

Supplemental Information

Passive sampling methods for contaminated sediments: State of the science for organic contaminants

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Table SI-1. Application of passive sampling methods that target the freely dissolved concentration (C_{free}) in sediment.

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Sheets/Film	100 µm PE	E ^c	in situ, ex situ	PAHs	N	C_{free}	NA	Cornelissen et al. 2008a
Sheets/Film	100 µm PE	E	Laboratory-spiked	PAHs, PCBs	N	C_{free} , toxicity	<i>Ampelisca abdita</i> , <i>Americamysis bahia</i>	Perron et al. 2009
Sheets/Film	100 µm PE	E	Laboratory-spiked	PAHs	N	C_{free} , toxicity	<i>Ampelisca abdita</i> , <i>Americamysis bahia</i>	Perron et al. 2011
Sheets/Film	80 µm PE	K ^d /E	ex situ	PAHs, PCBs, PeCB HCB, octachlorostyrene, <i>p,p'</i> -DDE, <i>p,p'</i> -DDD	Y	C_{free}	NA	Allan et al. 2012
Sheets/Film	80 µm PE	E	ex situ	PAHs	N	C_{free} , bioaccumulation	<i>Nereis virens</i> <i>Hinia reticulata</i>	Ruus et al. 2013
Sheets/Film	74-84 µm PE	E	ex situ	PAHs	N	C_{free} , bioaccumulation	<i>Nereis virens</i>	Vinturella et al. 2004
Sheets/Film	70 µm PE tube	E	in situ, ex situ	PCBs, PAHs, HCB	Y	C_{free}	NA	Booij et al. 2003
Sheets/Film	53.6 µm PE , (PE Tube Dialysis)	K	ex situ	PAHs	N	C_{free}	NA	MacRae and Hall 1998
Sheets/Film	51 µm PE tube	E	in situ	PAHs, PCBs, PCDDs	N	C_{free}	NA	Lohmann et al. 2005

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Sheets/Film	51 µm PE	E	in situ, ex situ	PCBs	N	C _{free} , remediation, bioaccumulation	<i>Macoma nasuta</i>	Cho et al. 2009
Sheets/Film	51 µm PE	E	ex situ	PCBs	N	C _{free}	NA	Friedman et al. 2011
Sheets/Film	51 µm PE	E	ex situ	DDTs	N	C _{free}	NA	Hale et al. 2009
Sheets/Film	51 µm PE	E	ex situ	PAHs	N	C _{free}	NA	Hale et al. 2010
Sheets/Film	51 µm PE	E	in situ	PCBs	Y	C _{free}	NA	Oen et al. 2011
Sheets/Film	51 µm PE	K	in situ, ex situ	PCBs	Y	C _{free}	NA	Tomaszewski and Luthy 2008
Sheets/Film	51 µm PE	E	ex situ	DDT	N	C _{free} , bioaccumulation	<i>Mytilus edulis</i>	Tomaszewski et al. 2008
Sheets/Film	51 µm PE	K	laboratory-spiked	PAHs	Y	C _{free} , bioaccumulation, remediation	<i>Chironomus plumosus</i>	Wang et al. 2011
Sheets/Film	51 and 25 µm PE	K	ex situ	PAHs	Y	C _{free}	NA	Fernandez et al. 2009a,b

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Sheets/Film	50 µm PE (Membrane dialysis extraction)	K/E	laboratory-spiked	2,4- dinitrophenol, diuron, fluoranthene, nonylphenol, parathion, pentachlorophenol	N	Toxicity	<i>Danio rerio</i>	Zielke et al. 2011
Sheets/Film	50 µm PE	K	in situ	PAHs	Y	C _{free}	NA	Devault et al. 2010
Sheets/Film	38 µm PE tube	E	laboratory-spiked	DDE, TCB, PAHs	N	C _{free}	NA	Lebo et al. 2003
Sheets/Film	26 µm PE	E	ex situ	PAHs	N	C _{free}	NA	Hale et al. 2010
Sheets/Film	25.5 µm PE tube	E	ex situ	PCBs	N	C _{free}	NA	Gschwend et al. 2011
Sheets/Film	25.4 µm PE tube	E	in situ, ex situ	PBDEs	Y	C _{free}	NA	Sacks and Lohmann 2012
Sheets/Film	25 µm PE	E	ex situ	PCDD/Fs	n	C _{free}	NA	Lambert et al. 2011
Sheets/Film	PE, (PE Tube Dialysis)	K	laboratory-spiked	PAHs	N	C _{free}	NA	MacRae and Hall 1998
Sheets/Film	500 µm POM	E	ex situ	PAHs	N	C _{free}	<i>Nereis diversicolor</i> , <i>Hinia reticulata</i>	Cornelissen et al. 2006a

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Sheets/Film	500 µm POM	E	ex situ	PAHs	N	C _{free}	NA	Cornelissen et al. 2006b
Sheets/Film	500 µm POM	E	ex situ	PAHs, PCBs	N	C _{free}	NA	Jonker and Koelmans 2001
Sheets/Film	500 µm POM	E	in situ, ex situ	PAHs, PCBs, PBDEs	N	C _{free}	NA	Koelmans et al. 2010
Sheets/Film	500 µm POM	E	ex situ	PAHs	N	C _{free} , bioaccumulation	<i>Hinia reticulata</i>	Oen et al. 2006
Sheets/Film	500 µm POM	E	ex situ	PAHs	N	C _{free} , bioaccumulation	<i>Nereis diversicolor</i> , <i>Hinia reticulata</i> , <i>Nuculoma tenuis</i>	Ruus et al. 2010
Sheets/Film	500 µm POM	E	ex situ	PCB-77	N	C _{free} , bioaccumulation	<i>Lumbriculus variegatus</i>	Sormunen et al. 2008
Sheets/Film	500 µm POM	E	ex situ	chlorpyrifos, pyrene, tetrachlorobiphenyl, tetrabromodiphenyl ether	N	C _{free} , bioaccumulation	<i>Lumbriculus variegatus</i>	Sormunen et al. 2010
Sheets/Film	500 and 55 µm POM	E	ex situ	PAHs	N	C _{free}	NA	Cornelissen et al. 2008a
Sheets/Film	76 µm POM	E	ex situ	PCBs	N	C _{free}	NA	Gschwend et al. 2011
Sheets/Film	76 µm POM	E	ex situ	PCBs	N	C _{free}	NA	Hawthorne et al. 2009

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Sheets/Film	76 µm POM	E	ex situ	PAHs	N	C _{free}	NA	Hawthorne et al. 2011a
Sheets/Film	76 µm POM	E	ex situ	PCBs	N	C _{free}	NA	Hawthorne et al. 2011b
Sheets/Film	76 µm POM	E	ex situ	PAHs	N	C _{free} , toxicity	<i>Lumbriculus variegatus</i>	Kupryianchyk et al. 2011
Sheets/Film	76 µm POM	E	ex situ	Petroleum hydrocarbons	N	C _{free} , bioaccumulation, remediation	<i>Lumbriculus variegatus</i>	Muijs and Jonker 2011
Sheets/Film	76 µm POM	E	ex situ	Petroleum hydrocarbons	N	bioaccumulation	<i>Lumbriculus variegatus</i>	Muijs and Jonker 2012
Sheets/Film	55 µm POM	E	ex situ	PAHs	N	C _{free} , bioaccumulation	<i>Nereis virens</i> , <i>Lumbriculus variegatus</i>	Barthe et al. 2008
Sheets/Film	55 µm POM	E	in situ, ex situ	PAHs, PCBs	N	C _{free}	NA	Cornelissen et al. 2008b
Sheets/Film	55 µm POM	E	ex situ	PCBs	N	C _{free} , bioaccumulation	<i>Lumbriculus variegatus</i>	Sun and Ghosh 2008
Sheets/Film	55 µm POM	E	ex situ	PAHs, PCBs	N	C _{free}	NA	Arp et al. 2011
Sheets/Film	17 µm POM	E	in situ, ex situ	PCDD/Fs, PCBs	N	C _{free}	NA	Cornelissen et al. 2008c
Sheets/Film	17 µm POM	E	in situ, ex situ	PCBs	Y	C _{free} , bioaccumulation, remediation	<i>Neanthes arenaceodentata</i>	Janssen et al. 2011

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Sheets/Film	17 µm POM	E	in situ	PCBs	Y	C _{free}	NA	Oen et al. 2011
Sheets/Film	POM	E	ex situ	PAHs, PCBs	N	C _{free}	NA	Eek et al. 2008
Sheets/Film	POM	E	in situ, ex situ	PAHs	N	C _{free} , bioaccumulation	<i>Lumbriculus variegatus</i>	Van der Heijden & Jonker 2009
Coated Fibers	200 µm PDMS	E	ex situ	PAHs	N	C _{free} , bioaccumulation	<i>Nereis virens</i> , <i>Lumbriculus variegatus</i>	Barthe et al. 2008
Coated Fibers	100 µm PDMS	E	laboratory-spiked	HOCs	N	C _{free}	NA	Yang et al. 2007
Coated Fibers	100, 30, 7 µm PDMS	E	laboratory-spiked	PAHs, PCBs, DDTs, chlordanes	N	C _{free}	NA	Maruya et al. 2009
Coated Fibers	65 µm PDMS	K	laboratory-spiked, ex situ	TNT	N	degradation, C _{free}	NA	Conder et al. 2003
Coated Fibers	35 µm PDMS	K	laboratory-spiked	PBDEs	N	C _{free}	NA	Jia et al. 2012
Coated Fibers	30 µm PDMS	E	laboratory-spiked	PAHs	N	C _{free}	NA	Gidley et al. 2012
Coated Fibers	30 µm PDMS	K	laboratory-spiked	permethrin	N	toxicity, C _{free}	<i>Chironomus dilutus</i>	Hunter et al. 2008

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Coated Fibers	30 µm PDMS	K	laboratory-spiked, ex situ	bifenthrin, cypermethrin, esfenvalerate, fenpropathrin, permethrin	N	C _{free} , K _{PDMS/w}	NA	Hunter et al. 2009
Coated Fibers	30 µm PDMS	K	laboratory-spiked	PCBs, PBDEs, HCH, HCB, HCBd	N	C _{free}	NA	Jahnke and Mayer 2010
Coated Fibers	30 µm PDMS	E	ex situ	PAHs	N	bioaccumulation, sediment capping	<i>Ilyodrilus templetoni</i>	Lampert et al. 2011
Coated Fibers	30 µm PDMS	K	laboratory-spiked	bifenthrin, cyfluthrin, fenpropathrin	N	toxicity, C _{free}	<i>Chironomus dilutus</i>	Xu et al. 2007
Coated Fibers	30 and 7 µm PDMS	E	laboratory-spiked, ex situ	pyrethroids	N	C _{free}	NA	Bondarenko et al. 2007
Coated Fibers	28.5 µm PDMS	E	laboratory-spiked	PAHs	N	C _{free}	NA	Haftka et al. 2010
Coated Fibers	28.5 µm PDMS	E	in situ	PAHs	N	C _{free} , bioaccumulation	<i>Lumbriculus variegatus</i>	Jonker & Van der Heijden 2007
Coated Fibers	28.5 µm PDMS	E	laboratory-spiked, ex situ	PAHs	N	C _{free}	NA	ter Laak et al. 2006
Coated Fibers	28.5 µm PDMS	E	ex situ	PAHs	N	bioaccumulation	<i>Lumbriculus variegatus</i>	Muijs and Jonker 2009

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Coated Fibers	28.5 µm PDMS	E	ex situ	Petroleum hydrocarbons	N	C _{free} , bioaccumulation, remediation	<i>Lumbriculus variegatus</i>	Muijs and Jonker 2011
Coated Fibers	28.5 µm PDMS	E	in situ	PAHs, Petroleum hydrocarbons	N	C _{free} , bioaccumulation	<i>Lumbriculus variegatus</i>	Muijs and Jonker 2012
Coated Fibers	28.5 µm PDMS	E	in situ, ex situ	PAHs	N	C _{free} , bioaccumulation	<i>Lumbriculus variegatus</i>	Van der Heijden & Jonker 2009
Coated Fibers	15 µm PDMS	E	laboratory-spiked	PAHs, PCBs, polychlorobenzene, DDE	N	C _{free} , bioaccumulation	<i>Tubificidae</i>	Kraaij et al. 2003
Coated Fibers	15 µm PDMS	E	laboratory-spiked, ex situ	PAHs, PCBs, polychlorobenzene, DDE	N	C _{free}	NA	Mayer et al. 2000
Coated Fibers	10 µm PDMS	E	in situ	OCPs, PAHs, PCBs	N	C _{free} , bioaccumulation, toxicity	<i>Neanthes arenaceodentata</i> , <i>Musculista senhousia</i> , <i>Eohaustorius estuarius</i> , <i>Neanthes arenaceodentata</i>	Burton et al. 2012

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Coated Fibers	10 µm PDMS	E	laboratory-spiked	permethrin, DDE	N	bioaccumulation	<i>Lumbriculus variegatus</i> , <i>Hexagenia sp.</i>	Harwood et al. 2012a
Coated Fibers	10 µm PDMS	E	laboratory-spiked	bifenthrin permethrin	N	bioaccumulation	<i>Lumbriculus variegatus</i> , <i>Hexagenia sp.</i>	Harwood et al. 2012b
Coated Fibers	10 µm PDMS	E	laboratory-spiked	bifenthrin	N	toxicity, C _{free}	<i>Hyalella azteca</i> <i>Chironomus dilutus</i>	Harwood et al. 2013a
Coated Fibers	10 µm PDMS	E	ex situ	pyrethroids	N	toxicity	<i>Hyalella azteca</i> <i>Chironomus dilutus</i> <i>Hexagenia sp.</i>	Harwood et al. 2013 b
Coated Fibers	10 µm PDMS	E	in situ	VOCs, PAHs, pesticides	N	C _{free} , toxicity, bioaccumulation	<i>Leptocheirus plumulosus</i> , <i>Mercenaria mercenaria</i>	Rosen et al. 2012
Coated Fibers	10 µm PDMS	E	ex situ	PCBs	N	bioaccumulation	<i>Lumbriculus variegatus</i>	Trimble et al. 2008
Coated Fibers	10 µm PDMS	E	ex situ	PAHs	N	C _{free}	NA	Witt et al. 2009
Coated Fibers	10 µm PDMS	E	ex situ	PAHs	N	C _{free}	NA	Witt et al. 2010

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Coated Fibers	10 µm PDMS	E	laboratory-spiked	HCBP, DDE, permethrin, chlorpyrifos, phenanthrene	N	bioaccumulation	<i>Lumbriculus variegatus</i>	You et al. 2006
Coated Fibers	10 µm PDMS	E	laboratory-spiked	HCBP, DDE, permethrin, chlorpyrifos, phenanthrene	N	C _{free}	NA	You et al. 2007a
Coated Fibers	10 µm PDMS	E	laboratory-spiked	Permethrin, DDT	N	toxicity	<i>Hyalella azteca</i> , <i>Chironomus dilutus</i>	Ding et al. 2013
Coated Fibers	10 µm PDMS	E	ex situ	PCBs	N	bioaccumulation	<i>Lumbriculus variegatus</i>	You et al. 2007b
Coated Fibers	7 µm PDMS	E	laboratory-spiked	PAHs	N	C _{free}	NA	Hawthorne et al. 2005
Coated Fibers	7 µm PDMS	E	laboratory-spiked, ex situ	PAHs	N	C _{free} , toxicity	<i>Hyalella azteca</i>	Hawthorne et al. 2007
Coated Fibers	7 µm PDMS	E	laboratory-spiked	PCBs	N	bioaccumulation	Tubificidae, Chironomidae	Maenpaa et al. 2011
Coated Fibers	85 µm PA	E	laboratory-spiked	Fipronil	N	degradation, C _{free}	NA	Brennan et al. 2009

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Coated Fibers	85 µm PA	E	laboratory-spiked	TNT	N	toxicity	<i>Tubifex tubifex</i>	Conder and La Point 2005
Coated Fibers	85 µm PA	E	laboratory-spiked	2ADNT	N	toxicity	<i>Tubifex tubifex</i>	Bowen et al. 2006
Coated Fibers	85 µm PA	E	laboratory-spiked	4ADNT	N	toxicity	<i>Tubifex tubifex</i>	Bowen et al. 2006
Coated Fibers	85 µm PA	K	laboratory-spiked, ex situ	TNT	N	degradation, C _{free}	NA	Conder et al. 2003
Coated Fibers	85 µm PA	E	laboratory-spiked	TNT	N	toxicity	<i>Tubifex tubifex</i>	Conder et al. 2004a
Coated Fibers	85 µm PA	E	laboratory-spiked	TNT	N	toxicity	<i>Tubifex tubifex</i> <i>Chironomus tentans</i>	Conder et al. 2004b
Coated Fibers	70 and 50 µm carbowax-templated resin	K	laboratory-spiked, ex situ	TNT	N	degradation, C _{free}	NA	Conder et al. 2003
Coated Fibers	70 µm carboxen-divinyl benzene	K	laboratory-spiked, ex situ	TNT	N	degradation, C _{free}	NA	Conder et al. 2003
Coated Fibers	SPME	E	laboratory-spiked, ex situ	PAHs	N	C _{free} , toxicity	<i>Hyaella azteca</i>	Kreitinger et al. 2007

Table SI-1. Continued

Configuration	Phase characteristics	Region	Experimental conditions	Contaminants	PRC ^a	Endpoints ^b	Species	Reference
Coated Vials	2,4,8,16 µm PDMS	E	laboratory-spiked	PCBs	N	bioaccumulation	Tubificidae, Chironomidae	Maenpaa et al. 2011
Coated Vials	2, 4, 8 µm PDMS	E	ex situ	PCBs	N	C _{free}	NA	Jahnke et al. 2012
Coated Vials	0.05 µm EVA	K	laboratory-spiked	PAHs	N	C _{free} , bioaccumulation	<i>Corophium colo</i>	Golding et al. 2007
Coated Vials	0.05 µm EVA	K	laboratory-spiked	PAHs	N	C _{free} , bioaccumulation	<i>Corophium colo</i>	Golding et al. 2008
Coated Vials	EVA	E	laboratory-spiked, in situ	tetrachlorobenzene, pentachlorobenzene, hexachlorobenzene, PCBs	N	bioaccumulation	<i>Macoma balthica</i>	Meloche et al. 2009

^aPerformance Reference Compound (PRC)

^bToxicity as an endpoint is currently limited primarily to measures of mortality.

^cEquilibrium region

^dKinetic region