Response Factor of All 209 Chlorobiphenyl Compounds on Capillary Column SGE HT8

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Abstract

Elution order and relative response factors (RRFs) of all 209 chlorobiphenyls (CBs) on the SGE HT-8 capillary column were assigned using HRMS. Peak separation for each compound improved compared to the 5% phenyl or equivalent phase, especially for non-*ortho* and mono- *ortho* CB. Analysis for each congener can be completed within 30 minutes. Using these RRFs, it is possible to determine all CB concentrations without all CB standards.

Introduction

To clarify the behavior and environmental fate of CB, obtaining accurate data regarding the concentration of CB is indispensable. None the less, there are few studies available to researchers that provide HRGC/HRMS data using all CB standards for all CB compounds. Usually 5% phenyl phases' columns are used for the analysis of CB. However, the separation of each CB by 5% phenyl phases' is not so good. The authors [1] reported elution order of all 209 CBs on the HT-8 SGE capillary column. Generally, it is impractical for institutions to prepare the all the CB standards. In this report, we present RRFs for all 209 CBs.

Experimental Methods

All 209 CB standards were prepared from compounds provided by AccuStandard (USA). Each standard was diluted with decane that had been purified by multiple distillations. All processes were carried out in a chemical hazard clean room where room temperature was maintained at 20 ± 0.5°C. 40pg/μL solutions were prepared for HRGC/HRMS analysis. HRGC/HRMS measurement was performed by the previously reported methods [1]. 20 or more injections were done for each congener, using five or more columns with different lot numbers. The averages of RRFs were calculated.

Results

Mass chromatograms for tri and hexa CB (other congeners' were represented in previous reports[1]) are shown in Figure 1. All calculated RRFs are shown in Table 1.

Literature Cited

(1) Matsumura,T., Tsubota,H., Ikeda.Y., Chisaki,Y., Ito,H. and Morita,M.(1997) Retention order of all 209 Chlorobiphenyl compounds on capillary column SGE HT8. *Organohalogen Compounds*, 1997, **31**, 14-19.

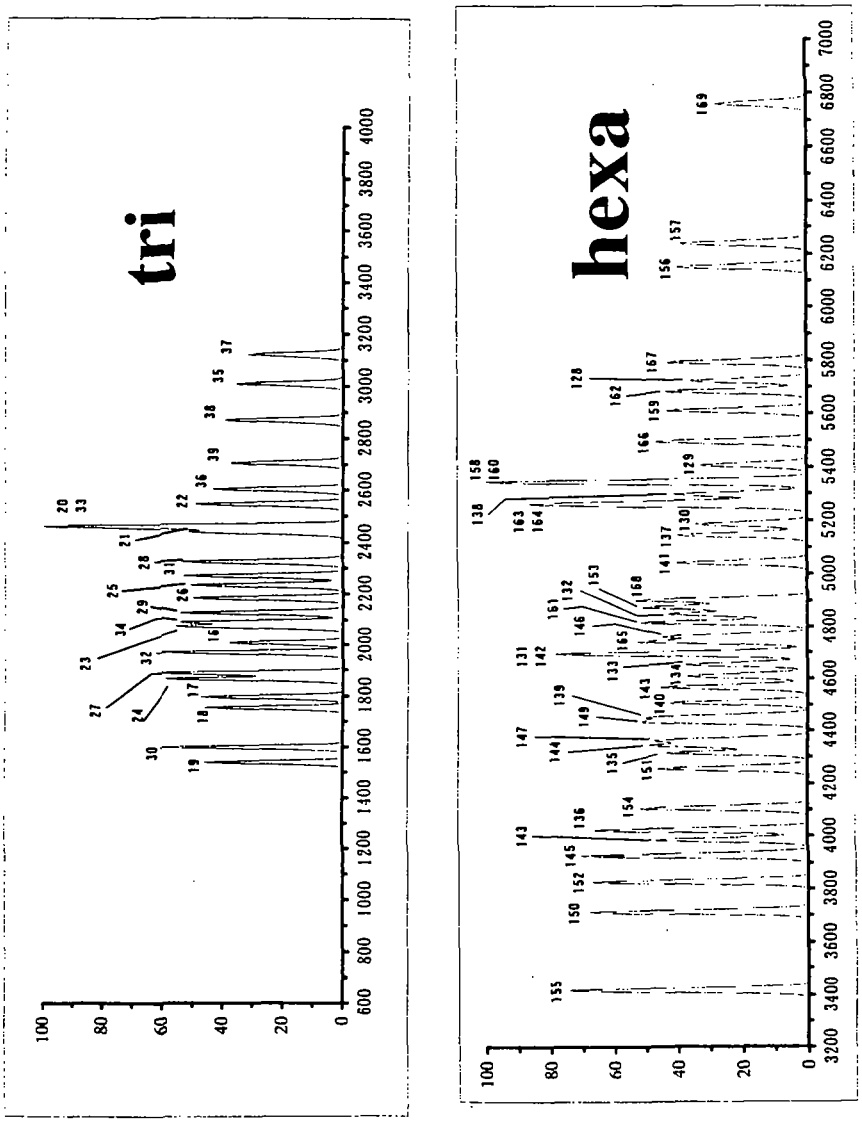

Figure 1. Chromatogram for tri and hexa CBs.

Table 1. Response factor for each compounds.

mono	BZ#	1	2	3					
	Average	1.00	0.98	1.03					
	SD	-	0.06	0.06					
	SD(%)	-	5.6	6.2					
di	BZ#	10	4	9	7	6	8+5	14	11
	Average	1.00	0.60	1.07	1.07	1.14	2.26	1.05	0.98
	SD	-	0.09	0.11	0.12	0.07	0.23	0.08	0.12
	SD(%)	-	14.2	10.4	11.2	6.3	10.2	8.0	12.5
	BZ#	13+12	15						
	Average	1.95	0.91						
	SD	0.23	0.14						
	SD(%)	11.8	14.9						
tri	BZ#	19	30	18	17	24	27	32	16
	Average	1.00	1.52	1.14	1.21	1.46	1.64	1.62	0.95
	SD	-	0.08	0.11	0.05	0.11	0.08	0.09	0.05
	SD(%)	-	5.0	9.4	4.1	7.7	4.8	5.3	5.6
	BZ#	23	34	29	26	25	31	28	21+33+20
	Average	1.57	1.50	1.55	1.52	1.54	1.68	1.74	4.55
	SD	0.11	0.13	0.09	0.10	0.11	0.18	0.18	0.32
	SD(%)	7.0	8.9	5.9	6.5	7.4	10.4	10.5	7.1
	BZ#	22	36	39	38	35	37		
	Average	1.54	1.48	1.37	1.35	1.33	1.22		
	SD	0.12	0.13	0.12	0.12	0.14	0.15		
	SD(%)	7.8	8.8	9.0	8.6	10.9	11.9		
tetra	BZ#	54	50	53	51	45	46+52+69	73	43+49
	Average	1.00	0.78	0.79	0.83	0.67	2.44	0.87	1.50
	SD	-	0.02	0.02	0.02	0.02	0.11	0.04	0.06
	SD(%)	-	2.4	2.2	2.4	2.4	4.4	4.3	4.0
	BZ#	75+65+47+48	62	44	59	42	72	64	71
	Average	3.80	0.98	0.64	1.07	0.68	1.05	0.97	1.22
	SD	0.18	0.04	0.04	0.08	0.03	0.08	0.06	0.10
	SD(%)	4.8	4.4	7.0	7.7	5.1	8.0	6.4	8.4
	BZ#	68+41	57+40	67	63+58	61+74	70	80+76	66
	Average	1.66	1.42	0.99	1.87	2.02	1.14	1.96	0.91
	SD	0.11	0.10	0.11	0.16	0.27	0.14	0.23	0.14
	SD(%)	6.4	7.3	10.7	8.5	13.2	12.6	12.0	15.3
	BZ#	55	60+56	79	78	81	77		
	Average	0.91	1.91	0.90	0.82	0.81	0.81		
	SD	0.13	0.22	0.14	0.14	0.16	0.17		
	SD(%)	13.8	11.6	15.6	16.6	19.5	20.9		
penta	BZ#	104	96	103	100	94	102+98+95+93	121+88+91	92
	Average	1.00	1.86	0.79	0.82	0.71	3.55	2.41	0.66
	SD	-	0.32	0.03	0.03	0.03	0.51	0.12	0.04
	SD(%)	-	17.4	4.4	3.7	4.1	14.5	5.0	6.4
	BZ#	84+90+101+89	113	99	119+112	83	109	86+97+117+125	111+116+115+87
	Average	2.84	0.85	0.78	1.83	0.51	0.89	3.13	3.50
	SD	0.18	0.06	0.06	0.16	0.04	0.12	0.31	0.41
	SD(%)	6.2	7.1	7.3	8.9	8.7	13.7	9.9	11.8
	BZ#	85+120	110	82	124	107+108	123	106+118	114
	Average	1.59	0.85	0.54	0.83	1.73	0.81	1.63	0.81
	SD	0.23	0.22	0.11	0.15	0.31	0.16	0.30	0.14
	SD(%)	14.2	25.4	19.6	18.1	17.9	20.2	18.2	17.1
	BZ#	122	127	105	126				
	Average	0.76	0.73	0.86	0.67				
	SD	0.12	0.19	0.14	0.19				
	SD(%)	15.5	25.7	16.4	27.9				

Table 1. Continued.

hexa	BZ#	155	150	152	145	148	136	154	151
	Average	1.00	0.93	0.90	0.94	0.67	0.90	0.74	0.64
	SD	-	0.03	0.02	0.02	0.02	0.03	0.03	0.03
	SD(%)	-	2.9	2.3	2.0	3.3	3.3	4.3	4.2
	BZ#	143	134	133	142+131	165	146	161	132
	Average	0.57	0.50	0.52	1.12	0.78	0.60	0.80	0.54
	SD	0.05	0.04	0.06	0.09	0.10	0.05	0.09	0.04
	SD(%)	8.0	9.0	10.7	7.8	13.0	7.9	11.1	8.0
	BZ#	153	168	141	137	130	164+163	162	128
	Average	0.74	0.83	0.61	0.63	0.53	1.71	0.77	0.54
	SD	0.09	0.06	0.04	0.06	0.05	0.23	0.11	0.05
	SD(%)	11.7	7.8	7.1	8.9	8.8	13.5	14.6	9.2
	BZ#	167	156	157	169				
	Average	0.73	0.68	0.68	0.55				
	SD	0.10	0.11	0.10	0.13				
	SD(%)	13.9	16.1	15.3	23.7				
hepta	BZ#	188	184	179	176	186	178	175	182+187
	Average	1.00	0.94	0.90	0.90	0.85	0.65	0.61	1.41
	SD	-	0.02	0.04	0.05	0.05	0.06	0.06	0.12
	SD(%)	-	2.1	4.0	5.2	5.4	8.5	10.2	8.3
	BZ#	171	173	172	192	180	193	191	170
	Average	0.57	0.52	0.58	0.73	0.61	0.89	0.78	0.54
	SD	0.08	0.09	0.10	0.13	0.12	0.15	0.16	0.13
	SD(%)	14.7	16.5	17.2	17.1	20.3	17.2	20.1	24.5
	BZ#	190	189						
	Average	0.76	0.69						
	SD	0.20	0.24						
	SD(%)	26.3	34.4						
octa	BZ#	202	200	204	197	199	198+201	196+203	195
	Average	1.00	1.09	1.08	1.13	1.08	1.35	1.49	0.54
	SD	-	0.03	0.04	0.04	0.08	0.13	0.16	0.07
	SD(%)	-	2.5	3.6	3.2	7.4	9.5	10.5	12.6
nona	BZ#	208	207	206					
	Average	1.00	1.56	0.65					
	SD	-	0.07	0.12					
	SD(%)	-	4.5	18.3					

Note RRFs were calculated by peak area of chromatogram.
Peak area for each isomer was normalized to 1st peak of each congener group.
There were no relations of RRFs between one congener and other congeners.