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Application Data Sheet

No.15

GC
Gas Chromatograph

Analysis of Residual Solvents in Packaging and Container Materials

Organic solvents are used in printing, adhesives, and other processes involved in manufacturing food packaging materials and containers. Therefore, the organic solvent residues that may remain in the packaging material must be measured. Such measurements are commonly performed using headspace gas chromatography. This Data Sheet describes an example of using a HS-10 headspace sampler with a GC-2014 gas chromatograph to analyze the residual solvents in various packaging materials.

Analysis Conditions

HS-10

Oven temperature:	80 ˚C	Vial pressurizing time:	1.2 min
Sample line temperature:	90 ˚C	Pressure equilibrating time:	0.10 min
Transfer line temperature:	105 ˚C	Load time:	0.5 min
Vial pressurizing pressure:	100 kPa	Load equilibrating time:	0.1 min
Vial agitation:	Off	Injection time:	1.0 min
Vial warming time:	30 min	Sample loop volume:	1.0 mL

GC-2014

Column:	SH-Rtx-1 (0.32 mm I.D. × 30 m, d.f. = 0.5 μm)		
Column temperature:	50 ˚C (5 min) -> 20 ˚C/min -> 200 ˚C (2.5 min)		
Injection port temperature:	150 ˚C	FID temperature:	200 ˚C
Carrier gas pressure:	100 kPa (He)	Hydrogen:	40 mL/min
Split ratio:	1:10	Make-up gas:	30 mL/min (He)
		Air:	400 mL/min

Results

Mix 1 mL each of methanol (MeOH), isopropanol (IPA), methyl ethyl ketone (MEK), ethyl acetate (EtAc), propylene glycol monomethyl ether (PM), propyl acetate (nPrAc), and toluene (Tol). Then accurately add dimethyl sulfoxide (DMSO) to make 50 mL of standard solution. Add 1 μL standard solution to a 20-mL headspace vial and immediately seal the vial. Reproducibility of the results for the standard solution are shown in Figure 1 and Table 1.

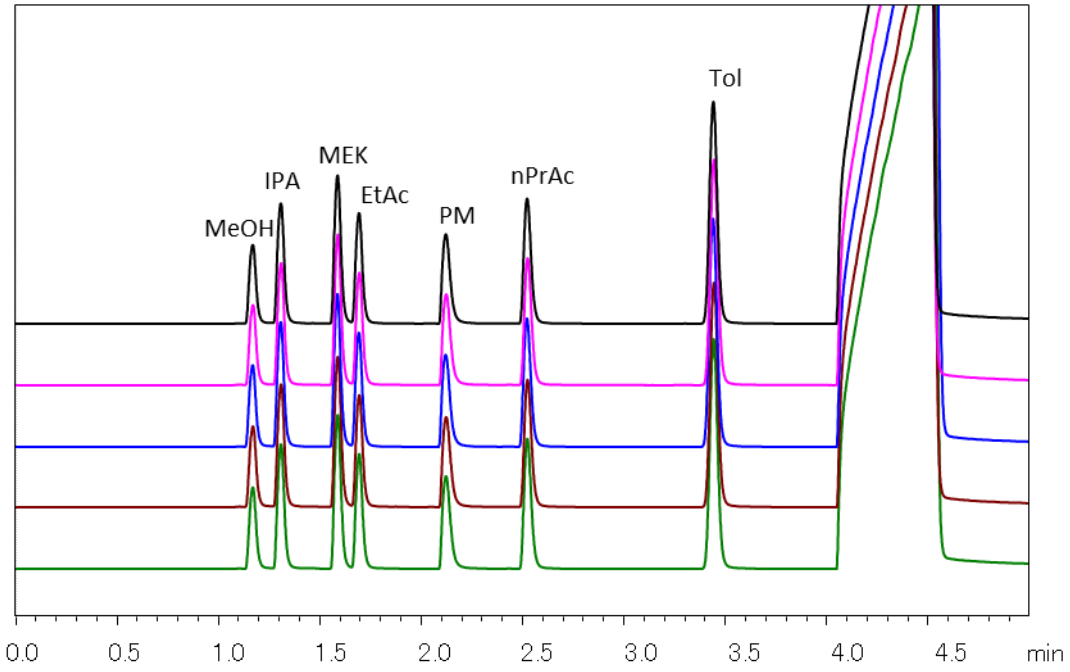

Fig. 1: Chromatograms from Five Consecutive Measurements

Table 1: Reproducibility of Area Values (μV × sec)

	ABSOLUTE Qty (μg)	1	2	3	4	5	AVERAGE	RSD(%)
MeOH	15.86	169535	172218	174521	174447	174892	173123	1.31
IPA	15.68	260065	263542	267385	266548	268688	265246	1.30
MEK	16.10	308780	313800	315933	314268	319852	314527	1.27
EtAc	17.96	239488	243306	244553	243141	247923	243682	1.24
PM	18.46	229435	233318	237270	233212	238710	234389	1.57
nPrAc	17.76	291146	294765	297302	295357	301950	296104	1.34
Tol	17.34	561652	569097	574631	570216	582658	571651	1.35

The film was cut into a 10 cm × 10 cm square, folded, and sealed inside a 20 mL volume headspace vial. Figure 2 shows a comparison of the chromatograms obtained from the standard solution and samples. Table 2 indicates the quantitative results for MeOH, IPA, MEK, EtAc, PM, nPrAc, and Tol contained in the film.

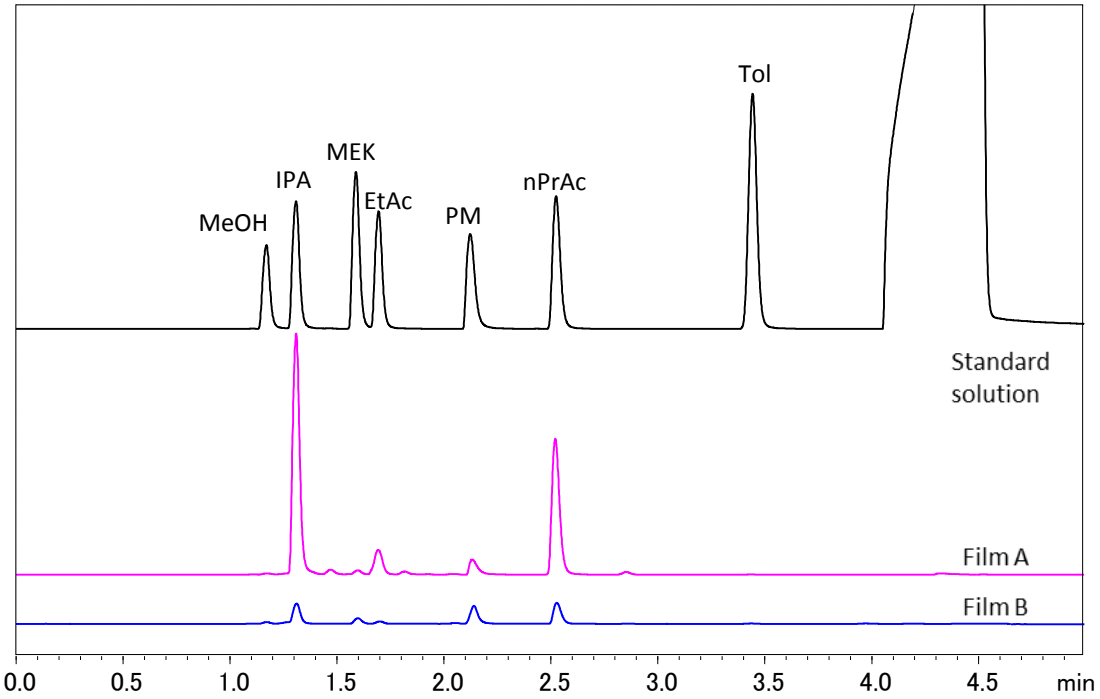

Fig. 2: Comparison of Standard Solution and Samples

Table 2: Quantitative Results for Residual Organic Solvents in the Film

	Units	MeOH	IPA	MEK	EtAc	PM	nPrAc	Tol
Film A	μg	0.30	28.19	0.51	4.38	2.97	17.66	–
	mg/m^2	0.030	2.819	0.051	0.438	0.297	1.766	–
Film B	μg	0.35	2.73	0.65	0.41	3.26	2.82	–
	mg/m^2	0.035	0.273	0.065	0.041	0.326	0.282	–

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