SAMPLING RATE OF PCB CONGENERS USING PASSIVE AIR SAMPLER

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Introduction

Persistent organic pollutants (POPs) are chemicals that persist in the environment, bioaccumulate through the food web, and exhibit toxic effects that may threaten the health of humans and wildlife.[1)] Active air sampler (AAS) is useful in the monitoring of POPs in air. Air sample was collected for POPs analysis using a filter/adsorbent. AAS using conventional air samplers requires pumps, filter/adsorbent, and source of electricity. This type of sampling can be costly and not always feasible, especially if several simultaneous sampling are required at different locations. There is an incentive therefore to further develop passive air sampler (PAS).[2)] The mechanism of uptake in PAS is based on the molecular diffusion from air to passive sampling medium. PAS are capable of time-integrated sampling with relatively low cost and simple operation, which is independent from power supply and free of noise.[3)] Therefore PAS is expected as a simultaneous monitoring in numerous locations. Various researchers investigate basic research.[4,5)]

In this study, we calculated sampling rate of PCB congeners in same location at the same period using PAS and AAS.

Materials and methods

Passive air sampling: Polyurethane foam plug (PUF: 85mm diameter , 50mm high) was set by different size double stainless steel bowl to protect the passive air sampler from direct deposition of particulate matter and to minimize the influence of varying air velocity (Fig. 1). PAS was deployed 1 month period in the sampling location. PCB was extracted using Soxhlet by acetone from PUF. Acetone solution concentrated and transferred to hexane.

Active air sampling: AAS was run alongside PAS using a low volume pump and two PS-Air (Waters) was arranged tandem (Fig. 2). AAS was deployed during same period of PAS. PCB was eluted using hexane from PS-Air cartridge. Hexane solution concentrated and substituted to 2,2,4-trimethylpentane.

Sample extraction and analysis:

PCB was analyzed using GC-MS/MS (Bruker, 320MS). HT8-PCB capillary column (Kanto Kagaku) was used for PCB congeners-specific analysis. EC5433 (CIL) was used for PCB determination as standard, and before deployment 13C-labeled PCB congeners (MBP-CG) was spike for internal standard.

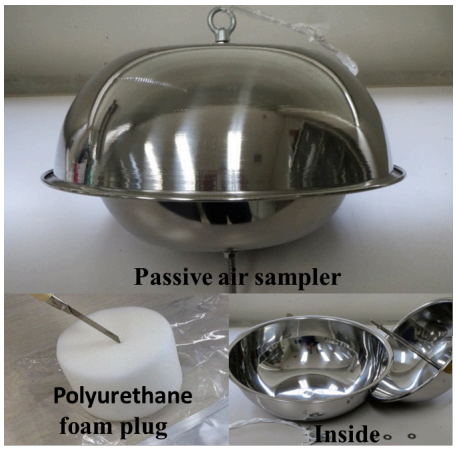


Fig. 1 Passive air sampling

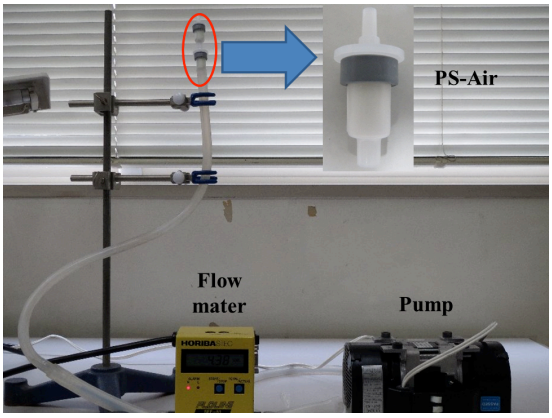
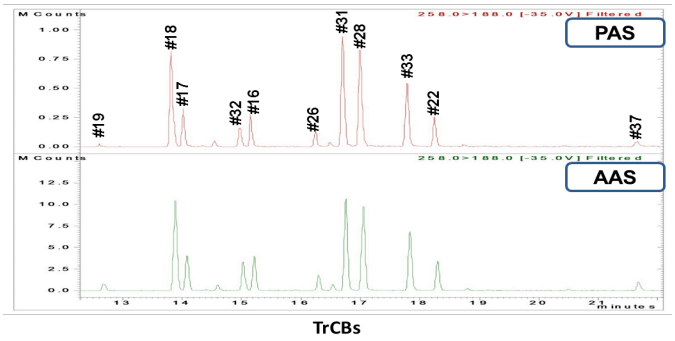
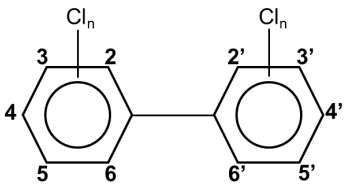


Fig. 2 Active air sampling

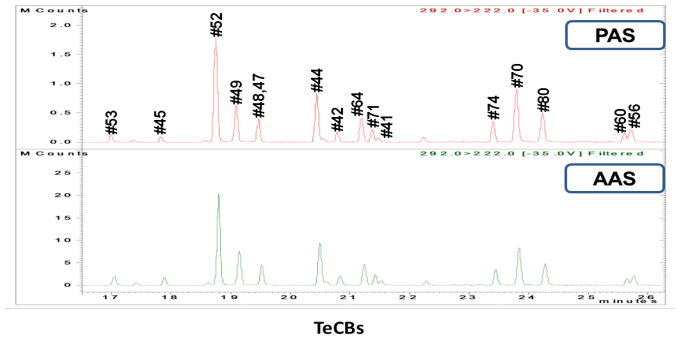
Results and discussion:

MRM chromatograms of PCB in air collected using PAS (PUF: adsorbed PCB) and AAS (PS-Air: adsorbed PCB) chromatograms were showed (Fig.3). Sampling rate of PCB congeners (m^3/day) were calculated using the value PAS(ng) and AAS(ng/m^3) (Fig. 4).

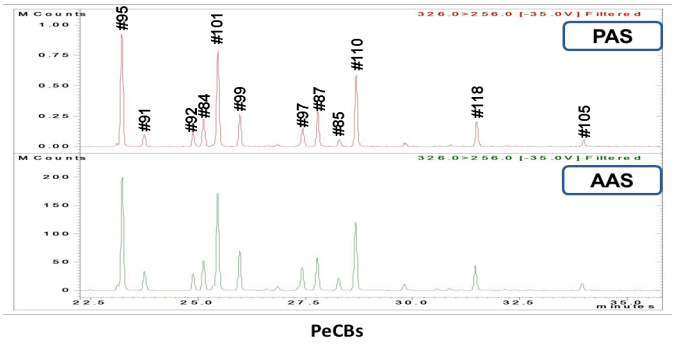




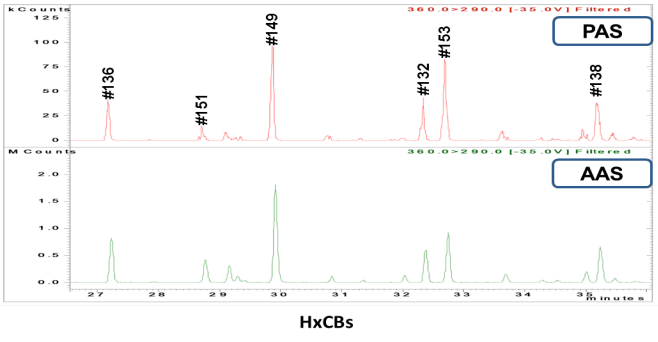
#19	2,2',6	#31	2,4',5
#18	2,2'5	#28	2,4,4'
#17	2,2',4	#33	2,3'4'
#32	2,4',6	#22	2,3,4'
#16	2,2',3	#37	3',4,4'
#26	2,3',5		



#53	2,2',5,6'	#64	2,3,4',6
#45	2,2',3,6	#71	2,3',4',6
#52	2,2',5,5'	#41	2,2',3,4
#49	2,2',4,5'	#74	2,4,4',5
#48	2,2',4,5	#70	2,3',4',5
#47	2,2',4,4'	#80	3,3',5,5'
#44	2,2',3,5'	#60	2,3,4,4'
#42	2,2',3,4'	#56	2,3,3',4'

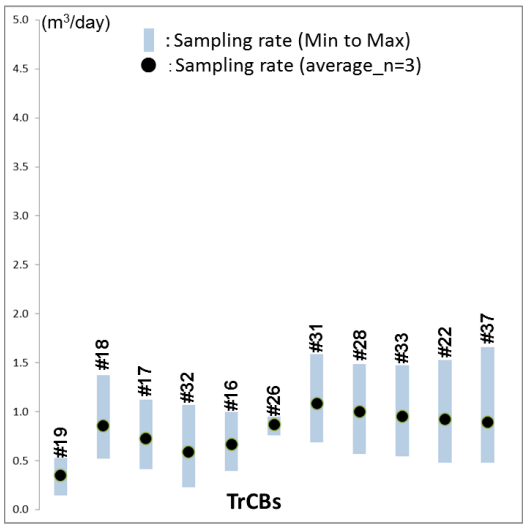


#95	2,2',3,5',6	#97	2,2',3,4',5'
#91	2,2',3,4',6	#87	2,2',3,4,5'
#92	2,2',3,5,5'	#85	2,2',3,4,4'
#84	2,2',3,3',6	#110	2,3,3',4',6
#101	2,2',4,5,5'	#118	2,3',4,4',5
#99	2,2',4,4',5	#105	2,3,3',4,4'



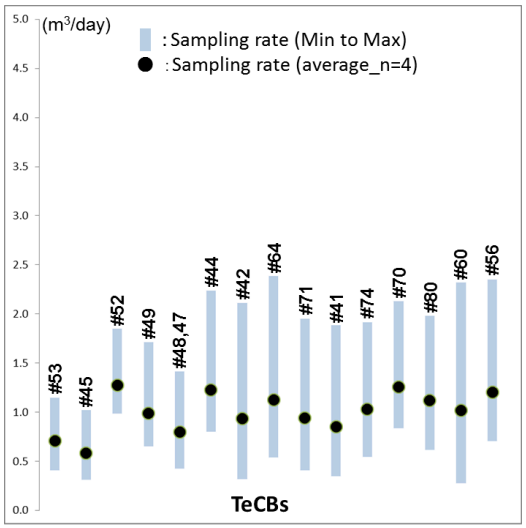
#136	2,2',3,3',6,6'
#151	2,2',3,5,5',6
#149	2,2',3,4',5',6
#132	2,2',3,3',4,6'
#153	2,2',4,4',5,5'
#138	2,2',3,4,4',5'

Fig. 3 MRM chromatograms of PCB in air collected using PAS and AAS



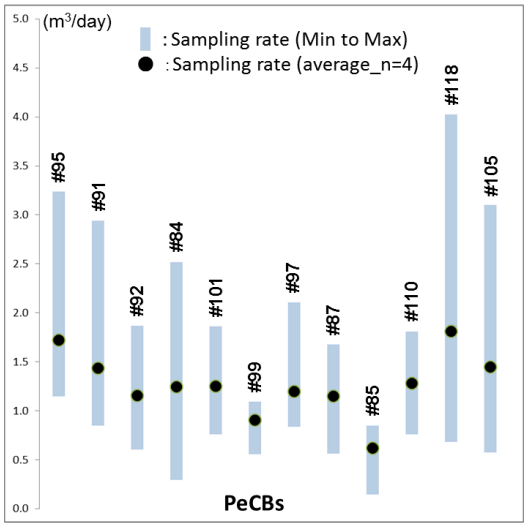
TrCBs

IUPAC No.	sampring rate (m^3/day)	average (m^3/day)
#19	0.1–0.5	0.4
#18	0.5–1.4	0.9
#17	0.4–1.1	0.7
#32	0.2–1.1	0.6
#16	0.4–1.0	0.7
#26	0.8–1.0	0.9
#31	0.7–1.6	1.1
#28	0.6–1.5	1.0
#33	0.5–1.5	1.0
#22	0.5–1.5	0.9
#37	0.5–1.7	0.9



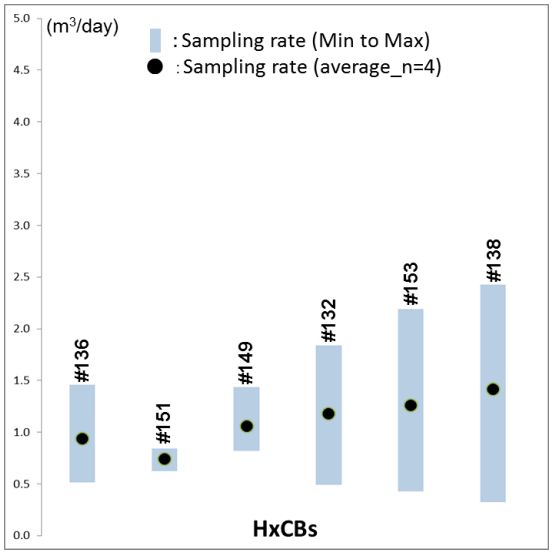
TeCBs

IUPAC No.	sampring rate (m^3/day)	average (m^3/day)
#53	0.4–1.2	0.7
#45	0.3–1.0	0.6
#52	1.0–1.9	1.3
#49	0.6–1.7	1.0
#48,47	0.4–1.4	0.8
#44	0.8–2.2	1.2
#42	0.3–2.1	0.9
#64	0.5–2.4	1.1
#71	0.4–2.0	0.9
#41	0.3–1.9	0.9
#74	0.5–1.9	1.0
#70	0.8–2.1	1.3
#80	0.6–2.0	1.1
#60	0.3–2.3	1.0
#56	0.7–2.4	1.2



PeCBs

IUPAC No.	sampring rate (m^3/day)	average (m^3/day)
#95	1.1–3.2	1.7
#91	0.8–2.9	1.4
#92	0.6–1.9	1.2
#84	0.3–2.5	1.3
#101	0.8–1.9	1.3
#99	0.6–1.1	0.9
#97	0.8–2.1	1.2
#87	0.6–1.7	1.2
#85	0.1–0.9	0.6
#110	0.8–1.8	1.3
#118	0.7–4.0	1.8
#105	0.6–3.1	1.5



HxCBs

IUPAC No.	sampring rate (m^3/day)	average (m^3/day)
#136	0.5–1.5	0.9
#151	0.6–0.8	0.7
#149	0.8–1.4	1.1
#132	0.5–1.8	1.2
#153	0.4–2.2	1.3
#138	0.3–2.4	1.4

Fig. 4 sampling rate

Average of sampling rate of PCB congeners were TrCBs 0.4(#19) to 1.1 m^3/day(#31), TeCBs 0.6(#45) to 1.3 m^3/day(#70), PeCBs 0.6(#85) to 1.8 m^3/day(#118), HxCBs 0.7(#151) to 1.4 m^3/day(#138). Calculated sampling rate is same level with the other reports.

Acknowledgements:
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References: (Example)

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