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APPENDIX

Appendix-A

The results of optimum conditions (Table)

Table A-1 The effect of sorbent mass on the percent recovery for each OPs in mixture solution at 1.00 ppm

Compounds	C_{18} SPE mass (mg)	Conc. before extraction(ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Malathion	100	1.00	20.91	104.55	±3.93
	200	1.00	19.89	99.48	±5.90
	300	1.00	19.06	95.30	±4.08
	400	1.00	19.86	99.32	±6.03
	500	1.00	20.45	20.45	±2.46
Methyl parathion	100	1.00	20.29	101.45	±1.30
	200	1.00	20.43	102.13	±3.97
	300	1.00	19.69	98.4	±4.79
	400	1.00	19.21	96.06	±6.22
	500	1.00	19.37	96.88	±5.58
Profenofos	100	1.00	20.44	102.22	±2.65
	200	1.00	16.27	81.35	±2.03
	300	1.00	6.77	33.85	±3.54
	400	1.00	2.69	13.47	±3.48
	500	1.00	ND	-	-
Chlorpyrefos	100	1.00	70.60	70.60	±2.35
	200	1.00	40.78	40.78	±1.13
	300	1.00	ND	-	-
	400	1.00	ND	-	-
	500	1.00	ND	-	-

Remark : ND = Not Detectable

Triplicate analysis

Table A-2 The effect of volume of mixture solution on the percent recovery for each OPs at 1.00 ppm (100 mg C_{18}SPE)

Compounds	Volume of aq.sol (mL)	Conc. before extraction(ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Malathion	500	1.00	9.72	48.64	±2.03
	400	1.00	13.32	80.91	±0.69
	300	1.00	9.67	80.60	±1.07
	200	1.00	6.68	83.56	±0.56
	100	1.00	3.44	86.07	±0.52
Methyl parathion	500	1.00	9.18	45.93	±0.78
	400	1.00	16.07	100.43	±1.57
	300	1.00	8.58	99.34	±0.61
	200	1.00	7.50	93.78	±0.58
	100	1.00	3.57	89.16	±0.40
Profenofos	500	1.00	19.99	99.96	±0.91
	400	1.00	14.55	90.97	±0.64
	300	1.00	10.18	84.87	±0.49
	200	1.00	7.99	99.91	±0.66
	100	1.00	3.98	99.57	±0.71
Chlorpyrefos	500	1.00	6.38	31.88	±0.47
	400	1.00	4.50	28.15	±1.17
	300	1.00	3.09	25.71	±1.44
	200	1.00	1.33	20.82	±2.45
	100	1.00	2.05	51.19	±1.13

Remark : ND = Not Detectable
Triplicate analysis

Table A-3 The effect of volume of mixture solution on the percent recovery for each OPs at 1.00 ppm (500 mg C_{18} SPE)

Compounds	Volume of aq.sol(mL)	Conc. before extraction (ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Malathion	500	1.00	20.42	102.07	±2.10
	400	1.00	16.16	101.01	±1.37
	300	1.00	8.59	71.57	±0.95
	200	1.00	6.86	85.68	±0.74
	100	1.00	3.20	80.13	±0.45
Methyl parathion	500	1.00	20.21	100.84	±2.48
	400	1.00	15.90	99.39	±0.94
	300	1.00	11.82	98.56	±0.39
	200	1.00	7.21	90.06	±0.79
	100	1.00	3.45	86.24	±0.48
Profenofos	500	1.00	ND	-	-
	400	1.00	ND	-	-
	300	1.00	ND	-	-
	200	1.00	ND	-	-
	100	1.00	ND	-	-
Chlorpyrefos	500	1.00	ND	-	-
	400	1.00	ND	-	-
	300	1.00	ND	-	-
	200	1.00	ND	-	-
	100	1.00	ND	-	-

Remark : ND = Not Detectable
Triplicate analysis

Table A-4 The effect of elution solvent ($MeOH/H_2O$) on the percent recovery for Malathion and Methyl parathion in mixture solution at 1.00 ppm using 100 mg C_{18} SPE cartridge

Compounds	Ratio of $MeOH/H_2O$	Conc. before extraction (ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Malathion	90:10	1.00	18.04	90.19	±0.54
	80:20	1.00	17.39	86.97	±0.38
	70:30	1.00	16.73	83.66	±0.57
	60:40	1.00	16.19	80.95	±1.01
	50:50	1.00	15.66	75.69	±0.70
	40:60	1.00	8.81	44.08	±0.75
	30:70	1.00	ND	-	-
	20:80	1.00	ND	-	-
	10:90	1.00	ND	-	-
Methyl parathion	90:10	1.00	18.97	94.86	±0.84
	80:20	1.00	18.19	90.98	±0.79
	70:30	1.00	17.15	85.75	±0.49
	60:40	1.00	16.42	82.10	±0.18
	50:50	1.00	15.79	78.96	±0.71
	40:60	1.00	5.55	27.73	±1.58
	30:70	1.00	ND	-	-
	20:80	1.00	ND	-	-
	10:90	1.00	ND	-	-

Remark : ND = Not Detectable
Triplicate analysis

Table A-5 The effect of elution solvent ($MeOH/H_2O$) on the percent recovery for Profenofos and Chlorpyrifos in mixture solution at 1.00 ppm using 100 mg C_{18} SPE cartridge

Compounds	Ratio of $MeOH/H_2O$	Conc. before extraction (ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Profenofos	90:10	1.00	16.44	82.20	±0.36
	80:20	1.00	15.95	79.77	±0.60
	70:30	1.00	14.82	74.12	±0.31
	60:40	1.00	8.16	40.78	±1.08
	50:50	1.00	ND	-	-
	40:60	1.00	ND	-	-
	30:70	1.00	ND	-	-
	20:80	1.00	ND	-	-
	10:90	1.00	ND	-	-
Chlorpyrefos	90:10	1.00	16.43	82.14	±0.43
	80:20	1.00	14.97	74.83	±1.04
	70:30	1.00	9.20	46.01	±1.91
	60:40	1.00	ND	-	-
	50:50	1.00	ND	-	-
	40:60	1.00	ND	-	-
	30:70	1.00	ND	-	-
	20:80	1.00	ND	-	-
	10:90	1.00	ND	-	-

Remark : ND = Not Detectable

Triplicate analysis

Table A-6 The effect of elution solvent (ACN/H_2O) on the percent recovery for Malathion and Methyl parathion in mixture solution at 1.00 ppm using 100 mg C_{18} SPE cartridge

Compounds	Ratio of ACN/H_2O	Conc. before extraction(ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Malathion	90:10	1.00	20.06	100.31	±0.95
	80:20	1.00	19.97	99.87	±1.11
	70:30	1.00	19.75	98.75	±0.39
	60:40	1.00	20.00	100.00	±1.13
	50:50	1.00	18.80	94.00	±0.94
	40:60	1.00	7.66	38.30	±1.67
	30:70	1.00	0.29	1.46	±4.13
	20:80	1.00	ND	-	-
	10:90	1.00	ND	-	-
Methyl parathion	90:10	1.00	18.59	92.96	±0.40
	80:20	1.00	18.61	93.05	±0.76
	70:30	1.00	19.22	96.09	±0.16
	60:40	1.00	20.19	100.96	±1.51
	50:50	1.00	19.84	99.21	±0.67
	40:60	1.00	12.08	60.41	±0.69
	30:70	1.00	9.71	4.85	±3.29
	20:80	1.00	ND	-	-
	10:90	1.00	ND	-	-

Remark : ND = Not Detectable
Triplicate analysis

Table A-7 The effect of elution solvent (ACN/H_2O) on the percent recovery for Profenofos and Chlorpyrifosin mixture solution at 1.00 ppm using 100 mg C_{18} SPE cartridge

Compounds	Ratio of ACN/H_2O	Conc. before extraction(ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Profenofos	90:10	1.00	12.22	61.12	±0.75
	80:20	1.00	12.37	61.87	±0.24
	70:30	1.00	13.75	68.76	±1.49
	60:40	1.00	19.98	99.89	±1.92
	50:50	1.00	12.39	61.99	±1.31
	40:60	1.00	1.93	9.65	±0.21
	30:70	1.00	ND	-	-
	20:80	1.00	ND	-	-
	10:90	1.00	ND	-	-
Chlorpyrefos	90:10	1.00	12.15	60.74	±0.81
	80:20	1.00	12.74	63.71	±0.72
	70:30	1.00	13.59	67.98	±0.72
	60:40	1.00	16.96	84.81	±0.47
	50:50	1.00	11.00	55.03	±0.25
	40:60	1.00	2.56	12.80	±0.86
	30:70	1.00	ND	-	-
	20:80	1.00	ND	-	-
	10:90	1.00	ND	-	-

Remark : ND = Not Detectable
Triplicate analysis

Table A-8 The results of volume of elution solvent (60%acetonitrile)on the percent recovery for Malathion and Methyl parathion in mixture solution at 1.00 ppm

Compound	Volume of 60/40(ACN/H_2O) (ml)	Conc. before) extraction (ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Malathion	1.0	1.00	2.74	27.45	±1.89
	2.0	1.00	7.66	76.63	±2.07
	3.0	1.00	13.58	82.46	±0.25
	4.0	1.00	22.24	88.94	±1.79
	5.0	1.00	18.34	91.68	±0.62
	6.0	1.00	11.60	68.24	±0.56
	7.0	1.00	8.21	57.41	±0.43
	8.0	1.00	6.91	55.31	±1.89
	9.0	1.00	6.22	55.99	±0.68
	10.0	1.00	5.39	53.95	±1.43
Methyl parathion	1.0	1.00	4.01	40.11	±2.39
	2.0	1.00	7.90	79.04	±3.89
	3.0	1.00	14.09	85.42	±0.59
	4.0	1.00	22.06	88.27	±0.45
	5.0	1.00	19.71	98.55	±2.40
	6.0	1.00	15.82	93.07	±1.91
	7.0	1.00	9.58	67.00	±1.43
	8.0	1.00	8.14	65.10	±0.23
	9.0	1.00	7.09	63.80	±0.64
	10.0	1.00	6.00	60.02	±1.62

Remark : ND = Not Detectable
Triplicate analysis

Table A-9 The results of volume of elution solvent (60%acetonitrile) on the percent recovery for Profenofos and Chlorpyrifos in mixture solution at 1.00 ppm

Compound	Volume of 60/40(ACN/H_2O) (ml)	Conc. before) extraction (ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Profenofos	1.0	1.00	ND	-	-
	2.0	1.00	1.93	19.33	±2.14
	3.0	1.00	7.91	47.96	±1.27
	4.0	1.00	16.17	64.71	±0.69
	5.0	1.00	17.76	88.84	±0.43
	6.0	1.00	14.89	87.58	±0.49
	7.0	1.00	12.77	89.32	±0.70
	8.0	1.00	11.63	93.07	±0.32
	9.0	1.00	10.60	95.46	±0.53
	10.0	1.00	9.74	97.42	±0.25
Chlorpyrefos	1.0	1.00	ND	-	-
	2.0	1.00	ND	-	-
	3.0	1.00	3.61	21.89	±1.23
	4.0	1.00	10.50	42.00	±1.31
	5.0	1.00	15.71	78.55	±0.73
	6.0	1.00	13.76	80.96	±1.01
	7.0	1.00	11.97	83.75	±0.41
	8.0	1.00	10.94	87.57	±0.55
	9.0	1.00	10.25	92.22	±0.35
	10.0	1.00	9.61	96.11	±0.43

Remark : ND = Not Detectable

Triplicate analysis

Table A-10 The effect of SPE vacuum pump (in.Hg) on the percent recovery for OPs in mixture solution at 1.00 ppm

Compounds	SPE pump (in.Hg)	Conc. before extraction(ppm)	Conc. after extraction (ppm)	Recovery (%)	RSD (%)
Malathion	3.0	1.00	18.69	93.46	±0.27
	5.0	1.00	18.79	93.97	±0.45
	7.0	1.00	19.11	95.55	±0.51
	10.0	1.00	19.35	96.77	±0.36
	12.0	1.00	19.48	97.39	±0.51
	15.0	1.00	19.35	96.78	±0.74
	17.0	1.00	19.61	98.04	±0.41
	20.0	1.00	19.72	98.59	±0.56
	22.0	1.00	19.18	95.91	±0.38
Methyl parathion	3.0	1.00	18.46	92.32	±1.39
	5.0	1.00	18.95	94.73	±0.34
	7.0	1.00	19.06	95.31	±0.50
	10.0	1.00	19.09	95.44	±0.32
	12.0	1.00	18.89	94.45	±0.74
	15.0	1.00	19.33	96.67	±0.58
	17.0	1.00	19.81	99.06	±0.67
	20.0	1.00	19.96	99.82	±1.31
	22.0	1.00	19.40	97.02	±0.49
Profenofos	3.0	1.00	13.66	68.31	±1.77
	5.0	1.00	15.32	76.57	±0.61
	7.0	1.00	16.96	84.80	±0.55
	10.0	1.00	16.85	84.24	±1.07
	12.0	1.00	17.03	85.15	±0.21
	15.0	1.00	17.76	88.78	±1.02
	17.0	1.00	18.16	90.78	±0.75
	20.0	1.00	17.18	85.91	±0.59
	22.0	1.00	15.92	79.58	±0.77
Chlorpyrefos	3.0	1.00	4.93	24.98	±2.84
	5.0	1.00	7.97	39.83	±2.01
	7.0	1.00	8.32	41.06	±1.23
	10.0	1.00	8.61	43.05	±1.97
	12.0	1.00	8.95	44.76	±2.63
	15.0	1.00	11.25	56.24	±0.64
	17.0	1.00	14.50	71.51	±0.73
	20.0	1.00	9.51	47.57	±1.24
	22.0	1.00	8.98	44.92	±1.74

Appendix-B

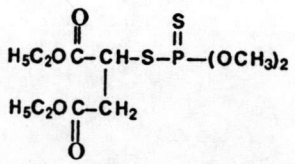
Characteristic of the four OPs pesticides

Malathion (Richardson and Gangolli, 1994)

Function : Insecticides

Chemical Name : S-(1,2-bis(ethoxycarbonyl)ethyl O,O-dimethyl phosphorodithioate;

Formula : $C_{10}H_{19}O_6PS_2$ **Mol.Wt.** 330.36



Trade Name : carbofos, mercaptothion, phosphothion, moldison, sodophos

Physical properties :

M.Pt. 2.9^0 C; **B.Pt.** 156-157^0 C; **Specific gravity** d^{25}_4 1.2315; **Partition coefficient** log P_{ow} 2.36(1); **Volatility** v.p. 4×10^{-5} mm Hg at 30^{0}C.

Solubility :

Water: 145 mg l^{-1} at 20^0 C. Organic solvent: esters, alcohols, ethers, ketones, aromatic and alkylated aromatic hydrocarbons, vegetable oils.

Occupational exposure:

US TLV (TWA) 10 mg m^{-3} ; **UK Long-term limit** 10 mg m^{-3}; **Supply classification** harmful. **Risk phrases** Harmful if swallowed. **Safety phrases** avoid contact with skin.

Ecotoxicity:

Fish toxicity:

LD_{50} (96 hr) bluegil sunfish, bass, brown trout, rainbow trout 0.1-0.29 mg l^{-1}

LC_{50} (48) carp 9.80-10.04 mg l^{-1}

Snakehead fish (6 months resulting to spawning phase) 0.02 mg l^{-1}

Invertebrate toxicity:

LC_{50} (24, 48, 72, 96 hr) freshwater carb 8.9, 6.5, 3.8 ppm, respectively.

Anabaena oryzae and *Phormidium fragile* 93.5% and 85.7% of applied dose recovered in respiration the metabolited were mono-and dicarboxylic acid, mercaptoethyl succinate, mono- and di-ethylsuccinate.

Bioaccumulation:

Bioconcentration factor for carp in muscle, liver and kidney 2.7-17.3

Bioconcentration factor coho salmon 29.3

Degradation studies:

The time required for complete biodegradation in a model river water were 8, 12 and 18 days for 5, 10 and 15 mg dm^{-3}, respectively. Rate of degradation in 10 days 81-92% in various non-sterile loam soil and 5-19% in various sterile loam soils.Unsterile seawater and sedimented cores under laboratory light at 20^0 C, pH 8 $t_{1/2}$ 2.6 and 20 days, respectively.

Mammalian and avian toxicity

Acute data

LD_{50} oral mouse, rat 190, 290 mg kg^{-1}, respectively

LC_{50} oral redwing blackbird 400 mg kg^{-1} diet.

LC_{50} (4 hr) inhalation rat 84.6 mg m^{-3}

LD_{50} (24 hr) dermal rabbit 4100 mg kg^{-1}

LD_{50} intraperitoneal rat,mouse 193, 250 mg kg^{-1}, respectively.

Legislation:

Limited under EC Directive on Drinking Water Quality 80/778/EEC.

Pesticieds: maximum admissible concentration 0.1 μg l^{-1} .Included in

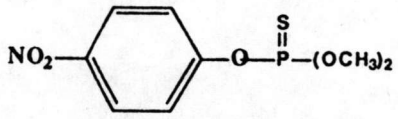
Schedule 6 (Release into Land: Prescribed Substances) Statutory Instrument No. 472, 1991.UK Department of Environment advisory value for drinking water 7 $\mu g\ l^{-1}$.

Methyl Parathion (Richardson and Gangolli, 1994)

Function : Insecticide

Chemical Name : O,O-dimethyl O-4-nitrophenyl phosphorothioate

Formula : $C_8H_{10}NO_5PS$ **Mol.Wt.** 263.21



Trade Name : Dalf (Bayer), Nitrox 80 (Bayer), Bladan (Bayer), Tekwaisa Folidoc M (Bayer),Metron Metacide (Bayer), Patron M

Occurrence: Residues have been isolated from water, sediments, soil, crops and in fish tissues.

Physical properties:

M.Pt.35 - 38^0 C; **B.Pt**. 154^0 C; **Specific gravity** d_4^{20} 1.358; **Partition coefficient** log P_{ow} 3.11 ; **Volatility** v.p. 9.7×10^{-6} mmHg at 20^0 C.

Solubility:

Water: 50 mg l^{-1} at 20^0 C. Organic solvent; acetone, benzene chloroform,diethyl ether, dichloromethane, carbon tetrachloride,ethanol, mineral oils.

Occupational exposure:

UK Long-term limit 0.2 mg m^{-3}; **UK Short-term limit** 0.6 mg m^{-3}; **UN No.**2783; **Supply classification** very toxic. **Risk phrases** Toxic in contact with skin very toxic if swallowed. **Safety phrases** After contract with skin, wash immediately with plenty of soap and water. Water suitable protective clothing and gloves. In case of accident or if you feel unwell, seek medical advice immediately.

Ecotoxicity

Fish toxicity:

LC_{50} (96 hr) golden orfe, rainbow trout, flathead minnow, large-mouth bass 2.7-8.9 mg l^{-1}

Invertebrate toxicity:

LC_{50} (96 hr) sand shrimp, grass shrimp, hermit crab 2-7 μg l^{-1}

Degradation studies

Degraded to carbon dioxide and water by a *Bacillus sp.* isolated from soil. A mixed bacterial culture from the soil, including a *Pseudomonas sp.* could not utilise methyl parathion as a sole carbon source. In anaerobic sediments, aminomethyl parathion was identified as the reduction product. In heat-sterilised sediments the rate of reduction was halved.

Mammalian and avian toxicity

Acute data

LD_{50} oral rat, mouse 14,200 mg kg^{-1}, respectively.

LD_{50} oral starling, redwing blackbird 7.5, 10 mg kg^{-1}, respectively.

LD_{50} (4 hr) inhalation rat 34 mg m^{-3}.

LD_{50} dermal mouse 1200 mg kg^{-1}.

LD_{50} subcutaneous rat, mouse 6, 18 mg kg^{-1}, respectively.

LD_{50} intraperitoneal rat, mouse 2.8, 5.4 mg kg^{-1}

LD_{50} intravenous rat, mouse 9.0, 9.8 mg kg^{-1}

Legislation

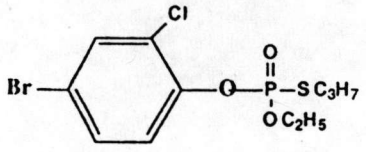
Limited under EC Directive on Drinking Water Quality 80/778/ EEC. Pesticides: maximum admissible concentration 0.1 $\mu g\ l^{-1}$. Included in Schedule 6 (Release into Land: Prescribed Substances) Statutory Instrument No. 472, 1991. EEC maximum residue level for fruit and vegetables 0.2 ppm. Tolerable daily intake (TDI) human 0.02 $mg\ kg^{-1}$.

Profenofos (Richardson and Gangolli, 1994)

Function : Insecticide and acaricide

Chemical Name : O-(4-Bromo-2-chlorophenyl) O-ethyl-S-propyl phosphorothioate

Formula : $C_{11}H_{15}BrClO_3PS$ **Mol.Wt.** 373.64



Trade Name : CGA-15324 (Ciba Geigy)
Curacron (ciba-Geigy)

Physical properties:

B.Pt 110^0 C; **Specific gravity** d^{20} 1.455; **Partition coefficient** l^{-1} at 20^o C; **Volatility** v.p. 9.75×10^{-6} mmHg at 20^0 C.

Solubility: Water: 20 $mg\ l^{-1}$ at 20^0 C.

Occupational exposure:

UN No. 3018; **Supply classification** harmful.

Risk phrases Harmful by inhalation, in contact with skin and if swallowed.

Safety phrases Wear suitable protective clothing and gloves.

Ecotoxicity

Fish toxicity:

LC50 (96 hr) rainbow trout, crucian carp, bluegill sunfish 0.08-0.3 mg l^{-1}.

Mammalian and avian toxicity

Acute data

LD_{50} oral rat, rabbit 358, 700 mg kg^{-1}, respectively.

LD_{50} oral chicken 1900 μg kg^{-1}.

LC_{50} (4 hr) inhalation rat 3 mg l^{-1}

LD_{50} dermal rabbit 472 mg kg^{-1}.

Carcinogenicity and long-term effects

No effect level in 2 years feeding trial in rats 0.38 mg kg^{-1} diet.

No effect level in 18 month feeding trials in mice 0.08 mg kg^{-1} diet.

Legislation

EC maximum residue limit in maize 0.05 ppm.

Limited under EC Directive on Drinking Water Quality 80/778/EEC.

Pesticides: maximum admissible concentration 0.1 μg l^{-1}

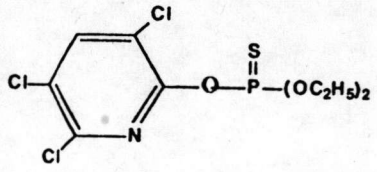
Chlorpyrifos (Richardson and Gangolli, 1994)

Function : Insecticide

Chemical Name : O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate

Trade Name : Dowco 179, DursbanL, Orsban

Formula : $C_9H_{11}C_{l3}NO_3PS$ **Mol.Wt.** 350.59



Occurrence: Residues have been isolated from soils, crops and animal fats.

Physical properties:

M.Pt. 42^0 C; **B.Pt.** 160^0 C (decomp.); **Specific gravity** d^{43}_1 1.398; **Partition coefficient** log P_{ow} 5.11; **Volatility** v.p. 1.87×10^{-5} mmHg at 25^0 C.

Solubility

Water: 2 mg l^{-1} 25^0 C. organic solvent: isooctane, methanol

Occupational exposure

US TLV (TWA) 0.2 mg m^{-3}; **UK long-term limit** 0.2 mg m^{-3}; **UK Short-term limit** 0.6 mg m^{-3}; **Supply classification** toxic.

Risk phrases Toxic in contact with skin and if swallowed.

Safety phrases After contact with skin, wash immediately with plenty of soap and water. Wear suitable protective clothing and gloves-If you feel unwell, seek medical advice.

Ecotoxicity

Fish toxicity

LC_{50} (24 hr) goldfish 0.18 mg l^{-1}.

LC_{50} (96 hr) rainbow trout 0.003 - 0.011 mg l^{-1}

LC_{50} (96 hr) catfish 11.1 mg l^{-1}

Invertebrate toxicity

LC_{50} (96 hr) *Gammarus lacustris, Gammarus fasciatus* 0.11- 0.32 μg l^{-1}.

Degradation studies

$t_{1/2}$ in dry loam soil 4 weeks and in silt loam 12 weeks. In both these soils sterilised by autoclaving $t_{1/2}$ was 24 weeks.

Mammalian and avian toxicity

Acute data

LD_{50} oral rat 135-160 mg kg^{-1}

LD_{50} oral guinea pig 504 mg kg^{-1}

LD_{50} oral rabbit 1000-2000 mg kg^{-1}

LD_{50} oral redwing blackbird, starling 13-75 mg kg^{-1}

LD_{50} (4 hr) inhalation rat > 0.2 mg kg^{-1}

LD_{50} dermal rabbit ≈ 2000 mg kg^{-1}

Legislation:

Limited under EC Directive on Drinking Water Quality 80/778/ EEC.

Pesticides: maximum admissible concentration 0.1 μg l^{-1}.

Appendix-C

GLOSSARY OF TERMS

CAPACITY :

The total mass of isolates and/or interferances that a specific sorbent mass can retain in a given solvent environment. Capacity of a sorbent for a specific isolate is a function of the solvent or matrix environment. In general, the maximum retentive capacity of sorbent is a few percent of the sorbent mass.

C-18 :

Functional group: Octadecyl

(18-carbon straight-chain hydrocarbon)

Primary interaction: Non-Polar

Secondary interactions: Polar, Cation Exchange

Comments:

C_{18} is the most non-polar sorbent available. It is the most retentive of all sorbents for isolates being retained by a non polar mechnism. Extremely non-polar compounds are often difficult to elute from C_{18}. Conversely, C_{18} does not retain certain very polar molecules such as carbohydrates. C_{18} is generally regarded as the least selective sorbent, since it retains almost anything from aqueous matrices often a benefit when the isolates vary widely in structure. Because of C_{18}'s low selectivity, final extracts are often not as pure as they are when more selective sorbents are employed. C_{18} is excellent for desalting matrices prior to ion exchange because salts pass through it unretained. The potential for significant with C_{18} than with any other sorbent because of the predominant effect of the long hydrocarbon chain.

ELUTION :

Removal of a chemical species from a sorbent by changing the solvent or matrix chemistry to disrupt the isolate/sorbent interaction. Strength of an elution solvent refers to the effectiveness of the solvent for eluting an isolate or interferences from a particular sorbent. For example, non-polar solvents are strong eluters for non-polar sorbents, whereas polar solvents are weak elution solvents for non-polar sorbents.

EXTRACTION :

Transfer of the chemical species from one phase into another. In sorbent extraction, transfer of the species of the interest from the matrix environment onto the solvent (elution). Isolate purification is effected by a series of selective extraction steps.

INTERACTION :

Attraction or repulsion between two chemical species in a specific chemical environment. In sorbent extraction, the three principal interactions are isolate/sorbent, matrix/sorbent, and isolate/matrix. Specific possible interactions include non-polar, polar, ion-exchange, covalent and a variety of others.

INTERFERENCES :

Undesired components in the sample matrix. In sorbent extraction two types of interferences exist. These are retention interferences, that inhibit isolate retention on a sorbent by competition or by interaction with the isolate, and detection interferences, that interfere with the final analysis or end use of the isolate and therefore must be removed from the sample.

ISOLATE :

The compounds of interest to be isolated from the sample matrix.

MATRIX :

The sample environment from which the isolate is to be extracted. A blank matrix is one that does not contain the isolate. The matrix is important in sorbent extraction because retention of the particular isolate on a given sorbents is strongly influenced by the chemistry of the matrix.

NON-POLAR :

A commonly used mechanism in sorbent extraction. Non-polar interactions occur between non-polar isolate functional groups and non-polar functional groups on the surface of the sorbent. Also refers to functionalgroupsthat exhibit predominantly van der waals interactions. Thus C18 is referred to as a non-polar sorbent because of its hydrocarbon chain.

NORMAL PHASE :

Silica, Diol, NH_2 and CN Extract-clean bonded and non-bond phases are available in this separation mode. In normal, or adsorption, phase separation, polar sample constituents are preferentially retained by the solid phase and eluted with use of polar solvent systems. Normal phase SPE systems are usually employed in sample-presituations involving a polar to moderately polar analyte in a non-polar matrix.

POLAR :

A commonly used mechanism in sorbent extraction. Polar interactions occur between isolate functional groups exhibiting dipole moments, and similar groups on the sorbent. Also refers to the functional groups themselves. For example unbonded silica is a very polar sorbent because of the high content of Silanols.

RETENTION :

The attraction of a chemical species for a sorbent such that the species is immobilized on the sorbent. The degree of this attraction is referred to as the strength of the retention. This attraction is due to one of the chemical interactions.

REVERSE PHASE :

C_{18}, C_8, C_2 and CH Extract-clean bonded phase are available in this separation mode. In reverse phase separations, non-polar sample constituents are preferentially retained by the bonded phase and eluted with use of non-polar solvent systems. Moderately polar, organic samples may also be retained by reverse phase SPE products and, since the attractive forces are not as those involved in non-polar interaction, eluted with more polar solvent systems. Reverse phase sample/sorbent/solvent interactions are very similar to those found in liquid/liquid partition systems. Reverse phase SPE systems are often the first choice for sample systems involving a non-polar to moderately polar analyte in an aqueous or polar matrix.

SOLVATION :

The process that prepares a sorbent for sample application. In most cases, solvation consists of 2-3 steps: first, a wetting of the sorbent with an organic solvent (this solvent should be miscible with the solvent used in the next step), followed by removal of excess wetting solvent off the sorbent using a solvent similar to the sample

matrix to be applied. A solvated sorbent is one that has been processed in this manner. Solvation is important to retention of chemical species since an improperly solvated may retain nothing.

SORBENT :

The porous, chemically modified silica used for selective extraction of chemical species from liquids. The sorbents described in this handbook are 40 μm particle size, 60 angstrom porosity bonded silica gels.

Biography

Miss Pranee Tethgatuk received a Bachelor Degree of Science (Chemistry) from Faculty of Science, Bhurapha University in 1991. After graduation, she worked at Scientific and Technological Research Equipment centre (STREC) of Chulalongkorn University since 1992 to present. Then in 1994, she has continue studied in Interdisciplinary Programme in Environmental Science, Graduate school, Chulalongkorn University.