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Review

Green extraction techniques as advanced sample preparation approaches in biological, food, and environmental matrices: A review

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Supplementary Material

Table S1. Representative applications of GreETs for the analysis of biological samples.

	Matrix	Analytical approach	Ref
Solid phase microextraction (SPME)			
Aldehydes	Breath	GC-MS	[1]
Antidepressants	Urine	UHPLC-UV	[2]
Aromatic Amines	Urine	GC-MS/MS	[3]
BTEX	Urine	GC-FID	[4]
Doxorubicin	Lung tissue	LC-MS/MS	[5]
Estrogens	Urine	HPLC-FLD-UV	[6]
Flavonoids	Urine, feces	UHPLC-UV	[7]
Nicotine and cotinine	Hair	LC-MS/MS	[8]
Polyamines	Urine	GC-QqQ-MS	[9]
VOCs	Blood, urine	NMR	[10]
	Blood, urine	GC-MS	[11]
Micro solid-phase extraction (μSPE)			
Carbamazepine	Urine	HPLC-UV	[12]
Carotenoids and vitamins	Serum	HPLC-DAD	[13]
Glyphosate, aminomethyl phosphonic	Urine	LC-HRMS	[14]
Ni, Pb	Blood	AT-AAS	[15]
Ofloxacin and sparfloxacin	Plasma	HPLC-UV	[16]
Oxazepam, nitrazepam	Plasma, urine	HPLC-DAD	[17]
PAHs	Urine	LC-MS	[18]
Pb	Hair	GAAFS	[19]
	Blood and urine	FAAS	[20][a]
Phenolphthalein	Urine	HPLC-PDA	[21]
Microextraction in packed syringe (MEPS)			
β-blocker	Urine	LC-FLD	[22]
Amphetamine-type stimulants	Urine	GC-MS	[23]
Anesthetics	Plasma, saliva	HPLC-MS	[24]
Antidepressants	Urine	UHPLC-PDA	[25]
Antisense oligonucleotide	Plasma	LC-UV	[26]
Anti-inflammatory drugs and fluoroquinolones	Plasma, urine	UHPLC-PDA	[27]
Asthma biomarkers	Urine	UHPLC-PDA	[28]
Azole antimicrobial drugs	Plasma, urine	HPLC-DAD	[29]
Lamotrigine (*garcinia cambogia*)	Rat plasma	LC-DAD	[30]
Levofoxacin	Plasma	UHPL-UV	[31]
Mandelic Acid	Urine	LC-UV	[32]
Nifrofurantoin	Urine	UV-VIS	[33]
Opiates	Blood	GC-MS/MS	[34]
Magnetic Solid phase extraction (MSPE)			
Antiepileptic drugs	Plasma	HPLC-DAD	[35]
Atorvastatin, simvastatin	Urine	HPLC-PDA	[36]
Ibuprofen	Plasma	HPLC-DAD	[37]
Fluoxetine	Urine	Spectrophotometry	[38]
Methadone	Urine, plasma	GC–FID, GC–MS	[39]
NSAIDs	Urine	HPLC-DAD	[40]

Parabens, bisphenol A	Breast milk, urine	HPLC-UV	[41]
Pseudoephedrine	Urine	HPLC-UV	[42]
Stir Bar Sorptive Extraction (SBSE)			
Amphetamine and methamphetamine	Urine	HPLC-UV	[43]
Antidepressants	Urine	HPLC	[44][a]
Ibuprofen, aspirin, and venlafaxine	Urine	GC-MS	[45]
Losartan and Valsartan	Plasma	LC-MS	[46]
Propranolol	Urine	HPLC-UV	[47]
4-Chloro-1-Naphthol	Urine, wastewater	HPLC-UV	[48]
Pipette Tip Solid-Phase Extraction (PT-SPE)			
Indometacin and acemetacin	Urine	HPLC-UV	[49]
Ketoconazole	Urine	HPLC-DAD	[50]
PAHs (16)	Blood	GC-MS	[51]
Toluene and xylene exposure biomarkers	Urine	HPLC-UV	[52][a]
Fabric phase sorptive extraction (FPSE)			
Androgens and progestogens	Urine, wastewater	UHPLC-MS/MS	[53]
Anticancer drugs	Blood, plasma and urine	HPLC-DAD	[54]
Antidepressants	Urine	HPLC-DAD	[55]
Azole antimicrobial drugs	Plasma, urine	HPLC-DAD	[56]
Benzodiazepines	Blood	HPLC-PDA	[57]
Bisphenol A, residual dental restorative material	Breast milk	HPLC-DAD	[58]
Cu(II), Ni(II), Zn(II), Pb(II), and Cd(II)	Urine	FAAS	[59]
Inflammatory bowel disease treatment drugs	Blood, plasma and urine	HPLC-DAD	[60]
NSAIDs	Saliva	HPLC-DAD	[61]
Parabens	Blood, plasma and urine	HPLC-DAD	[62]
Radiation exposure markers	Blood	LC-MS	[63]
Dispersive liquid-liquid microextraction (DLLME)			
Antidepressants	Plasma, blood	LC-MS/MS	[64]
Androgen receptor modulators	Urine	UHPLC-MS/MS	[65]
Benzodiazepines	Blood	LC-MS/MS	[66]
Carbamazepine and lamotrigine	Serum, plasma and urine	HPLC-DAD	[67][a]
Empagliflozin, dapagliflozin and canagliflozin	Plasma	HPLC-DAD	[68]
Methotrexate	Urine	Spectrophotometer	[69][a]
Neurotransmitters	Urine	HILIC-MS	[70]
Ni and Co	Blood, serum and urine	ET-AAS	[71][a]
Pb	Blood and scalp hair	FAAS	[72]
Soluble vitamins and carotenoids	Serum	HPLC-PDA	[73][a]
Suvorexant (sedative)	Urine	UHPLC–MS/MS	[74]
Trans,trans-muconic acid	Urine	HPLC-DAD	[75][a]
µQuEChERS			
Bisphenol A	Urine	GC-MS	[76]
Fluoxetine and clomipramine	Urine	UHPLC-PDA	[77]
Psychotropic Drugs	Serum and Postmortem	UHPLC–MS-MS	[78]
Wild life pollutants	Blood	LC-MS/MS, GC-MS/MS	[79][a]

Legend: [a] – application involving the use of ILs or DES; DES: deep eutectic solvents, ET-AAS: electro thermal atomic absorption spectrometry; FAAS: flame atomic absorption spectrometry; GC-FID: gas chromatography with flame ionization detector; GC-MS/MS: gas chromatography tandem mass spectrometer; GC-MS: gas chromatography coupled with mass spectrometry; GFAAS: graphite furnace atomic absorption

spectrometry; HPLC: high performance liquid chromatography; HPLC-FLD: high performance liquid chromatography with fluorescence detection; HPLC-UV: high-performance liquid chromatography combined with an ultraviolet detector; ILs: ionic liquids; LC-HRMS: liquid chromatography-high resolution mass spectrometry; LC-MS/MS: liquid chromatography tandem mass spectrometry; NMR: nuclear magnetic resonance; PAHs: polycyclic aromatic hydrocarbons; UHPLC: ultra-high performance liquid chromatography; UV/Vis: ultraviolet-visible spectrophotometry.

Table S2. Representative applications of GreETs for the analysis of food samples.

Analytes	Matrix	Analytical approach	Ref
Solid phase microextraction (SPME)			
Acrylamide	Biscuits	GC-MS	[80]
Organophosphorus pesticides	Wine, juice	GC-FPD	[81]
Organophosphorus pesticides	Wine and juice	GC-ECD	[81][a]
Pesticides	Tomato	GC-FID	[82][a]
Phthalates	Food packing	GC-MS	[83]
	Wines	GC-MS	[84]
Synthetic phenolic antioxidants	Food-grade lubricants	GC-MS	[85]
VOCs	Walnut oils, *Hongeo*, dairy products, melon	GC-MS	[86–89]
Xanthines	Coffee beverages	UPLC-MS/MS	[90]
1,4-dioxane, 1,2,3-trichloropropane	Corn, wheat and tomato	GC-MS	[91]
2-dodecylcyclobutanone, 2-tetradecylcyclobutanone	Dairy products	GC-MS	[92]
3,4-Dihydroxybenzoic acid	*Ilex chinensis* Sims	SPME	[93][a]
Micro solid-phase extraction (μSPE)			
Aflatoxins	Non-dairy beverages	LC-MS/MS	[94]
Bisphenol A	Bottled water	HPLC-UV	[95]
Chlorobenzenes	Apple juice	HPLC-DAD	[96]
Diazinon	Tomato, cucumber, lettuce	HPLC-UV	[97]
Fluoroquinoles and amantadine	Chicken	ESI-QQQ-MS	[98]
Pesticides	Catfish	GC-MS/MS	[99]
PAHs	Roast potatoes, baked fish	HPLC-DAD	[100]
	Spent tea leaves	GC-FID	[101]
	Sunflower oil	GC-MS	[102]
	Vegetables and fruit juice	GC-FID	[103][a]
Pesticides	Cereals	GC-MS	[104]
Phenolic compounds	Fruit juice samples	HPLC-UV	[105][a]
Rosmarinic acid	Medicinal plants	HPLC-UV	[106]
Se	Green tea	FS	[107]
Trace metals (As, Cd, Cr, Co, Sb, Pb and Tl)	Vegetables	ICP-OES	[108]

Vitamin D3	Bovine milk	HPLC-UV	[109]
Microextraction in packed syringe (MEPS)			
Caffeine	Soft and energy drinks	HPLC-UV	[110]
Ciprofloxacin, enrofloxacin, marbofloxacin	Bovine milk	UHPLC-PDA	[111]
Clorophenhols, phenoxy acid herbicides, PAHs	Rice	GC-FID	[112]
Fipronil, fluazuron	Drinking water	UHPLC-DAD	[113]
Pesticides	Coffee	GC-MS/MS	[114][a]
Parabens	Vegetable oil	HPLC-MS	[115]
Pesticides	Apple juice	HPLC-UV	[116]
	Coffe	GC-MS/MS	[114]
PAHs	Apple	GC-MS	[117]
Polyphenols	Baby food	UHPLC-PDA	[118]
Steroids	Bovine milk	HPLC-DAD	[119]
Polybrominated diphenyl ethers	Egg	GC-MS	[120]
Matrix solid-phase dispersion (MSPD)			
EDCs, organochlorine pesticides	Mussels	HPLC-DAD	[121]
Ergosterol	Edible fungi	LC-DAD	[122]
Flavonoids	Buckwheat sprouts	HPLC-PDA	[123]
	Dendrobium huoshanense	UHPLC-Q-TOF/MS	[124]
Mangiferin, hyperoside	Mango processing waste	LC-UV	[125]
Pesticides	Peppers	GC-MS	[126]
	Chicken eggs	GC-MS	[127]
	Vegetables	HPLC-DAD	[128][a]
Polyphenols	Apple	LC-DAD-MS	[129]
	Grape residues	HPLC-DAD	[130]
Pharmacologically active substances, pesticide residues	Microalgae (Chrorella and spirulina)	GC-MS	[131]
Rhodamine B	Chili, tomato ketchup, jelly	HPLC-UV	[132]
Sulfonylurea herbicides	Soybean, peanut, corn	LC-MS/MS	[133]
Triazine herbicides	Brown sugar	HPLC-PDA	[134][a]
Magnetic solid phase extraction (MSPE)			
Acrylamide	Biscuits,	HPLC-UV	[135]
	Fruits, vegetables, chips	GC-MS	[136]
Bisphenols	Fruit juices	UHPLC-MS/MS	[137]
Caffeine	Teas, coffees, cocoa, chocolates	GC-MS	[138]
Co(II) and Hg(II)	Vegetables, meat, fish, milk	ICP-OES	[139]
Cu(II)	Cereals	FAAS	[140]
PAHs	Beef and pork	HPLC-FLD	[141][a]

PAHs	Tea	GC-MS,	[142]
	Rice	GC-FID	[143]
Parabens	Cola and green tea	GC-MS	[144][a]
Pesticide residues	Fruits and vegetables	HPLC-UV	[145][a]
Plant growth regulators	Vegetables	GC-MS	[146]
Sb(V)	Soft drinks, orange juice, beers	ET-AAS	[147]
Fabric phase sorptive extraction (FPSE)			
Estrogenic EDCs, bisphenol A residues	Milk	HPLC-UV, LC-MS/MS	[148]
Sulfonamides	Milk	HPLC-UV	[149]
Fungicides	Tea	HPLC-DAD	[150]
Fungicides	Tea infusions	HPLC-DAD	[150][a]
Fungicides, insecticides	Wine	UPLC-MS/MS	[151]
Oligomers	Pineapple juice	UHPLC-MS	[152]
Organophosphorus pesticides	Beans, tomato, brinjal, cabbage	GC-MS	[153]
PAHs	Nutritional supplements	HPLC-FLR	[154]
Steroid hormone residues	Raw milk	UHPLC-MS/MS	[155]
Tetracicline residues	Milk	HPLC-UV	[156]
Triazine herbicides	Fruit juices	HPLC-DAD	[157]
Dispersive liquid-liquid microextraction (DLLME)			
Bendiocarb, azinphos-ethyl	Orange juice, tomato, potato	IMS	[158]
Benzoylurea pesticides	Tea and fruit juices	DES/HPLC-UV	[159]
Cd, As	Wine	FAAS	[160]
Cd, Cu, Fe	Margarine	HR-CS ET ASS	[161]
Chloramphenicol	Honey	UHPLC-MS/MS	[162]
Cr	Water, beverages, vegetables	FAAS	[163]
Cu, Cd, Pb	Honey	FAAS	[164]
Histamine	Fish and meat	UV-Vis	[165][a]
Mycotoxins	Rice bran	LC-MS/MS	[166]
NSAIDs	Milk	HPLC-UV	[167]
Organothiophosphate pesticides	Honey samples	GC-MS	[168][a]
Se(VI)	Cereals, vegetables	HG-AAS	[169]
Strobilurin fungicides	Apples	HPLC-UV	[170]
µQuEChERS			
Insecticides	Patotoes	UHPLC-PDA	[171]
PAHs	Coffee, tea	GC-MS	[172]
Pesticide residues	Wine	UHPLC-MS/MS	[173]
Polyphenols	Baby food	UHPLC-PDA	[174]
	Fruits and Vegetables	UHPLC-PDA	[175]

	Endemic blueberries	LC-ESI-MS/MS	[176]
Pyrrolizidine alkaloids	Aromatic herbs	UHPLC-MS/MS	[177,178]
Single drop microextraction (SDME)			
2-phenoxyethanol	Fish	GC-MS	[179]
Acrylamide	Bread, potato chips, cookies	GC-ECD	[180]
Ammonia	Milk, yoghurt, cheese, beer	CCD-array	[181]
Cu(II)	Tap water	ET-AAS	[182]
Ethyl carbamate	Wine	GC-MS	[183]
Formaldehyde	Octopus, chicken	UV-Vis	[184]
Tartrazine	Food	IV	[185]
Solidification of floating organic drop microextraction (SFOME)			
β-Lactam antibiotic residues	Egg, honey, chicken muscle,	HPLC-PDA	[186]
Antibiotics	Honey		[187]
Acidic pesticides	Tomato	GC-MS	[188]
Cd	Biscuit	GFAAS	[189]
Free fatty acid	Milk	GC-MS	[190][a]
Mn(II)	Energy drink, ice tea, sprite drink	GFAAS	[191]
Ni(II), Co(II)	Broccoli, spinach	FAAS	[192]
Organochlorine pesticides	Cocoa powder	GC-ECD	[193]
Organophosphorus and pyrethroid pesticides	Organic and conventional vegetables	GC-MS	[194]
PAHs	Honey	GC-MS	[195]
Pesticides	Milk	GC–FID	[63]
Pesticides	Fruit juices and vegetables	GC-MS	[196][a]
Phytosterols	Edible oil	GC-MS	[197]
Terpenes	Spices	GC-MS	[198][a]
Volatile components	*Satureja hortensis* L. leaves	GC-MS	[199][a]
Pulsed electric field-assisted extraction (PEAE)			
Bioactive compounds	Cocoa bean shell, coffee silverskin	HPLC-PDA	[200]
	thinned peach fruits	HPLC-PDA	[201]
Carotenoids	Tomato wastes	HPLC-UV	[202]
Functional compounds	Nepeta binaludensis	HPLC-UV	[203]
Phenolic compounds	almond red leaves	HPLC-UV	[204]
	Rosemary, thyme by-products	UPLC-MS/MS	[205]
Procyanidins	*Vitis amurensis* seeds	UV-Vis	[206]
Sulforaphane	Broccoli florets	HPLC-DAD	[207]
Supercritical fluid extraction (SFE)			
Antioxidant and antibacterial compounds	Feijoa leaf	LC-MS/MS	[208]
Fatty acids	Borage seed oil	UV-Vis, GC	[209]

Oils	*Terminalia catappa* fruits	GC, IV	[210]
Oleoresins	*Capsicum annuum, Capsicum chinense,*	HPLC-UV	[211]
	Sea buckthorn pomace	HPLC-UV, GC/MS	[212]
Phytochemicals	*Terminalia chebula* pulp	UV-Vis	[213]
Polar lipid fraction	Blackberry, passion fruits	LC-DAD-MS/MS	[214]
Seed oil and active compounds	Peel from pumpkin	UV-Vis	[215]
Subcritical water extraction (SWE)			
Antioxidant protein hydrolysates	Shellfish waste	UV-Vis	[216]
Anthocyanins	Raspberry	HPLC-DAD	[217]
Bioactive compounds	Pumpkin peel, apple bark	HPLC-UV/Vis, GC-MS	[218,219]
Fatty acids	*Ulva lactuca*, *Caulerpa racemosa*	GC	[220]
Hesperidin and narirutin	*Citrus unshiu* peel	HPLC-UV/Vis	[221]
Pectic polysaccharides	Apple pomace	UV-Vis, FTIR	[222]
Phenolic antioxidants	Chestnut shells	HPLC-MS	[223]
Phenolic compounds	Avocado fruit flesh	UV-Vis	[224]
Phytochemical compounds	*Moringa oleifera*, *Sauropus androgynus*, *Sesbania grandiflora*	UV-Vis, FTIR	[225]
Scopoletin, alizarin, and rutin	*Morinda citrifolia*	HPLC-UV/Vis	[226]

Legend: [a] – application involving the use of ILs or DES; CCD-array: charge-coupled device; DES: deep eutectic solvents; EDCs: endocrine-disrupting compounds; FAAS: flame atomic absorption spectrometry; FTIR: Fourier-transform infrared spectroscopy; FS: fluorescent spectroscopy; GC: gas chromatography; GC-ECD: gas chromatography with electron capture detector; GC-FID: gas chromatography with flame ionization detector; GC-MS/MS: gas chromatography tandem mass spectrometer; GC-MS: gas chromatography coupled with mass spectrometry; GFAAS: graphite furnace atomic absorption spectrometry; GFAAS: graphite furnace atomic absorption spectrometry; HPLC: high performance liquid chromatography; HPLC-FLD: high performance liquid chromatography with fluorescence detection; HPLC-FLD: high performance liquid chromatography with fluorescence detection; HPLC-UV: high-performance liquid chromatography combined with an ultraviolet detector; ICP-OES: inductively coupled plasma optical emission spectrometry; ILs: ionic liquids; LC-MS/MS: liquid chromatography tandem mass spectrometry; PAHs: polycyclic aromatic hydrocarbons; UHPLC: ultra-high performance liquid chromatography; UHPLC-MS/MS: ultra-high performance liquid chromatography tandem mass spectrometry; UV/Vis: ultraviolet-visible spectrophotometry; VOCs: volatile organic compounds.

Table S3. Representative applications of GreETs for the analysis of environmental samples.

Analytes	Matrix	Analytical approach	Ref
Solid phase microextraction (SPME)			
Endocrine-disruptive pesticides	Water	GC-MS	[227]
Estrogens	Water	HPLC	[228][a]
Microplastic	Coral reef invertebrates	LC-MS	[229]
NSAIDs	Lake water	HPLC-UV	[230][a]
Organophosphorus pesticides	Water	CD-IMS	[231]
PAHs	Soil, rain, water	GC-FID, GC-MS	[232–235]
PAHs	Water	GC-FID	[236][a]
Pb (II)	Tap water	FI-ICP-OES	[237][a]
Phthalate esters	Water	GC-FID	[238][a]
Pesticides	Water	GC-MS	[239]
Toluene, ethylbenzene and o-xylene	Water	GC-FID	[240][a]
VOCs	Wastewater, air	GC-MS	[241,242]
Ultraviolet filters	Water	GC-MS	[243][a]
Micro solid-phase extraction (μSPE)			
Aluminium	Wastewater	ICP-MS	[244]
Chemical warfare agents	Tap water	GC-FID-MS/MS	[245]
Chlorobenzenes	Water, soil	HPLC-DAD	[96]
Diazinon	Soil	HPLC-UV	[97]
Dyes	Water	Spectrophotometry	[246][a]
EDCs	Wastewater, water, ambient air	HPLC-DAD,GC-MS/MS	[247,248]
Herbicides	Water	UHPLC-MS/MS	[249]
Non-steroidal anti-inflammatory drugs	Water	HPLC-UV	[250]
Organochlorine pesticides	Water	GC-MS	[251]
PAHs	Seawater, water	HPLC-FLR, GC-FID	[101,252]
Polar herbicides	Tap and reservoir waters	UHPLC-MS/MS	[253]
Trace metals (As, Cd, Cr, Co, Sb, Pb and Tl)	Water	ICP-OES	[108]
Microextraction in packed syringe (MEPS)			
Benzene, phenol and their derivates	Water	HPLC-UV	[254]
Diazinon	Water	CD-IMS	[255]
Fipronil, fluazuron residues	Wastewater	UHPLC-DAD	[113]
Fluoxetine	Wastewater, river, dam water	FL	[256]
La^{3+}, Tb^{3+}	Water	ICP-OES	[257]
PAHs	Soil, water, snow	HPLC-UV/Vis, GC-FID, GC-MS	[258–260]
Organophosphorus pesticides	Water	GC-MS	[261]

Phthalates	Tap and river water	GC-FID	[262]
Pipette Tip Solid-Phase Extraction (PT-SPE)			
Methyl and propyl parabens	Wastewater and shampoo samples	Spectrophotometry	[263]
Sulfamerazine	River water	HPLC	[264][a]
2,4-dichlorophenoxyacetic	Lake water	HPLC-SPD	[265]
Matrix solid-phase dispersion (MSPD)			
Atrazine	Water	HPLC-UV/Vis-DAD	[266]
Azole fungicides	Fish	HPLC-DAD	[267]
Emerging contaminants	Aquatic plants	GC-MS	[268]
EDCs	Mussels	HPLC-DAD	[121]
Fluoroquinolones	Water	LC-MS/MS	[269]
Organophosphorus flame retardants	Marine mussel	LC-MS/MS	[270]
PAHs	Soil	GC-MS	[271]
Pesticides	Honeybees, water	GC-MS	[272,273]
Triazine herbicides	Marine sediments	HPLC-DAD	[274]
Bisphenol Contaminants	Bee polen	HPLC-DAD	[275]
Fluazuron (acaricid)	Bovine plasma	LC-UV	[276]
Magnetic solid phase extraction (MSPE)			
Benzoylurea pesticides	Water	HPLC-DAD	[277]
Cu (II), Cd (II), Cr (III), Zn (II), Pb (II)	Water	ICP-OES	[278]
Heterocyclic pesticides	Water	HPLC-DAD-FLR	[279]
Microcystins	Lake water	UHPLC-MS/MS	[280][a]
Organophosphorus pesticides	Water	HPLC-UV	[281]
PAHs	River, lake and sludge waters and soil	GC-MS	[282][a]
Pharmaceutical compounds	River and dam water	HPLC-UV	[283][a]
PAHs	Water	GC-MS	[284]
Phenols	Water	HPLC-UV	[285]
Se, Te	Water	ICP-MS	[286]
Strobilurin fungicides	Water	HPLC-MS/MS	[287]
Sulfonamide antibiotics	Water	HPLC-MS/MS	[288]
Triazole fungicides	Water	HPLC-DAD	[289]
Fabric phase sorptive extraction (FPSE)			
Amphetamine drugs	Water	LC-MS	[290]
Antidepressant drugs	Wastewater, lake water	HPLC-DAD	[291]
Cytostatic drug residues	Water	UHPLC-MS/MS	[292]
Emerging contaminants	Wastewater	UHPLC–LTQ-Orbitrap MS	[293]
Fungicides	Water	GC-MS	[294]

Parabens	Wastewater	HPLC-PDA	[295]
PAHs	Water	CD-IMS	[296]
Pesticide residues	Water	HPLC-PDA	[297]
Substituted phenols	Water	HPLC-UV	[298]
UV filters	Water	GC-MS/MS	[299]
Lead and cadmium	Wastewater	FAAS	[300]
Brominated flame retardants	Wastewater	HPLC	[301]
Plastic additives contaminants	Food packages	UPLC-MS	[302]
Sexual pheromones	Environmental air	GC-MS	[303]
Dispersive liquid-liquid microextraction (DLLME)			
Antibiotics	Tap, waste, and seafood market water	HPLC-UV	[304][a]
Aromatic amines	Water	HPLC-UV	[305]
Cd	Water	TS-FF-AAS	[306]
Cr	Water	GFAAS	[307]
Cu	Wastewater	FAAS	[308][a]
Dyes	Water	RSM-CCD	[309]
Fluoroquinolones	River water	HPLC-FLD	[310]
Herbicides	Water	GC-MS	[311]
Lipophilic organic UV filters	River, sea, and swimming pool water	TD-GC-MS	[312][a]
Ni^{2+}, Co^{2+}, Cd^{2+}, Cu^{2+}, Pb^{2+}	River, lake water	LC-UV	[313]
Ni (II) and Co (II)	Water	DES/GFAAS	[314]
NSAIDs	Water	HPLC-UV	[167]
PAHs	Water	GC-MS	[315][a]
Pesticides	Water	HPLC-UV	[316][a]
Polybrominated biphenyls	Water	HPLC-UV	[317]
Pyrethroid insecticides	Water	HPLC-UV	[318]
Tetracycline	Water	HPLC-UV	[319]
Steroids	Water	HPLC-PDA	[320][a]
Phenol	wastewater	Android app Color Grab	[321]
µQuEChERs			
Acidic, basic, neutral, amphiphilic species	Soil	LC-MS	[322]
Insecticides	Guttation fluids	LC-MS/MS	[323]
Pesticides	Arthropods, gastropods	GC-MS/MS	[324]
Pesticides, insecticides	Pollen, nectar	LC-MS/MS	[325]
VOCs	Small organisms (zebrafish)	GC-MS/MS	[326]
Single drop microextraction (SDME)			
Aromatic compounds	Lake water	HPLC-UV	[327][a]
Cu (II)	Tap water, seawater	GFAAS	[182]

Endocrine disrupting compounds	Water	HPLC-DAD	[328][a]
Mn (II)	Fish	GFAAS	[329]
PAHs	Tap water	GC-MS	[330]
PAHs	River water and wastewater	GC-MS	[330][a]
Pesticides	Mango	GC-MS	[331]
Ranitidine	Wastewater	LC-MS/MS	[332]
V (V)	Water	DIC	[333]
Volatile aromatic hydrocarbons	Water	GC-FID	[334][a]
Solidification of floating organic drop microextraction (SFOME)			
Antiviral agents	River water	HPLC-UV	[335]
Cd	River, sea, and tap water	FAAS	[336]
Pb	Water	GFAAS	[336]
Ni, Co, Cu	Fish	FAAS	[337]
NSAIDs	Water	HPLC-UV/Vis	[338]
Phenol, chlorophenols	Water	HPLC	[339]
Benzophenone and salicylate ultraviolet filters	Water	HPLC-Vis	[340]
Supercritical fluid extraction (SFE)			
Ag	Electronic waste	ICP	[341]
Neonicotinoid pesticides	Green onion	LC-MS	[342]
PAHs	Soil	SFC-MS	[343]
Petroleum biomarkers	Tar balls, crude oils	GC-MS	[344]
Petroleum hydrocarbons	Soil	GC-FID	[345]
Polyethylene and polypropylene waxes	Polyolefin plastic feedstock	GC-MS	[346]
Solanesol	Tobacco residues	HPLC-DAD	[347]
Subcritical water extraction (SWE)			
Co, Li and Mn	Spent lithium-ion batteries	XPS	[348]
Crude oil	Soil	BBD-RSM	[349]
Oil shale	Mines	GC-MS	[350]
PAHs	Atmospheric particulate matter	GC-MS/MS	[351]
Petroleum hydrocarbons, oil	Soil	GC-MS	[352]
VOCs	Sewage sludge	GC-MS	[353]

Legend: [a] – application involving the use of ILs or DES; BBD-RSM: Box-Behnken Design under response surface methodology; DES: deep eutectic solvents; DIC: digital image colorimetry; EDCs: endocrine-disrupting compounds; FAAS: flame atomic absorption spectrometry; GC-FID: gas chromatography with flame ionization detector; GC-MS/MS: gas chromatography tandem mass spectrometer; GC-MS: gas chromatography coupled with mass spectrometry; GFAAS: graphite furnace atomic absorption spectrometry; GFAAS: graphite furnace atomic absorption spectrometry; HPLC: high performance liquid chromatography; HPLC-FLD: high performance liquid chromatography with fluorescence detection; HPLC-FLD: high performance liquid chromatography with fluorescence detection; HPLC-UV: high-performance liquid chromatography combined with an ultraviolet detector; ICP-MS: Inductively coupled plasma mass spectrometry; ILs: ionic liquids; LC-MS/MS: liquid chromatography tandem mass spectrometry; PAHs: polycyclic aromatic hydrocarbons; RSM-CCD: response surface methodology with central composite design; SFC-MS: supercritical fluid chromatography mass spectrometry; TS-FF-AAS: thermospray flame furnace atomic absorption spectrometry; UHPLC: ultra-high performance liquid chromatography; UHPLC-MS/MS: ultra-high performance liquid chromatography tandem mass spectrometry; VOCs: volatile organic compounds.

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