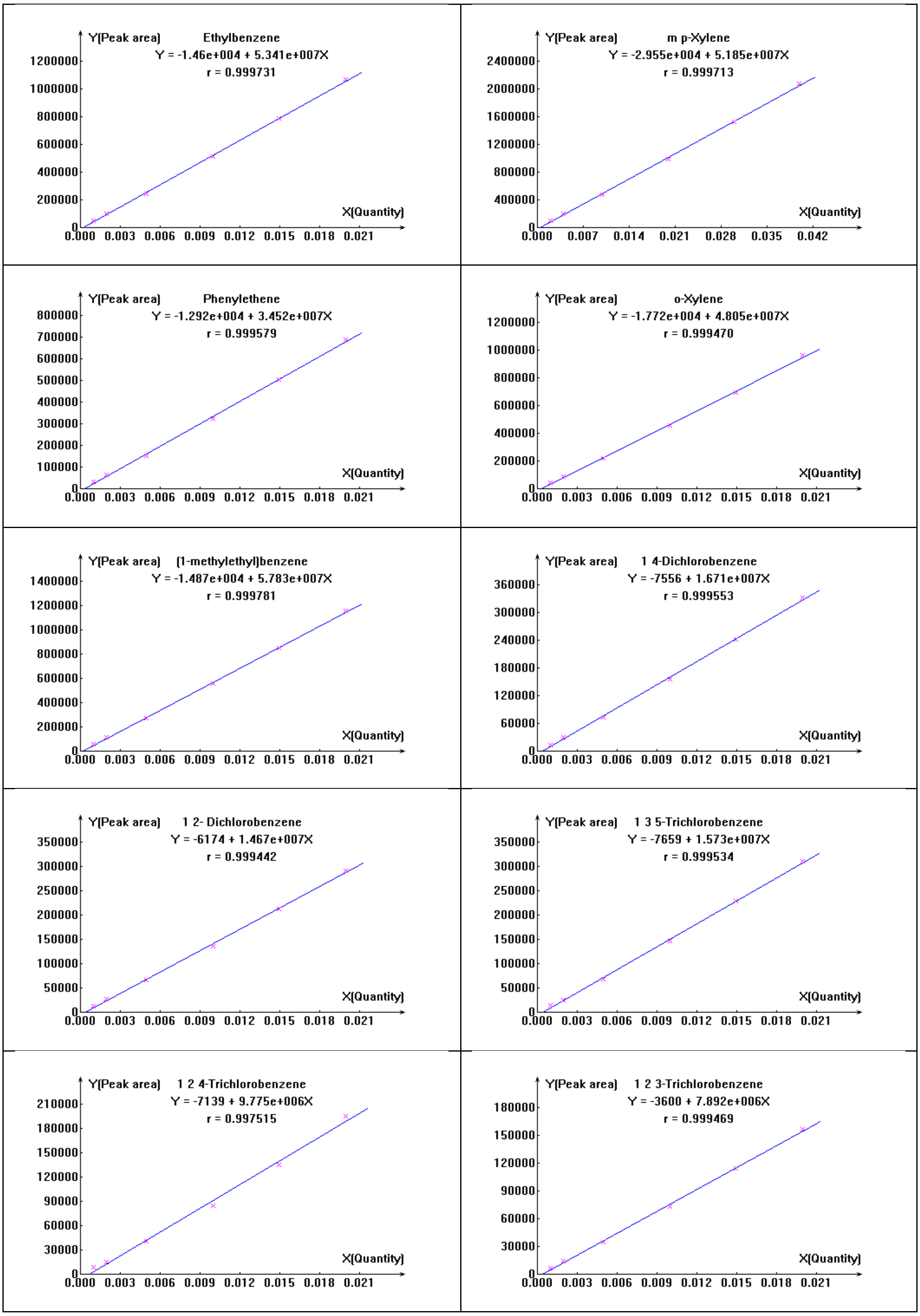

Y(Peak area)
Carbon tetrachloride
Y = 1129 + 1.532e+006X
r = 0.999204
X(Quantity)


Y(Peak area)
Thrichloroethene
Y = -2342 + 1.104e+007X
r = 0.999804
X(Quantity)


Y(Peak area)
Methylbenzene
Y = -1.366e+004 + 5.14e+007X
r = 0.999694
X(Quantity)


Y(Peak area)
Tetrachloroethene
Y = -1582 + 9.756e+006X
r = 0.999893
X(Quantity)


Y(Peak area)
Chlorobenzene
Y = -9977 + 2.787e+007X
r = 0.999707
X(Quantity)


Y[Peak area]
Ethylbenzene
Y = -1.46e+004 + 5.341e+007X
r = 0.999731
X[Quantity]
Y[Peak area]
m p-Xylene
Y = -2.955e+004 + 5.185e+007X
r = 0.999713
X[Quantity]
Y[Peak area]
Phenylethene
Y = -1.292e+004 + 3.452e+007X
r = 0.999579
X[Quantity]
Y[Peak area]
o-Xylene
Y = -1.772e+004 + 4.805e+007X
r = 0.999470
X[Quantity]
Y[Peak area]
(1-methylethyl)benzene
Y = -1.487e+004 + 5.783e+007X
r = 0.999781
X[Quantity]
Y[Peak area]
1 4-Dichlorobenzene
Y = -7556 + 1.671e+007X
r = 0.999553
X[Quantity]
Y[Peak area]
1 2- Dichlorobenzene
Y = -6174 + 1.467e+007X
r = 0.999442
X[Quantity]
Y[Peak area]
1 3 5-Trichlorobenzene
Y = -7659 + 1.573e+007X
r = 0.999534
X[Quantity]
Y[Peak area]
1 2 4-Trichlorobenzene
Y = -7139 + 9.775e+006X
r = 0.997515
X[Quantity]
Y[Peak area]
1 2 3-Trichlorobenzene
Y = -3600 + 7.892e+006X
r = 0.999469
X[Quantity]

4. Detection Limits : 2.5 ug/L , Repeated 7times

(配制7个样品浓度为2.5 ug/L的标准水样， 分别进行测定， 计算混合标样的标准偏差。其3.143倍标准偏差为方法检出限.)

No.	Compound	Measured Value (ug/L)							标准偏差（ug/L）	Detection Limits（ug/L）
		1	2	3	4	5	6	7		
1	Chloroethylene	2.447	2.619	2.322	2.684	2.828	2.775	2.745	0.185	0.581
2	Dichloromethane	2.338	2.813	2.613	2.484	2.572	2.510	2.514	0.145	0.456
3	trans-1,2-Dichloroethane	2.506	2.706	2.612	2.495	2.563	2.425	2.522	0.091	0.286
4	cis-1,2-Dichloroethane	2.418	2.748	2.604	2.517	2.468	2.390	2.461	0.124	0.390
5	Trichloromethane	2.371	2.752	2.591	2.524	2.481	2.675	2.689	0.134	0.421
6	1,2-Dichloroethane	2.229	2.717	2.603	2.521	2.617	2.484	2.474	0.155	0.487
7	Benzene	2.445	2.731	2.607	2.541	2.572	2.464	2.551	0.095	0.299
8	Carbon tetrachloride	2.510	2.691	2.464	2.728	2.489	2.341	2.438	0.138	0.434
9	Trichloroethene	2.514	2.708	2.626	2.567	2.651	2.486	2.630	0.079	0.248
10	Toluene	2.497	2.774	2.65	2.606	2.584	2.459	2.547	0.104	0.327
11	Tetrachloroethene	2.542	2.714	2.61	2.541	2.576	2.371	2.530	0.103	0.324
12	Chlorobenzene	2.564	2.816	2.677	2.669	2.638	2.511	2.555	0.102	0.321
13	Ethylbenzene	2.542	2.767	2.653	2.606	2.617	2.445	2.535	0.102	0.321
14	m,p-Xylene	5.128	5.558	5.324	5.262	5.246	4.904	5.098	0.204	0.642
15	Phenylethene	2.623	2.804	2.692	2.709	2.660	2.500	2.582	0.097	0.305
16	o-Xylene	2.548	2.781	2.696	2.640	2.637	2.425	2.482	0.124	0.390
17	(1-methylethyl) benzene	2.583	2.717	2.604	2.585	2.571	2.445	2.534	0.081	0.255
18	1,4-Dichlorobenzene	2.549	2.814	2.728	2.720	2.627	2.557	2.616	0.098	0.308
19	1,2-Dichlorobenzene	2.535	2.795	2.727	2.742	2.682	2.567	2.673	0.094	0.295
20	1,3,5-Trichlorobenzene	2.348	2.496	2.493	2.485	2.542	2.391	2.440	0.067	0.211
21	1,2,4-Trichlorobenzene	2.692	2.854	2.854	2.866	2.739	2.649	2.681	0.094	0.295
22	1,2,3-Trichlorobenzene	2.380	2.555	2.578	2.616	2.674	2.597	2.630	0.094	0.295

5. **Precision : 5.0 ug/L , Repeated 6times**

(配制6个样品浓度为5.0 ug/L的标准水样，分别进行测定，计算相对标准偏差.)

No.	Compound	Measured Value (ug/L)						标准偏差（ug/L）	RSD（%）
		1	2	3	4	5	6		
1	Chloroethylene	5.654	5.711	5.733	5.614	5.307	5.075	0.265	4.810
2	Dichloromethane	4.898	5.005	4.593	5.055	5.094	5.004	0.183	3.700
3	trans-1,2-Dichloroethane	4.924	4.893	4.934	4.892	5.042	4.952	0.055	1.120
4	cis-1,2-Dichloroethane	4.635	4.688	4.663	4.792	4.758	4.798	0.070	1.480
5	Trichloromethane	4.845	4.936	4.937	5.020	5.032	5.014	0.072	1.450
6	1,2-Dichloroethane	4.686	4.919	4.769	5.004	4.833	4.921	0.116	2.380
7	Benzene	4.921	4.939	4.934	4.987	5.074	5.019	0.059	1.190
8	Carbon tetrachloride	5.389	5.357	5.611	5.554	5.453	5.349	0.109	2.000
9	Trichloroethene	5.007	5.026	5.056	5.077	5.151	5.123	0.055	1.090
10	Toluene	4.826	4.840	4.874	4.873	5.033	4.953	0.079	1.610
11	Tetrachloroethene	4.811	4.795	4.899	4.829	5.089	4.894	0.108	2.210
12	Chlorobenzene	4.761	4.918	4.811	4.921	4.971	4.976	0.088	1.800
13	Ethylbenzene	4.836	4.827	4.853	4.870	5.029	4.957	0.080	1.640
14	m,p-Xylene	9.664	9.666	9.698	9.766	10.056	9.920	0.160	1.632
15	Phenylethene	4.716	4.738	4.719	4.769	4.882	4.818	0.065	1.370
16	o-Xylene	4.822	4.862	4.800	4.881	4.996	4.974	0.080	1.630
17	(1-methylethyl) benzene	4.865	4.837	4.900	4.860	5.051	4.948	0.079	1.610
18	1,4-Dichlorobenzene	4.829	4.897	4.820	4.947	4.989	4.974	0.073	1.480
19	1,2-Dichlorobenzene	4.935	4.985	4.827	4.966	5.039	5.042	0.080	1.610
20	1,3,5-Trichlorobenzene	4.625	4.658	4.504	4.548	5.170	5.162	0.306	6.400
21	1,2,4-Trichlorobenzene	5.144	5.261	4.842	4.953	5.167	5.173	0.158	3.110
22	1,2,3-Trichlorobenzene	4.627	4.773	4.684	4.903	4.935	4.941	0.136	2.820

6. Accuracy : 5.0 ug/L , Repeated 6times

序号	化合物名称	测定值(1)	准确度(%)	测定值(2)	准确度(%)	测定值(3)	准确度(%)	测定值(4)	准确度(%)	测定值(5)	准确度(%)	测定值(6)	准确度(%)
1	Chloroethylene	5.654	-13.08	5.711	14.22	5.733	14.67	5.614	12.28	5.307	6.14	5.075	1.50
2	Dichloromethane	4.898	2.04	5.005	0.11	4.593	-8.14	5.055	1.10	5.094	1.89	5.004	0.09
3	trans-1,2-Dichloroethane	4.924	1.52	4.893	-2.14	4.934	-1.32	4.892	-2.16	5.042	0.83	4.952	-0.97
4	cis-1,2-Dichloroethane	4.635	7.30	4.688	-6.25	4.663	-6.75	4.792	-4.15	4.758	-4.84	4.798	-4.04
5	Trichloromethane	4.845	3.10	4.936	-1.27	4.937	-1.25	5.020	0.40	5.032	0.64	5.014	0.28
6	1,2-Dichloroethane	4.686	6.28	4.919	-1.62	4.769	-4.62	5.004	0.07	4.833	-3.34	4.921	-1.59
7	Benzene	4.921	1.58	4.939	-1.21	4.934	-1.31	4.987	-0.26	5.074	1.48	5.019	0.38
8	Carbon tetrachloride	5.389	-7.78	5.357	7.15	5.611	12.23	5.554	11.09	5.453	9.06	5.349	6.98
9	Trichloroethene	5.007	-0.14	5.026	0.53	5.056	1.12	5.077	1.54	5.151	3.01	5.123	2.45
10	Toluene	4.826	3.48	4.840	-3.21	4.874	-2.53	4.873	-2.53	5.033	0.67	4.953	-0.93
11	Tetrachloroethene	4.811	3.78	4.795	-4.09	4.899	-2.03	4.829	-3.42	5.089	1.78	4.894	-2.11
12	Chlorobenzene	4.761	4.78	4.918	-1.64	4.811	-3.78	4.921	-1.57	4.971	-0.58	4.976	-0.48
13	Ethylbenzene	4.836	3.28	4.827	-3.45	4.853	-2.94	4.870	-2.59	5.029	0.58	4.957	-0.86
14	m,p-Xylene	9.664	3.36	9.666	3.34	9.698	3.02	9.766	2.34	10.056	-0.56	9.920	0.80
15	Phenylethene	4.716	5.68	4.738	-5.24	4.719	-5.63	4.769	-4.61	4.882	-2.37	4.818	-3.64
16	o-Xylene	4.822	3.56	4.862	-2.76	4.800	-4.01	4.881	-2.38	4.996	-0.09	4.974	-0.52
17	(1-methylethyl)benzene	4.865	2.70	4.837	-3.26	4.900	-2.00	4.860	-2.79	5.051	1.02	4.948	-1.04
18	1,4-Dichlorobenzene	4.829	3.42	4.897	-2.06	4.820	-3.60	4.947	-1.06	4.989	-0.23	4.974	-0.53
19	1,2-Dichlorobenzene	4.935	1.30	4.985	-0.30	4.827	-3.47	4.966	-0.69	5.039	0.78	5.042	0.83
20	1,3,5-Trichlorobenzene	4.625	7.50	4.658	-6.84	4.504	-9.92	4.548	-9.04	5.170	3.39	5.162	3.24
21	1,2,4-Trichlorobenzene	5.144	-2.88	5.261	5.22	4.842	-3.15	4.953	-0.95	5.167	3.33	5.173	3.46
22	1,2,3-Trichlorobenzene	4.627	7.46	4.773	-4.53	4.684	-6.32	4.903	-1.94	4.935	-1.29	4.941	-1.19

7. **Sensitivity (S/N ratio) : 0.50 ug/L , Repeated 2times**

(配制2个样品浓度为0.50 ug/L的标准水样，分别进行测定，计算灵敏度，以S/N测定地址作为验收数据.)

No.	Compound	Sensitivity 1 (51uV)	S/N	Sensitivity 2 (50uV)	S/N
1	Chloroethylene	2447	48.94	2375	46.57
2	Dichloromethane	444	8.88	414	8.12
3	trans-1,2-Dichloroethane	1202	24.04	1148	22.51
4	cis-1,2-Dichloroethane	963	19.26	967	18.96
5	Trichloromethane	276	5.52	280	5.49
6	1,2-Dichloroethane	502	10.04	496	9.73
7	Benzene	4796	95.92	4708	92.31
8	Carbon tetrachloride	173	3.46	217	4.25
9	Trichloroethene	1102	22.04	1096	21.49
10	Toluene	4715	94.30	4677	91.71
11	Tetrachloroethene	750	15.00	692	13.57
12	Chlorobenzene	1807	36.14	1843	36.14
13	Ethylbenzene	3943	78.86	3970	77.84
14	m,p-Xylene	6418	128.36	6469	126.84
15	Phenylethene	2637	52.74	2621	51.39
16	o-Xylene	3909	78.18	3879	76.06
17	(1-methylethyl) benzene	5098	101.96	4980	97.65
18	1,4-Dichlorobenzene	1597	31.94	1643	32.22
19	1,2-Dichlorobenzene	1478	29.56	1527	29.94
20	1,3,5-Trichlorobenzene	1558	31.16	1628	31.92
21	1,2,4-Trichlorobenzene	851	17.02	943	18.49
22	1,2,3-Trichlorobenzene	752	15.04	845	16.57

▣ SPECIFICATION

1.1 General and Supply

- Dimension : 600 x 1,480 x 760 mm
- Power supply : 110 or 220VAC
- Line frequency : 50/60HZ

1.2 Measurement Procedure

- Sampling
- Purge and Trap
- Pre-concentration
- Desorption
- Detection (GC)

1.3 Thermal Desorber (TD)

- **Sampling**
  - **Pump :** 38 mL/min
  - **Sampling time :** 0~999 min (adjustable)
  - **Sparger volume :** 80mL

- **Pre-concentration & Desorption**
  - **Cooler type :** Peltier
  - **Focusing temperature :** Below -20℃
  - **Focusing trap :** Single-bed (Tenax-TA) with Glass (ID 2, OD 6.0, L 115;mm)
  - **Valve oven temperature :** 50 ~ 200℃

- **Desorption temperature :** Max. 400℃
- **Sample injection :** Closed loop injection providing high-speed sample introduction, which results in optimized peak separation.

1.4 Gas Chromatograph (GC)

- **Detection**
  - **Injection mode :** Split / Splitless with EPC
  - **Column :** PDMS (Polydimethyl siloxane)
  - **Detector :** FID
  - **Linearity :** 6point **(** 1, 2, 5, 10, 15, 20 ppb) : r ≥ 0.995
  - **Precision :** 6time for 5ppb 23compounds : RSD < 10%
  - **Accuracy :** 6time for 5ppb 23compounds : RSD < 15%
  - **Sensitivity**

1) Benzene: 0.5ppb in water – S/N > 100:1

2) Refer to page 8

KNR
#1301and #604, SKn Techno-Park, 124, Sagimakgol-ro, Jungwon-gu, Seongnam-si, Gyeonggi-do, 132070, Korea
Tel) +82-31-776–0489 ~ 0490 Fax) +82-31–776–0491
E-mail) KNR@eknr.com Homepage) www.eknr.com