Environmental Application, Fate, Effects and Concerns of Ionic Liquids: A Review
Supporting Information

Meseret Amde,[†,§] *Jing-Fu Liu,*[*,†,‡] *and Long Pang*[#]

[†]State Key Laboratory of Environmental Chemistry and Ecotoxicology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, P. O. Box 2871, Beijing 100085, China

[‡]Institute of Environment and Health, Jianghan University, Hubei Province, Wuhan 430056, China

[§]College of Resources and Environment, University of Chinese Academy of Sciences, Beijing 100049, China

[#]Department of Material and Chemical Engineering, Zhengzhou University of Light Industry, No. 166, Science Avenue, Zhengzhou 450001, China

Total Tables: 7

Total Pages: 18

* Corresponding author

E-mail: jfliu@rcees.ac.cn

Fax: +86-10-62849192

Table S1. The application of ionic liquids (ILs)inextraction of environmental pollutants

ILs	Pretreatment methods	Contaminants	Sample	Ref.
$[C_6MIM][NTf_2]$	Single drop microextraction	2,4,6-tricholoroanisole	Water and Wine Wine	[1,2]
$[C_4MIM][PF_6]$	Single drop microextraction	Cadmium	Rice and Water	[3]
$[C_4MIM][PF_6]$	Single drop microextraction	Lead	Water	[4]
$[C_8MIM][PF_6]$	Head space single drop microextraction	Musk fragrances	Water	[5]
$[C_6MIM][BF_4]$	Head space single drop microextraction	Flavor compounds	Fruit juices	[6]
$[C_8MIM][PF_6]$	Hollow fiber liquid-phase microextraction	Chlorophenols	Water	[7]
$[C_8MIM][PF_6]$	Hollow fiber liquid-phase microextraction	Sulfonamides	Water	[8]
$[C_6MIM][PF_6]$	Hollow fiber liquid-phase microextraction	Lead and nickel	Water	[9]
Functionalized ILs containing FAP anion	Dispersive liquid-liquid microextraction	Emerging contaminants	Water	[10]
$[C_4MIM][PF_6]$	Dispersive liquid-liquid microextraction	Tetracycline Antibiotics	Water	[11]
$[C_4MIM][PF_6]$, $[C_6MIM][PF_6]$, $[C_8MIM][PF_6]$ Extraction Solvent $[C_4MIM][BF_4]$, $[C_2MIM][BF_4]$, $[C_4MIM][NO_3]$ Dispenser	Dispersive liquid-liquid microextraction	Triclosan (TCS) Triclocarban (TCC)	Water	[12]
$[C_{10}\text{-NMDG}][Cl]$, peracetylated $[C_{10}NMDG][Cl]$	Dispersive liquid-liquid microextraction	Boron	Water	[13]
$[C_6MIM][PF_6]$ as solvent $[C_4MIM][BF_4]$ dispenser	Ultrasonic assisted dispersive liquid-liquid microextraction	Sulfonamides	Milk powder	[14]
$[C_8MIM][PF_6]$	Ultrasonic assisted dispersive liquid-liquid microextraction	Acaricides	Water	[15]
$[C_4MIM][PF_6]$	Dispersive liquid-liquid microextraction	Pyrethroid Pesticides	Tomato	[16]
$[C_4MIM][PF_6]$	Temperature controlled dispersive liquid-phase microextraction	Lead ions (Pb^{2+})	Blood samples	[17]
Task-specific ILs	Ultrasonic assisted dispersive liquid-liquid microextraction	Mercury ions (Hg^{2+})	Water	[18]

Table S1.Continued

ILs	Pretreatment methods	Contaminants	Sample	Ref.
$[C_8MIM][PF_6]$	Ultrasonic assisted dispersive liquid-liquid microextraction	Fluoroquinolones	Water	19
$[C_8MIM][PF_6]$	Ultrasonic assisted dispersive liquid-liquid microextraction	Pyrethroid pesticides	Honey	20
$[C_6MIM][FAP]$	Dispersive liquid-liquid microextractionwithmicro solid phase Extraction	Antidepressant drugs	Water	21
$[C_6MIM][PF_6]$	Dispersive liquid-liquid microextraction	Cobalt	Water, saliva and urine	22
$[C_6MIM][FAP]$	Ultrasonic assisted dispersive liquid-liquid microextraction	Ultraviolet filters	Water	23
$[C_6MIM][PF_6]$	Enzyme assistedextractionanddispersive liquid-liquid microextraction	Patulin	Apple juice	24
$[C_6MIM][Tf_2N]$	Dispersive liquid-liquid microextraction	Copper (Cu^{2+})	Water	25
$[C_6MIM][FAP]$	Temperature controlled dispersive liquid-phase microextraction	Ultraviolet filters	Water	26
$[C_6Py][PF_6]$	Dispersive liquid-liquid microextraction	Aluminum (Al^{3+})	Water, fruit juice and food	27
CYPHOS® IL 101	Dispersive liquid-liquid microextraction	Inorganic selenium (Se(IV))	Garlic and water	28
$[C_6MIM][NTf_2]$	Dispersive liquid-liquid microextraction	Pyrethroids	Honey	29
$[C_8MIM][PF_6]$	Dispersive liquid-liquid microextraction	Chromium(III)/chromium(VI)	Water	30
$[C_6MIM][PF_6]$	Ultrasonic assisted dispersive liquid-liquid microextraction	Cobalt, Copper and Zinc	Water	31
$[C_6MIM][Tf_2N]$	Dispersive liquid-liquid microextraction	Molybdenum(VI)	Water and leaves	32
$[C_4MIM][PF_6]$	Temperature assisted dispersive liquid-liquid microextraction	Vanadium	Water and Saliva	33
$[C_8MIM][Tf_2N]$	Ultrasonic assisted dispersive liquid-liquid microextraction	Rhodium (Rh(III))	Water	34
CYPHOS® IL 101	IL assisted ion pairing- dispersive liquid-liquid microextraction	Thallium (Tl^{3+})	Water	35
$[C_4MIM][NTf_2]$	Dispersive liquid-liquid microextraction	Arsenic	Water	36
$[C_6MIM][PF_6]$	Modified ILCold Induced Aggregation dispersive liquid-liquid microextraction	Chromium	Water and food	37
1-Methylimidazole	Solid phase Extraction	Tanshinones	*Silvia Miltiorrhiza*	38
$[C_6MIM][PF_6]$	Solid phase Extraction	Polycyclic aromatic hydrocarbons	Water	39
$[AMIM][BF_4]$	Head space solid phase microextraction	Organophosphate esters	Water	40
$[C_6MIM][PF_6]$	Head space solid phase microextraction	Benzene, toluene, ethylbenzene and o-xylene	Water	41
$[SiO_2–MIM–PF_6]$	Dispersive microsolid phase microextraction	organophosphate pesticides	Water	42
$[C_8MIM][PF_6]$	Solid phase microextraction	Benzene, Toluene, ethylbenzene, xylenes	Paints	43

Table S1. Continued

ILs	Pretreatment methods	Contaminants	Samples	Ref.
Polymeric ILs	Solid phase microextraction	Esters and fatty acid methyl esters	Wine	[44]
$[C_4MIM][PF_6]$	Liquid-liquid extraction	Substituted benzene derivatives	Water	[45]
$[C_4MIM][PF_6]$ $[C_4MIM][Cl]$	Liquid-liquid extraction	DDT, dieldrin, hexachlorobenzene, and pentachlorophen	Soils	[46]
$[C_4MIM][PF_6]$	Liquid-liquid extraction	Nanosize copper pollutants	Water	[47]
$[C_4MIM][PF_6]$ $[C_6MIM][PF_6]$ $[C_6MIM][BF_4]$ $[C_8MIM][PF_6]$	Liquid-liquid extraction	Anionic dyes	Water (removal)	[48]
$[C_4MIM][PF_6]$	Liquid-liquid extraction	Heavy metals (Hg^{2+}, Cu^{2+}, Pb^{2+}, and Cd^{2+})	Aqueous solution	[49]
Task-specific ILs	Liquid-liquid extraction	Hg^{2+}, Cd^{2+}	Water	[50,51]
$[C_4MIM][Tf_2N]$	Liquid-liquid extraction	Americium	Nitric acid solution	[52]
$[C_8MIM][PF_6]$	Liquid phase microextraction	Polycyclic aromatic hydrocarbons	Water	[53]
$[C_6MIM][PF_6]$	Liquid phase microextraction	4-nonylphenol (4-NP) and 4-*tert*-octylphenol (4-*t*-OP)	Water	[54]
Functionalized ILs	Liquid phase microextraction	Metals(loids) and cancerostatic platinum compounds	Water	[55]
1-lauryl-3-methylimidazolium bromide ([C12MIM][Br])	Ultrasonic assisted extraction	biphenyl cyclooctene lignans	Fruit	[56]
$[C_4MIM][Br]$	Ultrasonic assisted extraction	Isoliquiritigenin, liquiritin and glycyrrhizic acid	Licorice (medicinal herbal)	[57]
$[C_4MIM][Br]$	Ultrasonic assisted extraction	Eleutheroside B and E	*Acanthopanax senticosus*(medicinal herbal)	[58]
$[C_4MIM][PF_6]$	Liquid-liquid-liquid solvent bar microextraction	Phenols	Water	[59]

Table S1. Continued

ILs	Pretreatment methods	Contaminants	Samples	Ref.
$[C_4MIM][Br]$ $[C_4MIM][Cl]$ $[C_4MIM][BF_4]$ $[C_4MIM][TsO]$	Microwave assisted extraction	Rutin	Medicinal plants	60
$[C_nMIM][Cl]$	Pressurized liquid extraction	Rutin and quercetin	Medicinal plants	61
$[C_4MIM][PF_6]$	Microextraction in IL	Carboxylic SWCNTs	Water	62
$[C_8MIM][BF_4]$	Foam floatation and solid phase microextraction	Triazine herbicides	Corn	63
$[C_6MIM][BF_4]$	Modified cold-induced aggregation microextraction	Gold	Saline solutions	64
$[C_3MIM][Br]$	Ultrasonic assisted extraction	Ginsenosides	Ginseng (medicinal plant)	65
$[C_8MIM][Br]$	Negative pressure cavitation-assisted extraction	Flavonoids	Pigeonpea roots	66
$[C_4MIM]BF_4\text{-}(NH_4)_2SO_4$	Salt aqueous two-phase extraction	Sulfonamides	Water and Food	67
$[C_4MIM][PF_6]$	Temperature controlled microextraction	Lead (Pb^{2+})	Water and Hair	68
$[C_4MIM][Cl]$	IL extraction and derivatization	Fatty Acids	Algae	69
$[C_4MIM][BF_4]$ $[C_4MPy][BF_4]$	Water soluble IL based extraction	Endocrine-disrupting chemicals	Sediments	70
$[C_8MIM][PF_6]$	Microwave assisted extraction	Malachite Green and crystal violet	Water	71
$[C_4MIM][PF_6]$	IL supported vertox-assisted synergic microextraction	glucocorticoids	Water	72
$[C_8MIM][Br]$	Aqueous two-phase extraction	Antibiotics	Honey	73
Hydrophobic ILs	Selective Extraction	Copper, Mercury, Silver, and Palladium	Water	74
$[C_4MIM][Cl]$	*in situ* preconcentration	Polycyclic aromatic hydrocarbons	Water and fruit-tea infusions	75
$[3C_6PC_{14}][FeCl_4]$	Magnetic extraction	phenolic compounds	Aqueous solution	76

Table S2. Toxicity of ILs to Enzyme

Species	ILs	Toxicity	Ref.
Acetylcholinesterase	$[C_4MIM][BF_4]$, $[C_8MIM][BF_4]$, $[C_4MIM][Cl]$, $[C_4MIM][8OSO_3]$, $[C_4MIM][(CF_3SO_2)_2N]$, $[C_4MIM][(CF_3)_2N]$ and $[C_2MIM][(2\text{-}OPhO)_2B]$	EC_{50} (μM): 105, 46, 80, 100, 90 and 40, respectively	[77]
	2-HEAF, 2-HEAB, 2-HDEAF, 2-HDEAA, 2-HDEAPr, 2-HDEAB, 2-HDEAiB, 2-HDEAPe, 2-HTEAB, 2-HTEAPe, $[C_4MIM][Cl]$, $[C_8MIM][Cl]$ and $[C_4Py][Cl]$	EC_{50} (mg/L): 3467, 7079, 8912, 2089, 2399, 2344, 1995, 1862, 302, 427, 14.40, 9.10 and 8.59, respectively	[78]
Electrophorus electricus	$[C_3MIM][BF_4]$, $[C_4MIM][BF_4]$, $[C_8 MIM][BF_4]$, $[C_{10}MIM][BF_4]$, $[BnMIM][BF_4]$, $[PhEtMIM][BF_4]$, $[C_4EIM][BF_4]$, $[C_4MIM][PF_6]$, $[C_4MIM][Cl]$, $[C_4MIM][Br]$, $[C_4MIM][OcSO_4]$, $[C_4MIM][TFMS]$, $[C_4MIM][DCNA]$, $[C_4MIM][MDEGSO_4]$, $[C_4MIM][MPEGSO_4]$, $[C_4MPy][BF_4]$, $[C_4MPy][PF_6]$, Cytec 104, Cytec 105, Cytec 110, Cytec 111 and Aldicarb	EC_{50} (μM): 189, 105, 46, 13, 93, 77, 107, 140, 84, 80, 97, 88, 89, 114, 106, 34, 28, >2000, >2000, >2000, >2000 and 5, respectively	[79]

Table S3. Toxicity of ILs to Bacteria

Species	ILs	Toxicity	Ref.
Bacillus subtilis	$[C_4MIM][Ala]$, $[C_6MIM][Br]$, $[C_4MIM][Phe]$, [Chol][Gly], $[C_6Py][Br]$, [Chol][Phe], $[C_4MIM][Br]$, [Chol][Gln], [Chol][Met]and $[C_4Py][Br]$	Inhibition (at 0.1 M[a], 0.5[b]) (cm): 0.90[a], 1.25[b], 0.95[b], 1.05[b], 1.17[b], 0.95[b], 1.05[a], 1.00[a], 0.90[a] and 1.05[a], respectively	80
Escherichia coli	$[C_4MIM][Ala]$, $[C_6MIM][Br]$, $[C_4MIM][Phe]$, $[C_6Py][Br]$, $[C_4MIM][Br]$ and $[C_4Py][Br]$	Inhibition (at 0.1 M[a], 0.5[b]) (cm): 0.85[a], 1.35[b], 0.75[b], 1.53[b], 0.70[b] and 0.95[a], respectively	80
	$[C_2MIM][Cl]$, $[C_4MIM][Cl]$, $[C_6MIM][Cl]$, $[C_2MIM][SCN]$, $[C_4MIM][SCN]$, $[C_6MIM][SCN]$, $[C_4MIM][MeSO_3]$, $[C_4MIM][TCA]$, $[C_4MIM][DCA]$ and $[C_4MPy][DCA]$	MIC 18h (mM): 253.5, 105.5, 7.3, 133.6, 66.3, 13.5, 164.2, 39.1, 53.3 and 157.5, respectively	81
Geitlerinema amphibium	$[C_2MIM][Cl]$, $[C_4MIM][Cl]$, $[C_6MIM][Cl]$, $[C_8MIM][Cl]$, $[C_{10}MIM][Cl]$, $[C_4MIM][BF_4]$, $[C_4MIM][DCNA]$, $[C_4MIM][TFMS]$, $[C_4MIM][MeSO_4]$ and $[C_4MIM][MPEGSO_4]$	EC_{50} (μM): 30.90, 3.65, 0.97, 0.10, 0.02, 5.38, 6.91, 2.48, 5.08 and 4.90, respectively	82
Listeria monocytogenes	[C2MIM][Cl], [C4MIM][Cl], [C6MIM][Cl], [C2MIM][SCN], [C4MIM][SCN], [C6MIM][SCN], [C4MIM][MeSO3], [C4MIM][TCA], [C4MIM][DCA] and [C4MPy][DCA]	MIC 18h (mM): 691.4, 390.2, 47.0, 138.5, 90.1, 31.1, 329.4, 44.3, 251.7 and 284.4, respectively	81
Vibrio fischeri	$[C_3MIM][BF_4]$, $[C_4MIM][BF_4]$, $[C_4MIM][Br]$, $[C_4MIM][pTS]$, $[C_4EIM][BF_4]$, $[C_5MIM][BF_4]$, $[C_6MIM][BF_4]$, $[C_6EIM][BF_4]$, $[C_7MIM][BF_4]$, $[C_8MIM][BF_4]$, $[C_9MIM][BF_4]$, $[C_{10}MIM][Cl]$ and $[C_{10}MIM][BF_4]$	$LogEC_{50}$ (μM): 3.94, 3.55, 3.07, 3.52, 2.8, 3.14, 3.18, 2.15, 2.44, 1.41, 0.718, 0.498 and -0.182, respectively	83
	$[C_8MIM][Br]$, $[C_8MPy][Br]$, $[C_6MIM][Br]$, $[C_6MPy][Br]$, $[C_4\text{-}3,5\text{-}diMPy][N(CN)_2]$, $[N(CN)_2]$, $[MPy]^+$, $[C_4\text{-}3,5\text{-}diMPy][Br]$, $[C_4MPy][Br]$, $[C_4Py][N(CN)_2]$, $[C_4Py][Cl]$, $[C_4Py][Br]$, $[C_4MIM][Cl]$, $[C_4MIM][N(CN)_2]$, $[MIM]^+$and $[C_4MIM][Br]$	EC_{50} (mg/L): 1.17, 1.77, 6.44, 29.99, 55.71, 98, 110.6, 119.27, 130.48, 409.92, 439.97, 538.4, 897.47, 966.24, 1218.2 and 2248.38, respectively	84
	$[C_4MIM][BF_4]$, $[C_8MIM][BF_4]$, $[C_4MIM][Cl]$, $[C_4MIM][8OSO_3]$, $[C_4MIM][(CF_3SO_2)_2N]$, $[C_4MIM][(CF_3)_2N]$ and $[C_2MIM][(2\text{-}OPhO)_2B]$	EC_{50} (μM): 3500, 25, 2500, 70, 300, 3000 and 1000, respectively	77
	$[CMIM][MSO_4]$, $[C_2MIM][ESO_4]$, $[C_4MIM][Cl]$, $[C_6MIM][Cl]$, $[C_6MIM][PF_6]$, $[C_8MIM][Cl]$ and $[C_8MIM][PF_6]$	$logEC_{50}$ (μM): >4.76, 4.02, 3.39, 2.18, 2.11, 0.94 and 0.70, respectively	85
	$[C_3MIM][Tf_2N]$	EC_{50} (mg/L): 480 (5 min) and 240 (15 min)	86
	$[TMGC_4][I]$, $[TMGC_7][I]$, $[TMGC_{12}][I]$, $[(C_3O)_4DMG][Cl]$,	EC_{50} (mg/L): 30.6, 3.72, 15.6, 98.24, 3.81,	87

	[(di-h)$_2$DMG][Cl]; [C_5O_2MIM][Cl], [C_{10}C(O)OEtMIM][Br], [$P_{6,6,6,14}$][Br], [$P_{6,6,6,14}$][CH_3SO_3], [$P_{6,6,6,14}$][Cl], [$P_{6,6,6,14}$][TOS], [$P_{6,6,6,14}$][CH_3SO_4], [$P_{6,6,6,14}$][Br], [C_4MIM][Br], [C_4MIM][CH_3SO_3] and [C_4MIM][TOS]	40.55, 4.49, 6.38, 7.43, 7.1, 169.6, 273.6, 172.8, 735.93, 901.99 and 653.22, respectively	
	2-HEAF, 2-HEAB, 2-HDEAF, 2-HDEAA, 2-HDEAPr, 2-HDEAB, 2-HDEAiB, 2-HDEAPe, 2-HTEAB, 2-HTEAPe, [C_4MIM][Cl], [C_8MIM][Cl] and [C_4Py][Cl]	EC_{50} (mg/L): 700, 2239, 800, 1750, 650, 800, 850, 350, 501, 461, 287, 0.5 and 295, respectively	[78]
	[C_2MIM][Ms], [C_2MIM][Tf_2N], [C_2MIM][Ac], [chol][Ac], [C_4MPy][Cl], [C_4MPy][BF_4] and [$N_{4,4,4,4}$][Cl]	EC_{50} (mg/L): 14083, 837, 1637, 1843, 164, 45.3 and 400, respectively	[88]
	[C_4MPheIM][$MeSO_4$], [C_4MIM][SCN], [C_4MIM][C_4EtSO_4], [C_4MIM][H_2SO_4], [HOPMIM][glycolate], [HOPMIM][Cl], [HOPMIM][dca], [HOPMIM][FCH_2COO], [C_4MPy][BF_4], [C_4MPyr][Cl], [C_4MPyr][dca], [C_4MPyr][TFO], [MOxa][$MeSO_4$], [Chol][H_2PO_4], [$P_{4,4,4,1}$][$MeSO_4$] and [$P_{i4,i4,i4,1}$][TOS]	EC_{50} (mg/L): 17.83, 46.50, 505.64, 30.93, >21620, 582.21, 627.08, >21820, 760, >23780, 4588.85, >29130, 193.96, 1154.66, 141.99 and 106.23, respectively	[89]

Table S4. Toxicity of ILs to Algae

Species	ILs	Toxicity	Ref.
Chlamydomonas reinhardtii	[C_4MIM][Br], [C_6MIM][Br] and [C_8MIM][Br]	EC_{50} (mg/L): 4.76, 0.078 and 0.005, respectively	90
Chlorella vulgaris	[C_2MIM][Cl], [C_4MIM][Cl], [C_6MIM][Cl], [C_8MIM][Cl], [C_{10}MIM][Cl], [C_4MIM][BF_4], [C_4MIM][DCNA], [C_4MIM][TFMS], [C_4MIM][$MeSO_4$], [C_4MIM][$MPEGSO_4$] and [C_2BPy][Cl]	EC_{50} (μM): 6330.51, 1026.24, 64.52, 15.14, 3.68, 425.33, 2650.98, 1417.75, 1011.7, 930.81 and 2109.74, respectively	91
	[C_3MIM][Tf_2N]	EC_{50} (mg/L): 10.29	86
Oocystis submarina	[C_2MIM][Cl], [C_4MIM][Cl], [C_6MIM][Cl], [C_8MIM][Cl], [C_{10}MIM][Cl], [C_4MIM][BF_4], [C_4MIM][DCNA], [C_4MIM][TFMS], [C_4MIM][$MeSO_4$], [C_4MIM][$MPEGSO_4$] and [C_2BPy][Cl]	EC_{50} (μM): 13 573.01, 2224.48, 753.60, 79.13, 8.02, 707.81, 2984.4, 1689.88, 3292.98, 878.04 and 1924.31, respectively	91
Pseudokirchneriella subcapitata	[C_4MIM][Br], [C_4MIM][Cl], [C_4MIM][BF_4], [C_4MIM][PF_6], [C_4MIM][CF_3SO_3], [C_4MIM][$C_8H_{17}SO_4$] and [C_4MIM][SbF_6]	EC_{50} (μM): 2137, 2884, 2512, 1318, 2188, 2239 and 135, respectively	92
	AMMOENG 100, AMMOENG 130, [C_4Py][Tf_2N], [C_4MPyrl][Tf_2N], [C_4MIM][Tf_2N], [C_2ClMIM][Cl], [C_2ClMIM][Tf_2N], [C_2OHMIM][Tf_2N], [C_3OHMIM][Cl], [TMSiMMIM][Br], [C_6MIM][Cl], [HC_2ClIM][Cl], [$C_2(HIM)_2$]2[Cl], [Chol][PF_6], [C_2MMor][Br], [C_2BMor][Br], [ETHT][Br] and [$C_2C_2C_2$S][Br]	EC_{50} (mg/L): 0.12, 0.83, 7.05, >100, 26.49, 76.22, 71.15, 56.65, 29.82, 10.71, 82.13, 79.18, 67.92, 37.74, >100, >100, 59.61 and 43.74, respectively	93
	[C_3mim][Tf_2N]	EC_{50} (mg/L): 14.40	86
Scenedesmus quadricauda	[C_4MIM][Br], [C_6MIM][Br] and [C_8MIM][Br]	EC_{50} (mg/L): 1070, 260 and 4.07	90
Scenedesmus vacuolatus	[C_4MIM][BF_4], [C_8MIM][BF_4], [C_4MIM][Cl], [C_4MIM][$8OSO_3$], [C_4MIM][$(CF_3SO_2)_2$N], [C_4MIM][$(CF_3)_2$N] and [C_2MIM][(2-OPhO)$_2$B]	EC_{50} (μM): 130, 0.005, 140, 60, 50, 840 and 25, respectively	77
Selenastrum capricornutum	[C_4MIM][Br], [C_4MPy][Br], [C_4MPyrl][Br], [TBA][Br] and [TBP][Br]	logEC_{50} (μM): 3.46, 3.46, 3.67, 2.97 and 1.9, respectively	94

Table S5. Toxicity of ILs to Cell

Species	ILs	Toxicity	Ref.
C6	$[C_4MIM][PF_6]$, $[C_4MIM][BF_4]$, $[C_4MIM][Br]$, $[C_6MIM][PF_6]$, $[C_7MIM][PF_6]$, $[C_8MIM][PF_6]$, $[C_9MIM][PF_6]$ and $[C_{10}MIM][PF_6]$	$LogEC_{50}$ (μM): >3, >3, 3.13, >3, 3.08, 2.76, 1.90 and 1.69, respectively	[83]
Cat Fish Ovary	$[C_4MIM][PF_6]$, $[C_4MIM][BF_4]$, $[C_4MIM][Br]$, $[C_4MIM][Tf_2N]$, $[C_5MIM][Tf_2N]$, $[C_5MMIM][Tf_2N]$, $[C_5OMIM][Tf_2N]$, $[C_7MIM][Tf_2N]$, $[C_7MMIM][Tf_2N]$, $[C_{10}MIM][Tf_2N]$, $[C_{3\text{-}2}MIM][Tf_2N]$, $[C_{3\text{-}3}MIM][Tf_2N]$, $[BzMIM][Tf_2N]$ and $[APMIM][Tf_2N]$	EC_{50} (mmol/L): >10, 4.46, 3.81, 2.88, 0.26, <0.1, 0.26, <0.1, <0.1, <0.1, 0.55, 0.41, 0.31 and 1.10, respectively	[95]
CRL-1502	$[C_8MIM][FeCl_4]$, $[C_8MIM]_3[GdCl_6]$, $[C_8MIM]_2[CoCl_4]$, $[C_8MIM]_2[MnCl_4]$, $[Choline\text{-}C_1]_2[CoCl_4]$ and $[Choline\text{-}C_1]_2[MnCl_4]$	IC_{50} (μM): 1217, 678.9, 541.8, 422.8, >1200 and 1148, respectively	[96]
Dreissena polymorpha	$[C_4MIM][Br]$, $[C_6MIM][Br]$, $[C_8MIM][Br]$, $[C_4MPy][Br]$, $[C_6MPy][Br]$ and $[C_8MPy][Br]$	LC_{50} (mg/L): 1290, 106, 21.8, 901, 146 and 21.4, respectively	[97]
HeLa cells	$[C_2MIM][BF_4]$, $[C_4MIM][BF_4]$, $[C_8MIM][BF_4]$, $[CH_2C_6H_5MIM][BF_4]$, $[CH_2CH{=}CH_2MIM][BF_4]$, $[C_2MIM][Tf_2N]$, $[C_4MIM][Tf_2N]$, $[C_8MIM][Tf_2N]$, $[CH_2C_6H_5MIM][Tf_2N]$, $[CH_2CH{=}CH_2MIM][Tf_2N]$, $[C_2MIM][Br]$, $[C_4MIM][Br]$, $[C_8MIM][Br]$, $[CH_2C_6H_5MIM][Br]$, $[CH_2CH{=}CH_2MIM][Cl]$, $[C_2Py][Tf_2N]$, $[C_4Py][Tf_2N]$, $[CH_2CH{=}CH_2Py][Tf_2N]$, $[C_2Py][Br]$, $[C_4Py][Br]$, $[C_8Py][Br]$, $[CH_2C_6H_5Py][Br]$, $[CH_2CH{=}CH_2Py][Cl]$, $[C_2Chol][Tf_2N]$, $[C_4Chol][Tf_2N]$, $[C_8Chol][Tf_2N]$, $[CH_2C_6H_5Chol][Tf_2N]$, $[CH_2CH{=}CH_2Chol][Tf_2N]$, $[C_2Chol][Br]$, $[C_4Chol][Br]$, $[C_8Chol][Br]$, $[CH_2C_6H_5Chol][Br]$, $[CH_2CH{=}CH_2Chol][Cl]$, $[C_2Net_3][Br]$, $[C_4Net_3][Br]$, $[C_8Net_3][Br]$, $[CH_2C_6H_5Net_3][Br]$, $[CH_2CH{=}CH_2Net_3][Cl]$, $[(C_4H_9)_3PTD][Tf_2N]$, $[(C_6H_{13})_3PTD][Tf_2N]$	EC_{50} (mM): 2, 1.19, 1.64, 0.95, 1.58, 3.56, 1.2, 1.64, 0.93, 1.93, 1.72, 0.83, 1.72, 1.02, 1.42, 2.9, 1.95, 2.51, 2.3, 1.15, 1.39, 1.04, 2.02, 1.75, 2.28, 2.59, 0.96, 1.96, 3.08, 0.98, 1.6, 1.9, 1.58, 1.48, 1.74, 0.68, 1.69, 1.23, 2.24 and 2.5, respectively	[98]
IPC-81	$[C_4MIM][BF_4]$, $[C_8MIM][BF_4]$, $[C_4MIM][Cl]$, $[C_4MIM][8OSO_3]$, $[C_4MIM][(CF_3SO_2)_2N]$, $[C_4MIM][(CF_3)_2N]$ and $[C_2MIM][(2\text{-}OPhO)_2B]$	EC_{50} (μM): 1300, 40, 3600, 1700, 480, 150 and 10, respectively	[77]
	$[C_3MIM][BF_4]$, $[C_4MIM][PF_6]$, $[C_4MIM][BF_4]$, $[C_4MIM][Br]$, $[C_4MIM][pTS]$, $[C_4EIM][BF_4]$, $[C_5MIM][Cl]$, $[C_5MIM][PF_6]$,	$LogEC_{50}$ (μM): >3, >3, 3.14, >3, 3.19, >3, 3.16, 3.07, 3.09, 2.97, >3, 2.95, 2.01, 2.26,	[83]

	[C_5MIM][BF_4], [C_6MIM][Cl], [C_6MIM][PF_6], [C_6MIM][BF_4], [C_6EIM][Br], [C_6EIM][BF_4], [C_7MIM][Cl], [C_7MIM][PF_6], [C_7MIM][BF_4], [C_8MIM][Cl], [C_8MIM][PF_6], [C_8MIM][BF_4], [C_9MIM][Cl], [C_9MIM][PF_6], [C_9MIM][BF_4], [C_{10}MIM][Cl], [C_{10}MIM][PF_6], [C_{10}MIM][BF_4] and [C_{10}EIM][Br]	2.53, 2.3, 2.58, 2.01, 1.96, 1.74, 1.4, 1.85, 1.65, 1.34, 1.5, 0.77 and 0.533, respectively	
	[C_2MIM][BF_4], [C_4MIM][BF_4], [C_6MIM][BF_4], [C_2MIM][BBDB], [C_2MIM][BOB], [C_6MIM][$(CF_3SO_2)_3C$], [C_4MIM][$(CN)_2N$], [C_4MIM][$N(CF_3)_2$], [C_4MIM][$N(SO_2CF_3)_2$], [C_6MIM][$N(SO_2CF_3)_2$], [C_2MIM][PF_6], [C_4MIM][PF_6], [C_6MIM][PF_6], [C_2MIM][$(C_2F_5)_3PF_3$], [C_4MIM][$(C_2F_5)_3PF_3$], [C_6MIM][$(C_2F_5)_3PF_3$], [C_6MIM][$(C_3F_7)_3PF_3$], [C_2MIM][$(C_2F_5)_2P(O)O$], [C_4MIM][SbF_6], [C_4MIM][SCN], [C_4MIM][HSO_4], [C_4MIM][CH_3OSO_3], [C_2MIM][$C_2H_5OSO_3$], [C_4MIM][$C_8H_{17}OSO_3$], [C_4MIM][$H_3CO(CH_2)_2O–(CH_2)_2OSO_3$], [$C_4$MIM][$H_3C–(O–CH_2–CH_2)_nOSO_3$], [$C_4$MIM][$CH_3SO_3$], [$C_4$MIM][$CF_3SO_3$], [$C_4$MIM][Tos], [$C_2$MIM][Cl], [$C_4$MIM][Cl], [$C_6$MIM][Cl], [$C_4$MIM][Br], C_4MIM][I] and C_4MIM] [$Co(CO)_4$]	EC_{50} (µM): 3400, 1700, 960, 10, 860, <100, 1400, 150, 480, 180, 8400, 1300, 810, <100, <100, <100, <50, 680, 180, 2600, 1900, 1700, 8500, 1700, 1400, 1100, 3200, 1000, 1900, 7200, 3600, 720, 2700, 3000 and 280, respectively	[99]
	2-HEAF, 2-HEAB, 2-HDEAF, 2-HDEAA, 2-HDEAPr, 2-HDEAB, 2-HDEAiB, 2-HDEAPe, 2-HTEAB, 2-HTEAPe, [C_4MIM][Cl], [C_8MIM][Cl] and [C_4Py][Cl]	EC_{50} (mg/L): 3311, 269, >5000, 1778, 1047, 339, 575, 1096, 589, 851, 626, 24 and 862, respectively	[78]
MCF7 cells	[C_3MPyrl][Br], [C_4MPyrl][Br], [C_8MPyrl][Br], [C_3MPip][Br], [C_4MPip][Br], [C_8MPip][Br], [OPy][Br], [2MOPy][Br], [3MOPy][Br], [4MOPy][Br], [C_3MPyrl][Tf_2N], [C_4MPyrl][AsF_6], [C_4MPyrl][Tf_2N], [C_8MPyrl][Tf_2N], [C_4MPip][Tf_2N], [C_8MPip][Tf_2N], [C_8MPip][BF_4], [C_8MPip][$N(CN)_2$], [C_8MPip][TfO], [4MOPy][Tf_2N], [4MOPy][NfO], [C_3MIM][Tf_2N], [C_6MIM][Tf_2N], [C_8MIM][BF_4], [C_4MCNPip][Tf_2N], [C_5MS_2Pip][Tf_2N] and [C_5MS_2Pyrl][Tf_2N]	IC_{50} (mg/L): 8990, 3956, 22.29, 5465, 2364, 146.4, 2.18, 2.29, 2.86, 6.87, 1890, 2300, 588, 40.5, 372, <12.5, 345, 1501, 390.4, 16.28, 19.5, 2646, 286.3, 194.6, 3840, 1779 and 1660, respectively	[100]

Table S6. Toxicity of ILs to Invertebrates

Species	ILs	Toxicity	Ref.
Artemia salina	[C_4MIM][Br], [C_4MIM][Ala], [C_4MIM][Phe], [C_6MIM][Br], [C_4Py][Br], [C_6Py][Br], [Chol][Al], [Chol][Arg], [Chol][Cys], [Chol][Gln], [Chol][Glu], [Chol][Gly], [Chol][Met] and [Chol][Phe]	LC_{50} (mM): 0.092, 0.114, 0.094, 0.079, 0.117, 0.086, 9.001, 2.896, 5.434, 6.468, 6.278, 9.517, 6.816 and 6.764, respectively	80
Bacillaria paxillifer	[C_2MIM][Cl], [C_4MIM][Cl], [C_6MIM][Cl], [C_8MIM][Cl], [C_{10}MIM][Cl], [C_4MIM][BF_4], [C_4MIM][DCNA], [C_4MIM][TFMS], [C_4MIM][$MeSO_4$], [C_4MIM][$MPEGSO_4$]	EC_{50} (μM): 34.4, 6.48, 2.01, 1.52, 0.99, 8.04, 5.16, 6.99, 16.05 and 17.03	82
Cyclotella meneghiniana	[C_2MIM][Cl], [C_4MIM][Cl], [C_6MIM][Cl], [C_8MIM][Cl], [C_{10}MIM][Cl], [C_4MIM][BF_4], [C_4MIM][DCNA], [C_4MIM][TFMS], [C_4MIM][$MeSO_4$], [C_4MIM][$MPEGSO_4$]	EC_{50} (μM): 59.24, 7.21, 2.39, 0.73, 0.27, 2.75, 10.95, 5.72, 11.64 and 9.68	91
Daphnia longispina	[C_3MIM][Tf_2N]	EC_{50} (mg/L): 74.41	86
Daphnia magna	[C_4MIM][Br], [C_4MIM][Cl], [C_4MIM][PF_6] and [C_4MIM][BF_4]	LC_{50} (mg/L): 8.03, 14.8, 19.91 and 10.68, respectively	101
	[C_8MIM][Br]	LC_{50} (mg/L): 0.95	102
	AMMOENG 100, AMMOENG 130, [C_4Py][Tf_2N], [C_4MPy][Tf_2N], [C_4MIM][Tf_2N], [C_2ClMIM][Cl], [C_2ClMIM][Tf_2N], [C_2OHMIM][Tf_2N], [C_3OHMIM][Cl], [TMSiMMIM][Br], [C_6MIM][Cl], [HC_2ClIM][Cl], [$C_2(HIM)_2]_2$[Cl], [Chol][PF_6], [C_2MMor][Br], [C_2BMor][Br], [ETHT][Br] and [$C_2C_2C_2$S][Br]	EC_{50} (mg/L): 1.57, 0.55, 1.73, 37.15, 18.91, >100, >100, >100, 59.87, 17.53, >100, >100, >100, >100, >100, >100, >100 and >100	93
	[C_3MIM][Tf_2N]	EC_{50} (mg/L): 46.8	86
Folsomia candida	[C_4MIM][BF_4], [C_8MIM][BF_4], [C_4MIM][Cl], [C_4MIM][$8OSO_3$] and [C_4MIM][$(CF_3SO_2)_2$N]	EC_{50} (μM): >4400, 100, >3000, 1100 and 30, respectively	77
Physa acuta	[C_8MPy][Br], [C_8MIM][Br], [C_6MIM][Br], [C_4MIM][PF_6], Tetrabutyl phosphonium Br, [C_6MPy][Br], [C_4MIM][Br], [C_4MPy][Br] and Tetrabutyl ammonium Br	LC_{50} (mg/L): 1, 8.2, 56.2, 123.3, 208, 226.7, 229, 325.2 and 580.2, respectively	103
Skeletonema marinoi	[C_2MIM][Cl], [C_4MIM][Cl], [C_6MIM][Cl], [C_8MIM][Cl], [C_{10}MIM][Cl], [C_4MIM][BF_4], [C_4MIM][DCNA], [C_4MIM][TFMS], [C_4MIM][$MeSO_4$] and [C_4MIM][$MPEGSO_4$]	EC_{50} (μM): 112.36, 3.32, 1.01, 0.41, 0.08, 2.63, 2.66, 1.77, 3.01 and 3.76, respectively	91

Table S7. Toxicity of ILs to Plants

<table>
<tr><td>Species</td><td>ILs</td><td colspan="2">Toxicity</td><td>Ref.</td></tr>
<tr><td rowspan="4">Lemina minor</td><td>2-HEAF, 2-HEAB, 2-HDEAF, 2-HDEAA, 2-HDEAPr, 2-HDEAB, 2-HDEAiB, 2-HDEAPe, 2-HTEAB, 2-HTEAPe, [C$_4$MIM][Cl], [C$_8$MIM][Cl] and [C$_4$Py][Cl]</td><td colspan="2">EC$_{50}$ (mg/L): 288, 59, 525, 631, 209, 33, 79, 155, 178, 525, 48.98, 1.15 and 51.29, respectively</td><td>78</td></tr>
<tr><td rowspan="2">[C$_6$MIM][Br], [C$_8$MIM][Br], [C$_4$MPy][Br], [C$_4$MIM][Br] and [tC$_4$AMM][Br]</td><td>Frond growth</td><td>Root growth</td><td rowspan="2">104</td></tr>
<tr><td>EC$_{50}$ (mg/L): ND, 0.87, 18.09, 15.77 and 51.46, respectively</td><td>EC$_{50}$ (mg/L): 0.80, 0.25, 7.49, 8.56 and 32.71, respectively</td></tr>
<tr><td>[C$_4$MIM][BF$_4$], [C$_8$MIM][BF$_4$], [C$_4$MIM][Cl], [C$_4$MIM][8OSO$_3$], [C$_4$MIM][(CF$_3$SO$_2$)$_2$N], [C$_4$MIM][(CF$_3$)$_2$N] and [C$_2$MIM][(2-OPhO)$_2$B]</td><td colspan="2">EC$_{50}$ (μmol/kg): 310, 8, 660, 430, 380, 170 and 160, respectively</td><td>77</td></tr>
<tr><td>Lepidium sativum</td><td>[C$_4$MIM][BF$_4$], [C$_8$MIM][BF$_4$], [C$_4$MIM][Cl], [C$_4$MIM][8OSO$_3$], [C$_4$MIM][(CF$_3$SO$_2$)$_2$N], [C$_4$MIM][(CF$_3$)$_2$N] and [C$_2$MIM][(2-OPhO)$_2$B]</td><td colspan="2">EC$_{50}$ (μmol/kg): 1900, 300, >3000, >3000, 400 and >3500, respectively</td><td>77</td></tr>
<tr><td>Triticum aestivum</td><td>[C$_4$MIM][BF$_4$], [C$_8$MIM][BF$_4$], [C$_4$MIM][Cl], [C$_4$MIM][8OSO$_3$], [C$_4$MIM][(CF$_3$SO$_2$)$_2$N], [C$_4$MIM][(CF$_3$)$_2$N] and [C$_2$MIM][(2-OPhO)$_2$B]</td><td colspan="2">EC$_{50}$ (μmol/kg): 1700, 290, >3000, >3000, 110 and 3500</td><td>77</td></tr>
</table>

References

1. Marquez-Sillero, I.; Aguilera-Herrador, E.; Cardenas, S.; Valcarcel, M., Determination of 2,4,6-tricholoroanisole in water and wine samples by ionic liquid-based single-drop microextraction and ion mobility spectrometry. *Anal. Chim. Acta* **2011,** *702*, 199-204.
2. Marquez-Sillero, I.; Cardenas, S.; Valcarcel, M., Direct determination of 2,4,6-tricholoroanisole in wines by single-drop ionic liquid microextraction coupled with multicapillary column separation and ion mobility spectrometry detection. *J. Chromatogr. A* **2011,** *1218*, 7574-7580.
3. Wen, X.; Deng, Q.; Wang, J.; Yang, S.; Zhao, X., A new coupling of ionic liquid based-single drop microextraction with tungsten coil electrothermal atomic absorption spectrometry. *Spectrochim Acta A Mol. Biomol. Spectrosc.* **2013,** *105*, 320-325.
4. Manzoori, J. L.; Amjadi, M.; Abulhassani, J., Ultra-trace determination of lead in water and food samples by using ionic liquid-based single drop microextraction-electrothermal atomic absorption spectrometry. *Anal. Chim. Acta* **2009,** *644*, 48-52.
5. Vallecillos, L.; Pocurull, E.; Borrull, F., Fully automated ionic liquid-based headspace single drop microextraction coupled to GC-MS/MS to determine musk fragrances in environmental water samples. *Talanta* **2012,** *99*, 824-832.
6. Jiang, C.; Wei, S.; Li, X.; Zhao, Y.; Shao, M.; Zhang, H.; Yu, A., Ultrasonic nebulization headspace ionic liquid-based single drop microextraction of flavour compounds in fruit juices. *Talanta* **2013,** *106*, 237-242.
7. Peng, J.-F.; Liu, J.-F.; Hu, X.-L.; Jiang, G.-B., Direct determination of chlorophenols in environmental water samples by hollow fiber supported ionic liquid membrane extraction coupled with high-performance liquid chromatography. *J. Chromatogr. A* **2007,** *1139*, 165-170.
8. Tao, Y.; Liu, J. F.; Hu, X. L.; Li, H. C.; Wang, T.; Jiang, G. B., Hollow fiber supported ionic liquid membrane microextraction for determination of sulfonamides in environmental water samples by high-performance liquid chromatography. *J. Chromatogr. A* **2009,** *1216*, 6259-6266.
9. Abulhassani, J.; Manzoori, J. L.; Amjadi, M., Hollow fiber based-liquid phase microextraction using ionic liquid solvent for preconcentration of lead and nickel from environmental and biological samples prior to determination by electrothermal atomic absorption spectrometry. *J. Hazard. Mater.* **2010,** *176*, 481-486.
10. Yao, C.; Li, T.; Twu, P.; Pitner, W. R.; Anderson, J. L., Selective extraction of emerging contaminants from water samples by dispersive liquid-liquid microextraction using functionalized ionic liquids. *J. Chromatogr. A* **2011,** *1218*, 1556-1566.
11. Hou, D.; Guan, Y.; Di, X., Temperature-induced ionic liquids dispersive liquid–liquid microextraction of tetracycline antibiotics in environmental water samples assisted by complexation. *Chromatographia* **2011,** *73*, 1057-1064.
12. Zhao, R.-S.; Wang, X.; Sun, J.; Hu, C.; Wang, X.-K., Determination of triclosan and triclocarban in environmental water samples with ionic liquid/ionic liquid dispersive liquid-liquid microextraction prior to HPLC-ESI-MS/MS. *Microchimica Acta* **2011,** *174*, 145-151.
13. Joshi, M. D.; Chalumot, G.; Kim, Y. W.; Anderson, J. L., Synthesis of glucaminium-based ionic liquids and their application in the removal of boron from water. *Chem. Commun.* **2012,** *48*, 1410-1412.
14. Gao, S.; Yang, X.; Yu, W.; Liu, Z.; Zhang, H., Ultrasound-assisted ionic liquid/ionic liquid-dispersive liquid-liquid microextraction for the determination of sulfonamides in infant formula milk powder using high-performance liquid chromatography. *Talanta* **2012,** *99*, 875-882.
15. Peng, B.; Yang, X.; Zhang, J.; Du, F.; Zhou, W.; Gao, H.; Lu, R., Comparison of two ultrasound-enhanced microextractions combined with HPLC for determining acaricides in water. *J. Sep. Sci.* **2013,** *36*, 2196-2202.
16. Han, D.; Tang, B.; Row, K. H., Determination of pyrethroid pesticides in tomato using ionic liquid-based dispersive liquid-liquid microextraction. *J. Chromatogr. Sci.* **2014,** *52*, 232-237.
17. Shah, F.; Kazi, T. G.; Naeemullah; Afridi, H. I.; Soylak, M., Temperature controlled ionic liquid-dispersive liquid phase microextraction for determination of trace lead level in blood samples prior to analysis by flame atomic absorption spectrometry with multivariate optimization. *Microchem. J.* **2012,** *101*, 5-10.
18. Stanisz, E.; Werner, J.; Matusiewicz, H., Mercury species determination by task specific ionic liquid-based ultrasound-assisted dispersive liquid–liquid microextraction combined with cold vapour generation atomic absorption spectrometry. *Microchem. J.* **2013,** *110*, 28-35.
19. Vazquez, M. M.; Vazquez, P. P.; Galera, M. M.; Garcia, M. D., Determination of eight fluoroquinolones in groundwater samples with ultrasound-assisted ionic liquid dispersive liquid-liquid microextraction prior to high-performance liquid chromatography and fluorescence detection. *Anal. Chim. Acta* **2012,** *748*, 20-27.
20. Zhang, J.; Gao, H.; Peng, B.; Li, S.; Zhou, Z., Comparison of the performance of conventional,

temperature-controlled, and ultrasound-assisted ionic liquid dispersive liquid-liquid microextraction combined with high-performance liquid chromatography in analyzing pyrethroid pesticides in honey samples. *J. Chromatogr. A* **2011,** *1218*, 6621-6629.

21. Ge, D.; Lee, H. K., Ionic liquid based dispersive liquid-liquid microextraction coupled with micro-solid phase extraction of antidepressant drugs from environmental water samples. *J. Chromatogr. A* **2013,** *1317*, 217-222.

22. Berton, P.; Wuilloud, R. G., Highly selective ionic liquid-based microextraction method for sensitive trace cobalt determination in environmental and biological samples. *Anal. Chim. Acta* **2010,** *662*, 155-162.

23. Zhang, Y.; Lee, H. K., Ionic liquid-based ultrasound-assisted dispersive liquid-liquid microextraction followed high-performance liquid chromatography for the determination of ultraviolet filters in environmental water samples. *Anal. Chim. Acta* **2012,** *750*, 120-126.

24. Mohammadi, A.; Tavakoli, R.; Kamankesh, M.; Rashedi, H.; Attaran, A.; Delavar, M., Enzyme-assisted extraction and ionic liquid-based dispersive liquid-liquid microextraction followed by high-performance liquid chromatography for determination of patulin in apple juice and method optimization using central composite design. *Anal. Chim. Acta* **2013,** *804*, 104-110.

25. Khani, R.; Shemirani, F.; Majidi, B., Combination of dispersive liquid–liquid microextraction and flame atomic absorption spectrometry for preconcentration and determination of copper in water samples. *Desalination* **2011,** *266*, 238-243.

26. Zhang, Y.; Lee, H. K., Determination of ultraviolet filters in environmental water samples by temperature-controlled ionic liquid dispersive liquid-phase microextraction. *J. Chromatogr. A* **2013,** *1271*, 56-61.

27. Abdolmohammad-Zadeh, H.; Sadeghi, G. H., Combination of ionic liquid-based dispersive liquid-liquid micro-extraction with stopped-flow spectrofluorometry for the pre-concentration and determination of aluminum in natural waters, fruit juice and food samples. *Talanta* **2010,** *81*, 778-785.

28. Martinis, E. M.; Escudero, L. B.; Berton, P.; Monasterio, R. P.; Filippini, M. F.; Wuilloud, R. G., Determination of inorganic selenium species in water and garlic samples with on-line ionic liquid dispersive microextraction and electrothermal atomic absorption spectrometry. *Talanta* **2011,** *85*, 2182-8.

29. Li, M.; Zhang, J.; Li, Y.; Peng, B.; Zhou, W.; Gao, H., Ionic liquid-linked dual magnetic microextraction: a novel and facile procedure for the determination of pyrethroids in honey samples. *Talanta* **2013,** *107*, 81-87.

30. Wen, S.; Wu, J.; Zhu, X., Room temperature ionic liquid-based dispersive liquid–liquid microextraction combined with flame atomic absorption spectrometry for the speciation of chromium (III) and chromium (VI). *J. Mol. Liq.* **2013,** *180*, 59-64.

31. Rajabi, M.; Asemipour, S.; Barfi, B.; Jamali, M. R.; Behzad, M., Ultrasound-assisted ionic liquid based dispersive liquid–liquid microextraction and flame atomic absorption spectrometry of cobalt, copper, and zinc in environmental water samples. *J. Mol. Liq.* **2014,** *194*, 166-171.

32. Gharehbaghi, M.; Shemirani, F., Ionic liquid-based dispersive liquid-liquid microextraction and enhanced spectrophotometric determination of molybdenum (VI) in water and plant leaves samples by FO-LADS. *Food Chem. Toxicol.* **2011,** *49*, 423-428.

33. Berton, P.; Martinis, E. M.; Wuilloud, R. G., Development of an on-line temperature-assisted ionic liquid dispersive microextraction system for sensitive determination of vanadium in environmental and biological samples. *J. Hazard. Mater.* **2010,** *176*, 721-728.

34. Molaakbari, E.; Mostafavi, A.; Afzali, D., Ionic liquid ultrasound assisted dispersive liquid-liquid microextraction method for preconcentration of trace amounts of rhodium prior to flame atomic absorption spectrometry determination. *J. Hazard. Mater.* **2011,** *185*, 647-652.

35. Escudero, L. B.; Wuilloud, R. G.; Olsina, R. A., Sensitive determination of thallium species in drinking and natural water by ionic liquid-assisted ion-pairing liquid-liquid microextraction and inductively coupled plasma mass spectrometry. *J. Hazard. Mater.* **2013,** *244-245*, 380-386.

36. Rabieh, S.; Bagheri, M.; Planer-Friedrich, B., Speciation of arsenite and arsenate by electrothermal AAS following ionic liquid dispersive liquid-liquid microextraction. *Microchimica Acta* **2013,** *180*, 415-421.

37. Zeeb, M.; Ganjali, M. R.; Norouzi, P., Preconcentration and trace determination of chromium using modified ionic liquid cold-induced aggregation dispersive liquid–liquid microextraction: application to different water and food samples. *Food Anal. Methods* **2013,** *6*, 1398-1406.

38. Tian, M.; Yan, H.; Row, K. H., Solid-phase extraction of tanshinones from Salvia Miltiorrhiza Bunge using ionic liquid-modified silica sorbents. *J. Chromatogr. B Analyt. Technol. Biomed. Life Sci.* **2009,** *877*, 738-742.

39. Polo-Luque, M. L.; Simonet, B. M.; Valcarcel, M., Coiled carbon nanotubes combined with ionic liquid: a new soft material for SPE. *Anal. Bioanal. Chem.* **2012,** *404*, 903-907.

40. Gao, Z.; Deng, Y.; Hu, X.; Yang, S.; Sun, C.; He, H., Determination of organophosphate esters in water samples using an ionic liquid-based sol-gel fiber for headspace solid-phase microextraction coupled to gas

chromatography-flame photometric detector. *J. Chromatogr. A* **2013,** *1300*, 141-150.

41. Sarafraz-Yazdi, A.; Vatani, H., A solid phase microextraction coating based on ionic liquid sol-gel technique for determination of benzene, toluene, ethylbenzene and o-xylene in water samples using gas chromatography flame ionization detector. *J. Chromatogr. A* **2013,** *1300*, 104-11.

42. Galán-Cano, F.; Lucena, R.; Cárdenas, S.; Valcárcel, M., Dispersive micro-solid phase extraction with ionic liquid-modified silica for the determination of organophosphate pesticides in water by ultra performance liquid chromatography. *Microchem. J.* **2013,** *106*, 311-317.

43. Liu, J.-F.; Li, N.; Jiang, G.-B.; Liu, J.-M.; Jönsson, J. Å.; Wen, M.-J., Disposable ionic liquid coating for headspace solid-phase microextraction of benzene, toluene, ethylbenzene, and xylenes in paints followed by gas chromatography–flame ionization detection. *J. Chromatogr. A* **2005,** *1066*, 27-32.

44. Zhao, F.; Meng, Y.; Anderson, J. L., Polymeric ionic liquids as selective coatings for the extraction of esters using solid-phase microextraction. *J. Chromatogr. A* **2008,** *1208*, 1-9.

45. Huddleston, J. G.; Willauer, H. D.; Swatloski, R. P.; Visser, A. E.; Rogers, R. D., Room temperature ionic liquids as novel media for 'clean' liquid–liquid extraction. *Chem. Commun.* **1998**, 1765–1766.

46. Khodadoust, A. P.; Chandrasekaran, S.; Dionysiou, D. D., Preliminary assessment of imidazolium-based room-temperature ionic liquids for extraction of organic contaminants from soils. *Environ. Sci. Technol.* **2006,** *40*, 2339–2345.

47. Huang, H.-L.; Wang, H. P.; Wei, G.-T.; Sun, I.-W.; Huang, J.-F.; Yang, Y. W., Extraction of nanosize copper pollutants with an ionic liquid. *Environ. Sci. Technol.* **2006,** *40*, 4761-4764.

48. Pei, Y. C.; Wang, J. J.; Xuan, X. P.; Fan, J.; Fan, M., Factors affecting ionic liquids based removal of anionic dyes from water. *Environ. Sci. Technol.* **2007,** *41*, 5090–5095.

49. Wei, G.-T.; Yang, Z.; Chen, C.-J., Room temperature ionic liquid as a novel medium for liquid/liquid extraction of metal ions. *Anal. Chim. Acta* **2003,** *488*, 183-192.

50. Visser, A. E.; Swatloski, R. P.; Reichert, W. M.; Davis Jr, J. H.; Rogers, R. D.; Mayton, R.; Sheff, S.; Wierzbicki, A., Task-specific ionic liquids for the extraction of metal ions from aqueous solutions. *Chem. Commun.* **2001**, 135-136.

51. Visser, A. E.; Swatloski, R. P.; Reichert, W. M.; Mayton, R.; Sheff, S.; Wierzbicki, A.; DavisJr, J. H.; Rogers, R. D., Task-specific ionic liquids incorporating novel cations for the coordination and extraction of Hg^{2+} and Cd^{2+}: synthesis, characterization, and extraction studies. *Environ. Sci. Technol.* **2002,** *36*, 2523–2529.

52. Pribylova, G. A.; Smirnov, I. V.; Novikov, A. P., Effect of ionic liquids on the extraction of americium by diphenyl (dibutyl) carbamoylmethyl phosphine oxide in dichloroethane from nitric acid solutions. *J. Radioanal. Nucl. Chem.* **2013,** *295*, 83-87.

53. Liu, J.-F.; Jiang, G.-B.; Chi, Y.-G.; Cai, Y.-Q.; Zhou, Q.-X.; Hu, J.-T., Use of ionic liquids for liquid-phase microextraction of polycyclic aromatic hydrocarbons. *Anal. Chem.* **2003**, *75*, 5870-5876.

54. Liu, J.-f.; Chi, Y.-g.; Jiang, G.-b.; Tai, C.; Peng, J.-f.; Hu, J.-T., Ionic liquid-based liquid-phase microextraction, a new sample enrichment procedure for liquid chromatography. *J. Chromatogr. A* **2004,** *1026*, 143-147.

55. Fischer, L.; Falta, T.; Koellensperger, G.; Stojanovic, A.; Kogelnig, D.; Galanski, M.; Krachler, R.; Keppler, B. K.; Hann, S., Ionic liquids for extraction of metals and metal containing compounds from communal and industrial waste water. *Water Res.* **2011,** *45*, 4601-4614.

56. Ma, C. H.; Liu, T. T.; Yang, L.; Zu, Y. G.; Wang, S. Y.; Zhang, R. R., Study on ionic liquid-based ultrasonic-assisted extraction of biphenyl cyclooctene lignans from the fruit of Schisandra chinensis Baill. *Anal. Chim. Acta* **2011,** *689*, 110-116.

57. Yang, L.; Li, L. L.; Liu, T. T.; Zu, Y. G.; Yang, F. J.; Zhao, C. J.; Zhang, L.; Chen, X. Q.; Zhang, Z. H., Development of sample preparation method for isoliquiritigenin, liquiritin, and glycyrrhizic acid analysis in licorice by ionic liquids-ultrasound based extraction and high-performance liquid chromatography detection. *Food Chem.* **2013,** *138*, 173-179.

58. Yang, L.; Ge, H.; Wang, W.; Zu, Y.; Yang, F.; Zhao, C.; Zhang, L.; Zhang, Y., Development of sample preparation method for eleutheroside B and E analysis in Acanthopanax senticosus by ionic liquids-ultrasound based extraction and high-performance liquid chromatography detection. *Food Chem.* **2013,** *141*, 2426-2433.

59. Guo, L.; Lee, H. K., Ionic liquid based three-phase liquid-liquid-liquid solvent bar microextraction for the determination of phenols in seawater samples. *J. Chromatogr. A* **2011,** *1218*, 4299-4306.

60. Zeng, H.; Wang, Y.; Kong, J.; Nie, C.; Yuan, Y., Ionic liquid-based microwave-assisted extraction of rutin from Chinese medicinal plants. *Talanta* **2010,** *83*, 582-90.

61. Wu, H.; Chen, M.; Fan, Y.; Elsebaei, F.; Zhu, Y., Determination of rutin and quercetin in Chinese herbal medicine by ionic liquid-based pressurized liquid extraction-liquid chromatography-chemiluminescence detection.

Talanta **2012,** *88*, 222-9.

62. Lopez-Lorente, A. I.; Simonet, B. M.; Valcarcel, M., Determination of carboxylic SWCNTs in river water by microextraction in ionic liquid and determination by Raman spectroscopy. *Talanta* **2013,** *105*, 75-79.

63. Zhang, L.; Wang, Z.; Li, N.; Yu, A.; Zhang, H., Ionic liquid-based foam flotation followed by solid phase extraction to determine triazine herbicides in corn. *Talanta* **2014,** *122*, 43-50.

64. Mahpishanian, S.; Shemirani, F., Ionic liquid-based modified cold-induced aggregation microextraction (M-CIAME) as a novel solvent extraction method for determination of gold in saline solutions. *Miner. Eng.* **2010,** *23*, 823-825.

65. Lin, H.; Zhang, Y.; Han, M.; Yang, L., Aqueous ionic liquid based ultrasonic assisted extraction of eight ginsenosides from ginseng root. *Ultrason. Sonochem.* **2013,** *20*, 680-684.

66. Duan, M.-H.; Luo, M.; Zhao, C.-J.; Wang, W.; Zu, Y.-G.; Zhang, D.-Y.; Yao, X.-h.; Fu, Y.-J., Ionic liquid-based negative pressure cavitation-assisted extraction of three main flavonoids from the pigeonpea roots and its pilot-scale application. *Sep. Purif. Technol.* **2013,** *107*, 26-36.

67. Han, J.; Wang, Y.; Liu, Y.; Li, Y.; Lu, Y.; Yan, Y.; Ni, L., Ionic liquid-salt aqueous two-phase extraction based on salting-out coupled with high-performance liquid chromatography for the determination of sulfonamides in water and food. *Anal. Bioanal. Chem.* **2013,** *405*, 1245-1255.

68. Alothman, Z. A.; Yilmaz, E.; Habila, M.; Shabaka, A.; Soylak, M., Ligandless temperature-controlled ionic liquid-phase microextraction of lead (II) ion prior to its determination by FAAS. *Microchim. Acta* **2013,** *180*, 669-674.

69. Kilulya, K. F.; Msagati, T. A. M.; Mamba, B. B., Ionic liquid-based extraction of fatty acids from blue-green algal cells enhanced by direct transesterification and determination using GC × GC-TOFMS. *Chromatographia* **2014,** *77*, 479-486.

70. Wang, L.; Sun, H.; Zhang, G.; Sun, S.; Fu, X., Application of ionic liquids for the extraction and passive sampling of endocrine-disrupting chemicals from sediments. *J. Soils and Sediments* **2012,** *13*, 450-459.

71. Gao, Z.; Liu, T.; Yan, X.; Sun, C.; He, H.; Yang, S., Application of ionic liquid-based microwave-assisted extraction of malachite green and crystal violet from water samples. *J. Sep. Sci.* **2013,** *36*, 1112-1118.

72. Qin, H.; Li, B.; Liu, M. S.; Yang, Y. L., Separation and pre-concentration of glucocorticoids in water samples by ionic liquid supported vortex-assisted synergic microextraction and HPLC determination. *J. Sep. Sci.* **2013,** *36*, 1463-1469.

73. Yang, X.; Zhang, S.; Yu, W.; Liu, Z.; Lei, L.; Li, N.; Zhang, H.; Yu, Y., Ionic liquid-anionic surfactant based aqueous two-phase extraction for determination of antibiotics in honey by high-performance liquid chromatography. *Talanta* **2014,** *124*, 1-6.

74. Papaiconomou, N.; Lee, J.-M.; Salminen, J.; Stosch, M. v.; Prausnitz, J. M., Selective extraction of copper, mercury, silver, and palladium ions from water using hydrophobic ionic liquids. *Ind. Eng. Chem. Res.* **2008,** *47*, 5080–5086.

75. German-Hernandez, M.; Crespo-Llabres, P.; Pino, V.; Ayala, J. H.; Afonso, A. M., Utilization of an ionic liquid in situ preconcentration method for the determination of the 15 + 1 European Union polycyclic aromatic hydrocarbons in drinking water and fruit-tea infusions. *J. Sep. Sci.* **2013,** *36*, 2496-2506.

76. Deng, N.; Li, M.; Zhao, L.; Lu, C.; de Rooy, S. L.; Warner, I. M., Highly efficient extraction of phenolic compounds by use of magnetic room temperature ionic liquids for environmental remediation. *J. Hazard. Mater.* **2011,** *192*, 1350-1357.

77. Matzke, M.; Stolte, S.; Thiele, K.; Juffernholz, T.; Arning, J.; Ranke, J.; Welz-Biermann, U.; Jastorff, B., The influence of anion species on the toxicity of 1-alkyl-3-methylimidazolium ionic liquids observed in an (eco)toxicological test battery. *Green Chem.* **2007,** *9*, 1198–1207.

78. Peric, B.; Sierra, J.; Marti, E.; Cruanas, R.; Garau, M. A.; Arning, J.; Bottin-Weber, U.; Stolte, S., (Eco)toxicity and biodegradability of selected protic and aprotic ionic liquids. *J. Hazard. Mater.* **2013,** *261*, 99-105.

79. Stock, F.; Hoffmann, J.; Ranke, J.; Stormann, R.; Ondruschka, B.; Jastorff, B., Effects of ionic liquids on the acetylcholinesterase - a structure-activity relationship consideration. *Green Chem.* **2004,** *6*, 286–290.

80. Gouveia, W.; Jorge, T. F.; Martins, S.; Meireles, M.; Carolino, M.; Cruz, C.; Almeida, T. V.; Araujo, M. E., Toxicity of ionic liquids prepared from biomaterials. *Chemosphere* **2014,** *104*, 51-56.

81. Mester, P.; Wagner, M.; Rossmanith, P., Antimicrobial effects of short chained imidazolium-based ionic liquids-influence of anion chaotropicity. *Ecotoxicol. Environ. Saf.* **2015,** *111*, 96-101.

82. Latała, A.; Nędzi, M.; Stepnowski, P., Toxicity of imidazolium and pyridinium based ionic liquids towards algae. Bacillaria paxillifer (a microphytobenthic diatom) and Geitlerinema amphibium (a microphytobenthic blue green alga). *Green Chem.* **2009,** *11*, 1371–1376.

83. Ranke, J.; Mölter, K.; Stock, F.; Bottin-Weber, U.; Poczobutt, J.; Hoffmann, J.; Ondruschka, B.; Filser, J.;

Jastorff, B., Biological effects of imidazolium ionic liquids with varying chain lengths in acute *Vibrio fischeri* and WST-1 cell viability assays. *Ecotoxicol. Environ. Saf.* **2004,** *58*, 396-404.

84. Docherty, K. M.; Kulpa, J. C. F., Toxicity and antimicrobial activity of imidazolium and pyridinium ionic liquids. *Green Chem.* **2005,** *7*, 185–189.

85. Romero, A.; Santos, A.; Tojo, J.; Rodriguez, A., Toxicity and biodegradability of imidazolium ionic liquids. *Journal of hazardous materials* **2008,** *151*, (1), 268-73.

86. Ventura, S. P.; Goncalves, A. M.; Goncalves, F.; Coutinho, J. A., Assessing the toxicity on [C_3mim][Tf_2N] to aquatic organisms of different trophic levels. *Aquat. Toxicol.* **2010,** *96*, 290-297.

87. Ventura, S. P.; Marques, C. S.; Rosatella, A. A.; Afonso, C. A.; Goncalves, F.; Coutinho, J. A., Toxicity assessment of various ionic liquid families towards *Vibrio fischeri* marine bacteria. *Ecotoxicology and environmental safety* **2012,** *76*, (2), 162-8.

88. Costa, S. P.; Pinto, P. C.; Lapa, R. A.; Saraiva, M. L., Toxicity assessment of ionic liquids with *Vibrio fischeri*: an alternative fully automated methodology. *J. Hazard. Mater.* **2015,** *284*, 136-42.

89. Hernandez-Fernandez, F. J.; Bayo, J.; Perez de Los Rios, A.; Vicente, M. A.; Bernal, F. J.; Quesada-Medina, J., Discovering less toxic ionic liquids by using the Microtox(R) toxicity test. *Ecotoxicol. Environ. Saf.* **2015,** *116C*, 29-33.

90. Kulacki, K. J.; Lamberti, G. A., Toxicity of imidazolium ionic liquids to freshwater algae. *Green Chem.* **2008,** *10*, 104–110.

91. Latała, A.; Nędzi, M.; Stepnowski, P., Toxicity of imidazolium and pyridinium based ionic liquids towards algae. *Chlorella vulgaris*, *Oocystis submarina* (green algae) and *Cyclotella meneghiniana*, *Skeletonema marinoi* (diatoms). *Green Chem.* **2009,** *11*, 580–588.

92. Cho, C.-W.; Phuong Thuy Pham, T.; Jeon, Y.-C.; Yun, Y.-S., Influence of anions on the toxic effects of ionic liquids to a phytoplankton *Selenastrum capricornutum*. *Green Chem.* **2008,** *10*, 67–72.

93. Pretti, C.; Chiappe, C.; Baldetti, I.; Brunini, S.; Monni, G.; Intorre, L., Acute toxicity of ionic liquids for three freshwater organisms: *Pseudokirchneriella subcapitata*, *Daphnia magna* and *Danio rerio*. *Ecotoxicol. Environ. Saf.* **2009,** *72*, 1170-1176.

94. Cho, C. W.; Jeon, Y. C.; Pham, T. P.; Vijayaraghavan, K.; Yun, Y. S., The ecotoxicity of ionic liquids and traditional organic solvents on microalga *Selenastrum capricornutum*. *Ecotoxicology and environmental safety* **2008,** *71*, (1), 166-71.

95. Bubalo, M. C.; Radosevic, K.; Srcek, V. G.; Das, R. N.; Popelier, P.; Roy, K., Cytotoxicity towards CCO cells of imidazolium ionic liquids with functionalized side chains: preliminary QSTR modeling using regression and classification based approaches. *Ecotoxicol. Environ. Saf.* **2015,** *112*, 22-8.

96. Frade, R. F.; Simeonov, S.; Rosatella, A. A.; Siopa, F.; Afonso, C. A., Toxicological evaluation of magnetic ionic liquids in human cell lines. *Chemosphere* **2013,** *92*, 100-105.

97. Costello, D. M.; Brown, L. M.; Lamberti, G. A., Acute toxic effects of ionic liquids on zebra mussel (*Dreissena polymorpha*) survival and feeding. *Green Chem.* **2009,** *11*, 548–553.

98. Wang, X.; Ohlin, C. A.; Lu, Q.; Fei, Z.; Hu, J.; Dyson, P. J., Cytotoxicity of ionic liquids and precursor compounds towards human cell line HeLa. *Green Chem.* **2007,** *9*, 1191–1197.

99. Stolte, S.; Arning, J. r.; Bottin-Weber, U.; Matzke, M.; Stock, F.; Thiele, K.; Uerdingen, M.; Welz-Biermann, U.; Jastorff, B.; Ranke, J., Anion effects on the cytotoxicity of ionic liquids. *Green Chem.* **2006,** *8*, 621–629.

100. Kumar, R. A.; Papaiconomou, N.; Lee, J. M.; Salminen, J.; Clark, D. S.; Prausnitz, J. M., In vitro cytotoxicities of ionic liquids: effect of cation rings, functional groups, and anions. *Environ. Toxicol.* **2009,** *24*, 388-395.

101. Bernot, R. J.; Brueseke, M. A.; Evans-White, M. A.; Lamberti, G. A., Acute and chronic toxicity of imidazolium-based ionic liquids on *Daphnia magna*. *Environ. Toxicol. Chem.* **2005,** *24*, 87–92.

102. Luo, Y. R.; Li, X. Y.; Chen, X. X.; Zhang, B. J.; Sun, Z. J.; Wang, J. J., The developmental toxicity of 1-methyl-3-octylimidazolium bromide on Daphnia magna. *Environ. Toxicol.* **2008,** *23*, 736-744.

103. Bernot, R. J.; Kennedy, E. E.; Lamberti, G. A., Effects of ionic liquids on the survival, movement, and feeding behavior of the freshwater snail *Physa acuta*. *Environ. Toxicol. Chem.* **2005,** *24*, 1759–1765.

104. Larson, J. H.; Frost, P. C.; Lamberti, G. A., Variable toxicity of ionic liquid-forming chemicals to *Lemna minor* and the influence of dissolved organic matter. *Environ. Toxicol. Chem.* **2008,** *27*, 676–681.