

Index

Note: Page numbers followed by “f” and “t” indicate figures and tables respectively

1–9

- 1-(2-pyridylazo)-2-naphthol, 71
- 2,6-diaminopyridine, 71
- 4-vinylpyridine, 73
- 5-(4'-dimethylaminobenzyliden)-rhodamine, 72
- 8-aminoquinoline (AQ), 73
- 8-hydroxyquinoline (HQ), 73
- 8-mercaptoquinoline (MQ), 73

A

- Acanthocephalans (parasites), 367t, 390, 391t
 - Pt accumulation, 376
- Actinides, 212, 215
- Activated carbon, 35, 102
 - effect of pH on, 72f
 - in SPE, 70, 71
- Active monitoring, 341, 342
- Adenosine triphosphate (ATP), 388, 404f
 - in Cu ion pathway, 405–406
- Adsorption, 68, 370, 395
 - of noble metals, 37
- Adsorption (adsorptive) stripping voltammetry (AdSV), 54, 81, 86, 120t, 125t
- Adsorptive stripping, 312
- Adsorptive voltammetry, 342
 - stripping voltammetry (AdSV)
 - (see Adsorption (adsorptive) stripping voltammetry (AdSV))
- Adverse effects indication, using organisms, 383–386
 - at cellular level, 388–389
 - ecosystem level, 394–395
 - individual organism, 390

- internal and external factors, 384f
- at molecular level, 386–388
- at organelle level, 388
- at organs level, 389–390
- population level, 394
- test organisms, 391–393t
- at tissue level, 389–390
- Airborne particulate matter (Airborne PM)
 - PGE in, 448, 449–452t, 453–454
 - PGE reference materials analysis, 221–225t
 - Rh, Pd, and Pt concentrations in road/tunnel dust and, 220
 - Rh, Pd, and Pt concentrations in world, 228–232t
 - in road dust Houston, Texas, 212–213
- Alfalfa. *See* *Medicago sativa*
- Allergens, 438, 439, 456
- Alumina *See also* Aluminum oxide (Al₂O₃)
 - γ-alumina reference material, 304, 304f, 305
 - Pt/alumina model substance, 281–284, 294, 299f
 - reference material, 298t
- Aluminum oxide (Al₂O₃), 68, 164, 278–287
 - as anion exchange resin, 113
- American Conference of Governmental Industrial Hygienists (ACGIH), 466
- Aminated crosslinked lignophenol, 37
- Aminated lignin derivatives, 37
- Ammonium hexachloroplatinate, 439
- Ammonium pyrrolidinedithiocarbamate (APDC), 73
- Ammonium tetrachloroplatinate (II) ((NH₄)₂PtCl₄), 98, 367t, 438, 439
- Amphibia, 390

- Amphibia (*cont.*)
 laboratory studies on biological effects, 393*t*
 uptake and bioaccumulation of Pt, Pd and Rh, 367*t*
- Amplified fragment length polymorphism (AFLP) analysis, 386
- Ampyplatin, 402*f*, 408
- Animal tissues, inactive biomass derived from, 34, 37–40
 biosorbents, 38–39*t*
 glutaraldehyde cross-linked chitosan, 37
- Anion-exchange chromatography, 55, 206*t*
- Anion-exchange resin, 46, 213
- Anion exchangers, 101
- Anionic species (Cl⁻, NO₃⁻, SO₄²⁻), 278–279
 analysis, 280
 influence on Pt/Al₂O₃, 281–284
 particle surface chemistry analysis, 285–287
 quality control and quality assurance, 280–281
 sample extractions, 280
 sample material, 279
 sample preparation for XPS, 279
- Annelids, 369, 386, 390, 392*t*
 uptake and bioaccumulation of Pt, Pd and Rh by, 365*t*
- Anthropogenic activities, 34
 anthropogenically impacted ERs, 176
 and contamination, 4, 10, 14, 79, 179, 182
 emissions from PGE sources, 14*f*, 27, 55, 92, 109, 358, 420
- Antineoplastic drugs, 464, 465
- Antioxidant I (Atox1), 405
- Apoptosis, 406–408, 410
- Aquatic animals
 laboratory studies on, 365–368*t*
 PGE exposure studies (*see* Aquatic exposure studies)
 uptake and accumulation, 362, 369
- Aquatic ecosystems
 estuaries, 356–358
 flowing-water systems, 353–356
 lentic water ecosystems, 352–353
 marine ecosystem, 357–358
 platinum group elements (PGE), 351–352
 ultra-trace concentration ranges, 358
- Aquatic exposure studies
 exposure concentration, 372–373
 exposure medium, 373–374
 exposure period, 374–375
 PGE sources, 371–372
 route of exposure, 372
 temperature, 376–377
 test organism, 375–376 (*see also* Aquatic test organism)
 test parameters, 369
 test system, 370
- Aquatic plants
 laboratory studies on, 363–364*t*
 PGE exposure studies (*see* Aquatic exposure studies)
 uptake and accumulation, 362
- Aquatic test organism
 Acanthocephala, 391
 Amphibia, 393*t*
 Annelida, 392*t*
 Crustacea, 392*t*
 fish, 393*t*
 molluscs, 392*t*
 plants, 391*t*
- Arenicola marina*, 369, 372, 392*t*, 395
 uptake and bioaccumulation of Pt, Pd and Rh by, 365*t*
- Artificial lysosomal fluid (ALF), 133, 271, 455, 456
- Asellus aquaticus* (crustacean), 352, 353, 355, 356, 369, 373, 392*t*
 uptake and bioaccumulation of Pt, Pd and Rh by, 367*t*
- Aspergillus* sp., 42, 48, 54, 57
 atomization signals of Pt from solutions, 60*f*
 immobilized on Cellex-T resin, 58
 retention of palladium and platinum on, 59
 rinsing procedure, 59
 sample analysis, 60
 for separation/preconcentration of Pt(IV) and Pd(II), 45*t*
 SPE procedure based on, 48
- Assimilation efficiency (AE), 371, 378
- ATHENA software, 298
- Atmospheric PGE dispersion, 11
- Atomic absorption spectrometry (AAS), 34, 42, 342
 electrothermal AAS (ETAAS), 115, 117
 flame AAS (FAAS), 114, 115, 116–117
 graphite furnace AAS (GFAAS), 189, 191, 192, 196*t*
- ATP-binding cassette (ABC) transporter, 406
- Attrition, 164, 182, 200
- Autocatalyst (SRM-2556), 236
- Automobile catalysts, 4, 258
 catalytic converters, 131, 244, 258–263, 352, 355, 358, 361 (*see also* Automotive catalytic converters)
 catalytic material (SRM 2557), 269

- emissions, 19, 22, 327
- exhaust catalysts, 4, 145, 149
- platinum, 258
 - related atmospheric contamination, 164
 - as source of PGE, 4–6, 132
- Automotive catalytic converters, 112, 188, 195, 278, 279, 420, 453
 - emissions, 272
 - PGEs from, 172, 266
- Autoreactive T cells, 457
- Azolla filiculoides*, recovery of Rh(III), 39–40

- B**
- Background equivalent concentrations (BECs), 217, 220
- Barbel (*Barbus barbus*), 355, 356, 369, 393*t*
 - uptake and bioaccumulation of Pt, Pd and Rh by, 367*t*
- Barium (Ba), 133, 134, 140, 141, 164, 247
 - metal range concentration in road side, 139*t*
 - traffic derived, 138, 139, 140
- Barley (*Hordeum vulgare* L.), 331*t*, 332*t*
 - detection of platinum group elements in, 313*t*
- Batch procedures, disadvantages of, 36
- Bavarian roadside soil
 - palladium, 145, 146, 147, 148*f*, 150
 - platinum, 145, 146, 147, 148*f*, 149*f*, 150
 - rhodium, 145, 146, 147, 148*f*, 149*f*, 150
- Bax (apoptosis regulator protein), 407, 408
- Bayberry tannin immobilized on collagen fiber (BTICF), 37
- BCR-723 road dust, 114, 116, 117, 118, 127, 167, 191, 193, 260, 269, 319
 - atomization signals of, 58*f*
 - ETAAS method for analysis, 48
 - recovery of Pt from, 57
- Behavior, of platinum metals, 454–456
- Beretania site (storm drains), 171, 171*t*, 172, 173*f*
- Berner Box, 470
- β -(1-4)-linked D-glucosamine, 37
- BHVO-1 (reference material), 168, 169*t*
- Bignonia, detection of platinum group elements in, 313*t*
- Bioaccessibility
 - in airborne particulate matter, 447–459
 - of palladium, 372
 - of PGE, 266, 267
 - of platinum metals, 372, 454–456
- Bioaccumulation, 35–36
 - capability, 244
 - factors, 377–378
 - laboratory studies, 378
 - of metal ions by microorganisms, 36*f*
- Biological monitoring, 420, 435–439
 - of Ir, 425*t*, 431*t*
 - of Pd, 423–424*t*, 429–430*t*
 - of Pt, 422–423*t*, 428–429*t*
 - of Rd, 424*t*, 430*t*
- Biomagnification processes, 394
- Biomarkers, 385
 - concept of, 385*f*
 - of effects, 435–439, 441
 - of exposure, 421 (*see also* Occupational medicine, biomarker of exposure)
 - hypersensitivity reactions, 435, 436
 - Pt salt-specific IgE antibodies, 436, 437
 - skin-prick testing, 435
 - susceptibility, 439
 - T-cell receptor (TCR) repertoire, 438
- Biomonitoring, 81, 327, 339
 - mosses, 340
 - of PGEs in occupational medicine (*see* Occupational medicine, biomarker of exposure)
- Biosorption
 - binding, 35
 - of metal ions, 35–36, 36*f*
 - of PGE, 37–40
- Blood and serum, biomarker of exposure
 - iridium, 425*t*, 427
 - palladium, 423–424*t*, 426
 - PGE level monitoring, 440
 - platinum, 421, 422–423*t*, 426
 - rhodium, 424*t*, 427
- Blood-brain barrier, 458
- Boston, USA, 7, 10, 230*t*
 - airborne PM, 451*t*, 453
- Braunschweig, northern Germany, 154
 - City Park values, 156
 - Gifhorner Street values, 156–157, 158*f*
 - Hagenring sampling, 158, 159*f*
 - heavy-traffic roads, contamination in, 160
 - Motorway B 248 results, 156, 157*f*, 157*t*, 158*f*
 - PGE analysis, 155–156
 - PGE contamination of air and airborne dust, 159–160
 - preparation of soils, 154–155
 - sampling of airborne dust, 155
- Brazil, urban and roadside soils
 - other metals in, 138–141
 - PGE contamination in, 132
 - PGE levels and behavior, 134, 136–137
 - PGE ratio, 137–138
- Bronchial symptoms, 471, 472

- Bronsted acid, 402
- Brown mustard (*Brassica juncea*), 317r
detection of platinum group elements in, 333r
- Bryophytes, monitoring of PGEs, 339–342
analytical methods, 342–343
concentrations of PGE elements in, 344r
cost efficiency, 341
miscellaneous, 346
remote areas, 344
traffic sites, 344–345
urban and industrial environments, 345–346
- Buenos Aires, Argentina
airborne PM, 230r, 266, 451r, 453
urban aerosols from, 138
- Bulgaria, roadside dust, soil and vegetation in, 243–244
highways in, 244
instrumentation, 247
Pd, concentration of, 249r, 250f, 252f
plant samples, 251–252
Pt, concentration of, 249r, 250f, 251f
quality control, 248
reagents, 247
road dust sample results, 248–250
road map of, 245f
sample preparation, 245–246
soil sample results, 250–251
spectral interferences, 248
- Bus drivers, 432, 458
- Bushveld Igneous Complex (BIC), in South Africa, 20
map of mining areas, 21f
PGE in vicinity of mines in, 21–22
- C**
- Calcium alginate, 46, 56r
S. cerevisiae immobilized on, 44–45r, 46
- Canadian waterweed (*Elodea canadensis*), 314r, 330
exposure studies for platinum, palladium and rhodium to, 331r, 333r, 334r
- Capillary electrophoresis (CE), 101, 103
- Car exhaust catalysts, 188, 329
- Carbon monoxide, 4, 79, 211, 289, 290, 291, 420
- Carbon nanotubes (CNTs), 68, 71, 116
multi-walled, 71, 114, 121r, 125r
- Carbon-based sorbents, 70–72
electrostatic forces, 71
non-covalent forces, 71
- Carbonisation, 312, 318r
- Carbonylation, 402
- Carboplatin, 9, 179, 402f, 404, 406, 407
- Carcinogenicity, 473
in animals, 465
in humans, 465
- Catalytic converters, 153
manufacture of, 420
products, 167
- Cathodic stripping voltammetry (CSV), 100
- Cation-exchange chromatography, 201r, 202r, 203t, 204r, 207t, 208t, 210r
column performance, 216
separation of matrix ions by, 215
- Cation-exchange resin, 213
- Cellex-T resin, 43r, 45r, 46, 47
C. vulgaris immobilized on, 43t, 46–47
- Cellulose, 35, 46, 118, 267
- Cerium (Ce), 138, 140, 141
metal range concentration in road side, 139r
oxide (CeO₂), 68
- Certified reference materials (CRMs), 127, 319
- Chemical precipitation, 34, 35
- Chemiluminescence (CL), 54, 118, 121r, 126r
- Cherry laurel (*Prunus laurus cerasus*), 323r, 328
detection of platinum group elements in, 313r
- China, 7
PGE abundances in, 223r
PGE contamination in, 71, 132, 135r
PGE ratios for solid environmental media, 177–178r
- Chitosan, 37
- Chlorella stigmatophora*, 362
uptake and bioaccumulation of Pt, Pd and Rh by, 363r
- Chlorella vulgaris*, 42, 54
for the separation/preconcentration of Pt (IV) and Pd(II), 43r
immobilized on cellulose anion-exchange resin, 46
immobilized on silica gel, 46
- Chlorinated platinum species, 100–101
enrichment methods for pre-concentration of, 101–102
platinum speciation (*see* Platinum speciation)
- Chromatograms, 102
- Cisplatin (cis-dichloro-diammine-platinum(II)), 330, 402f, 407, 465
CTR1 methionine extracellular N-terminus, 404
disadvantages of, 403
DNA adducts, 407f

- on DNA repair mechanisms, 409
- endocytic vesicles, 405
- mitochondrial-dependent ROS response, 407
- platinum(II) complexes, 408
- scheme of cisplatin trafficking, 404f
- Closed vessel microwave-assisted acid digestion, 214, 215f
- Cloud point extraction (CPE), 192, 203t
 - selective enrichment of platinum species by, 192–193
- Cocksfoot grass (*Dactylis glomeratus*), 322t
 - detection of platinum group elements in, 313t
- Combustion engines, 402
- Common reed (*Phragmites australis*), 323t
 - detection of platinum group elements in, 313t
- Copolymers, octadecyl silica and styrene-divinylbenzene, 68
- Copper (Cu), 139, 140, 141
 - emissions rates from Cu-Ni production, 27
 - metal range concentration in road side, 139t
- Copper chaperone for superoxide dismutase 1 (CCS), 405
- Copper transporter 1 (CTR1), 404
- Corbicula* sp. (mollusc), 355
 - concentrations of Pt, 356
- COX17, 405
- Creatinine, 428t, 432, 458, 467, 471
 - airborne soluble platinum concentrations and, 468f
 - platinum excretion and, 470f
- Crustaceans, 355, 369, 386, 390
 - uptake and bioaccumulation of Pt, Pd and Rh by, 365t
- Cytochrome c oxidase, 405, 408
- Cytostatic drugs, 402
- Cytotoxicity, 394, 406
 - environmental Pd, 244
 - platinum anticancer agents, 408, 409, 410
- D**
- Dandelion, 316t, 322t
- Debye-Waller factors, 294, 299
- Degenerative effects, 389, 390, 392t
- Dehydrogenation, 402
- Dendrimers, 402
- DeNOx catalysator, 420
- Desulfovibrio*, 39t
 - as biosorbents for Pd(II) and Pt(IV), 40
- Detection techniques, for PGEs, 115
 - chemiluminescence, 118
 - electrothermal atomic absorption spectrometry, 117
 - flame atomic absorption spectrometry, 116–117
 - inductively coupled plasma-atomic emission spectrometry, 116
 - inductively coupled plasma-mass spectrometry, 115–116
 - laser ablation ICP-MS, 116
 - microwave-assisted digestion, 115
 - neutron activation analysis, 118, 127
 - voltammetry, 118
- Diesel catalysts, 4, 300t
- Diesel VEC catalysts from EU sources, 297–298
 - aged catalyst samples and nomenclature utilized, 298t
 - fresh catalyst samples and nomenclature utilized, 298t
- Differential pulse polarography, 342
- Differential pulsed voltammetry (DPV), 81, 85, 118, 312
- Dimethylglyoxime (DMG), 73, 75t
- Divalent cations, 341, 374
- DNA *See also* Eukaryotic cells, platinum compounds on
 - damage, 386
 - double-stranded, 408
 - effects of platinum compounds on eukaryotic cells and, 403–410
 - replication, 332
- DRC-q-ICP-MS analysis, 213, 220
 - sample preparation steps, 213f
- Dreissena polymorpha* (mollusc), 355, 366t, 367t, 373, 386
 - bioaccumulation factors, 371f
 - Pt uptake in, 375f
- Drip-zone effect, 146, 149, 150
 - in Bavarian roadside soils, 145–155, 148f
- Dynamic reaction cell (DRC) optimization, 216–217
 - measurement summary, 218t
 - NH₃ flow rate optimization, 217, 219, 219f
 - quality control/assurance, 220
 - rejection parameter q (RPq), 219–220
- E**
- E2F1 (transcription factor), 409
- Earth crust, 80, 92, 109
 - PGE compounds in, 67
 - upper continental crust, 20
- Ecotoxicology, 384, 385
- Electron beam techniques, 320

- Electron microscopy, 8, 10, 291, 319, 320, 362, 388
- Electrostatic forces, 42, 47, 71
- Electrothermal atomic absorption spectrometry (ETAAS), 34, 68, 100, 115, 117, 119*t*, 120*t*, 121*t*, 122*t*, 123*t*, 125*t*, 312
- digestion procedure for, 55–58
- optimization requirement, 62–63
- PGE, separation and determination of, 58–60
- Pt and Pd determination by, 53–55
- sample analysis of, 60–61
- Electrothermal atomization to laser absorption fluorescence spectrometry (ET LAFS), 191
- Electrothermal vaporization inductively coupled plasma—optical emission spectrometry (ETV ICP-OES), 312
- Elementograms, 102
- Employees precaution
- biological monitoring, 471, 473–474
- individual preventive medical examination, 471
- recommendation for medical examination program, 472
- workplace safety measures, 472–473
- Endocytic vesicles, 405
- Energy dispersive X-ray fluorescence, 320
- Enrichment factors (EF), 92
- for platinum, 93*f*
- for rhodium, 93*f*
- for traffic related elements, 233, 233*f*
- Enrichment ratios (ERs), grain-size normalized, 167–168
- Escherichia coli* biomass, 39*t*, 41
- Estuaries, PGE in, 356–358, 357*f*
- Ethyl-3-(2-aminoethylamino)-2-chlorobut-2-enoate, 71
- Ethylenediaminetetraacetic acid (EDTA), 268, 270, 271, 273, 455
- mean soluble fraction in, 270*t*
- sample extraction with, 268
- solubility of PGE, 278
- solubility of samples in, 271*f*
- Eukaryotic cells, platinum compounds on, 403
- binding and interaction of, to DNA, 408–409
- cellular uptake mechanisms of, 403–405
- cytoplasmic interactions, 406
- platinum nanoparticles, 409–410
- reactive oxygen species and apoptosis, 408–410
- significance of copper, 405–406
- European autocatalysts (EB-504), 236
- European tunnel dust (BCR 723), 236
- Evaluation of exposure of PGEs, platinum industry, 465–467
- Excision repair cross-complementation group 1 (ERCC1), 409, 410
- Exhaust gases, 4, 80, 188, 402
- Extended X-ray absorption fine structure (EXAFS), 291, 293, 303
- data of Pt-Cl containing reference compounds, 294
- Fourier transforms (FT) of, 294, 295*f*, 297*f*, 300*f*
- structural parameters of model compounds, 295*t*, 297*t*, 300*t*
- F**
- Fern, 39, 322*t*
- detection of platinum group elements in, 313*t*
- Filtration, 76, 125*t*, 126*t*
- Fish, 357, 395*t*
- Barbus barbus*, 357, 371
- uptake and bioaccumulation of Pt, Pd and Rh by, 369*t*
- Flame atomic absorption spectrometry (FAAS), 68, 115, 116–117, 120*t*, 121*t*, 125*t*, 126*t*
- Flow injection (FI) approach, 191
- Flowing-water systems, 353–356
- Fluvial bed sediments
- anthropogenic enrichment of, 165
- chemical analyses, 166–167
- grain-size fractionation, 167–168
- PGE concentration in, 164–165
- PGE concentrations, average, 169*t*, 170*t*
- PGE concentrations, baseline, 168–169
- PGE enrichment ratios, 167–168
- quality control, 166–167
- sample collection and processing, 165–166
- storm-drain associated bed sediment PGE concentrations, 169–171
- study area, 165
- Fossil combustion, 12
- Fourier transform infra red (FTIR) studies
- for carbon monoxide, 291
- Frankfurt am Main, airborne particulate matter (PM₁₀), 450*t*, 451*t*, 453
- analysis, 268–269
- materials, 267–268
- results, 269–273
- road dust analysis, 136
- sample collection, 267

sample extraction, 268
Free radical polymerization, 73
Freezing in liquid nitrogen, 317t

G

Gamble's solution, 133, 271, 455, 456
Gammarus fossarum (crustacean)
PGE concentration in, 355
Pt concentrations in, 352
Gammarus pulex (crustacean)
PGE concentration in, 355
Pt concentrations in, 352
Gasoline
catalysts, 91
engines, 4, 154, 290, 291, 455
Gastropod, 390
platinum during embryonic development, 394
Gauss-Lorentz curve analysis, 285t, 287t
Glutaraldehyde (GA), 37
Glutathione (GSH), 405
efflux, 406
Gothenburg, Sweden, airborne PM, 448, 449t
G-quadruplex DNA, 408
Graphite furnace atomic absorption spectrometry (GFAAS), 100, 189, 191
Grass (family *Gramineae*), 315t, 317t, 322t, 325t
detection of platinum group elements in, 313t
Green arrow arum (*Peltandra virginica*), 330, 331t, 333t, 334t
detection of platinum group elements in, 313t
Green vegetables, detection of platinum group elements in, 316t
Guanine, 465
cisplatin bound monofunctionality to, 409f
-protein cross-link, 409f

H

Hafnium-Oxygen species, 115
Hair, biomarker of exposure, 437
Hanging mercury drop electrode (HMDE), 85, 86
Harmful gases, 4
Health care settings
biological monitoring, 469–470
human health risks, 464–465
individual preventive medical examination, 473

recommendation for improvement of work safety, 473–474
workplace air monitoring, 467–469
workplace safety measures, 473
Heat shock proteins (hsp70), 387, 391t, 392t, 393t
PGE inducing production of, 386
Heavy duty diesel (HDD) VEC, 289
Heavy-traffic roads, contamination in, 160
Heyrovsky, Jaroslav, 81
High temperature abrasion, 200
High-resolution inductively coupled plasma mass spectrometry (HR-ICP-MS), 134, 205t, 209t
Highway Maintenance Agency Erlangen, 146
HLA phenotype, as biomarker, 439
Holm-oak (*Quercus ilex* L.)
concentration ranges of platinum, palladium and rhodium in, 325t
detection of platinum group elements in, 313t
Honolulu, Hawaii (USA)
cation exchange capacity (CEC) in, 181
chemical analyses, 166–167
concentrations of Pt, Pd and Rh, 172f
grain-size fractionation, 169–170
PGE concentrations, average, 171t, 172t
PGE concentrations, baseline, 170–171
PGE enrichment ratios, 169–170
quality control, 168–169
sample collection and processing, 167–168
spatial variation in bed sediment concentrations about storm drain outlets, 172–173
storm-drain associated bed sediment PGE concentrations, 171–172
Hot digestion, 314t
Houston, Texas, road dusts and airborne particles in, 454t, 455–456
airborne particulate matter, 214–215
analyte quantification, 217–218
analytical method development, 202–213
cation-exchange column performance, 218
certified elements analysis, 223–227t
closed vessel microwave-assisted acid digestion, 216, 217f
DRC optimization, 218–222
grain size distribution of, 214f
indicative elements analysis, 223–227t
PGE characterization, 236–238
reference materials, 215
Rh, Pd, and Pt concentrations in, 222, 225–236

- Houston, Texas, road dusts and airborne particles in (*cont.*)
 sample preparation, 216
 tunnel and road dust, 213
 vehicle autocatalyst, 215
- Human bronchial epithelial cells (BEAS-2B), 457
- Human health risks, 463
 health care settings, 464–465
 platinum industry, 464
- Humic substances, 374
- Hyderabad city, India, road dust analysis, 136
- Hydrocarbons, 4, 289, 290, 420
 residual, 164
 unburned, 79
- Hydroformylation, 402
- Hydrogen bonding, 71
- Hydrogenation, 402
- Hydrogenolysis, 402
- Hydrometallurgical processing, 34
- Hydrophobic interactions, 71
- Hypersensitivity reactions, 435, 436
 IgE-mediated, 441
- Hyperthermic intraperitoneal chemotherapy (HIPEC), 469
- I**
- Inactive biomass, from plant or animal sources, 37, 39–40
- India, PGE contamination in, 132
- Indium (In), 156, 269, 281
- Inductively coupled plasma
 atomic emission spectrometry (ICP AES), 68, 102, 115, 116, 120*r*, 342
 mass spectrometry (ICP MS), 34, 54, 68, 80, 100, 115–116, 119*t*, 120*r*, 121*t*, 122*t*, 124*t*, 125*t*, 166–167, 189, 200, 236, 247*t*, 312, 342, 343*t*
 optical emission spectrometry (ICP-OES), 54, 80, 100, 312
 quadrupole mass spectrometry (ICP-Q-MS), 280, 342
 sector field mass spectrometry (ICP-SFMS), 342, 343*t*
- Industrial PGE emissions, 9
- Inorganic nanoparticles, 68
- Institute for Reference Materials and Measurements (IRMM), 456
- Instrumental neutron activation analysis (INAA), 100, 134
- Intercellular elements, 340
- International Agency for Research on Cancer, 465
- International Platinum Group Metals Association (IPA), 471
- Ion exchange, 34, 35, 54, 68, 101, 102, 113, 213
 resins, 120*r*, 121*t*
- Ion imprinted polymers (IIPs), 72–75
 free radical polymerization, 73
 ion-association complexes, 73
 memory effect, 76
 for platinum metal enrichment and separation, 75*t*
 polymeric network, 73
 polymerization reaction, 74
 Ru(III)-allyl acetoacetate imprinted polymer, 74*f*
- Ion speciation, change in, 356
- Iridium (Ir), 3, 419
- Isotope dilution
 ICP-MS (ID-ICP-MS), 122*t*, 123*t*, 124*t*
 with mass spectrometric detection (IDMS), 100
- J**
- Jewelry, 8, 98, 109, 354, 420, 436
- Judd site (storm drains), 171, 171*t*, 172, 173*f*
- K**
- Kiwifruit pollen (*Actinidia deliciosa* var. *deliciosa*)
 detection of platinum group elements in, 314*t*
 platinum, palladium and rhodium to, 331*f*
- Kola Peninsula, NW Russia, 9, 23, 24*f*, 346
 platinum concentrations in vicinity of PGE mines on, 24, 26
- L**
- Lakes, 352–353
 PGE concentrations in, 353*f*
- Lanthanoids, 215
- Lanthanum (La), 138, 140, 141
 metal range concentration in road side, 139*t*
- Laser ablation ICP-MS (LA-ICP-MS), 116, 122*t*, 123*t*, 124*t*
- Lead (Pb), 138, 140, 141
 metal range concentration in road side, 139*t*
 Pb fire assay, 202*t*
- Lentic water ecosystems, 352–353
- Lentil, detection of platinum group elements in, 314*t*
- Lesser duckweed (*Lemna minor*), 334*t*

- detection of platinum group elements in, 317t
- Lettuce, 332t, 333t, 334t
 - detection of platinum group elements in, 313t, 315t
- Lichen (*Usnea barbata*)
 - concentration ranges of platinum, palladium and rhodium in, 323t
 - detection of platinum group elements in, 318t
- Light duty diesel (LDD) VEC, 289
- Limit of detection (LOD), 326, 342
 - for determination of Pt via ICP-MS, 343t
- Linear combination fitting methods (LCF), 292
- Liposomes, 402
- Liquid chromatography (LC), 101
- L-methionine, 267–268, 269, 270, 271, 455
 - mean soluble fraction in, 270t
 - sample extraction with, 268
 - solubility of PGE, 278
 - solubility of samples in, 272f
- Lucerne. *See Medicago sativa*
- M**
- Madrid, Spain
 - airborne PM, 231t, 232t, 448, 449t
 - PGEs abundances in, 224t
- Maghemite ($\gamma\text{-Fe}_2\text{O}_3$), 69
- Magnetic nanoparticles, 70
 - solid phase extraction procedure using, 70f
- Magnetite (Fe_3O_4), 68, 69
- Maize (*Zea mays* L.), 316t, 317t
 - exposure studies for platinum, palladium and rhodium to, 333t
- Marine ecosystems
 - marine snail (*Littorina littorea*), 369, 372
 - PGE in, 356–358
- Mass-to-charge ratio (m/z), 217
- Medicago sativa*, 37
 - detection of platinum group elements in, 317t
 - exposure studies in, 333t
- Medical treatment centers' PGE emission, 9–10
- Membrane filtration, 34
- Mercury (Hg) coprecipitation, 201t, 202t, 204t, 205t, 206t
- Metabolism-independent biosorption, 40
- Metals, 79
 - accumulation, 390
 - binding proteins, 405
 - metal pollution index (MPI), 92, 93f
 - toxicity, 389
- Metallochaperones, 405
- Metallothioneins (MTs), 387, 405, 458
- Method detection limits (MDLs), 220
- Metropolitan area of Mexico City (MAMC)
 - airborne PM, 451t, 453
 - ICP-MS analysis and quality control, 262
 - PM_{2.5}, 259–260, 262–263
 - Pt concentration, 262t
 - study area, 259
 - urban and road dust, 259, 261–262
- Micelles, 402
- Micro extraction, 76
- Microcosms, 394
- Micrometer-sized Pd particles, 329
- Microtox Test, 389
- Microwave-assisted digestion, 115, 313t, 314t, 315t, 316t, 318t
 - reaction profile, 215f
- Mining and production activities, in PGE emission, 21–22
 - economic loss and recovery, 27
 - environmental impact and human exposure, 26
 - global impact of, 27
- Miriplatin, 402f
- Molluscs, 355
 - uptake and bioaccumulation of Pt, Pd and Rh by, 366–367t
- Molt-4 (human leukemic T-cells line), 408
- Molybdenum (Mo), 138, 140, 141
 - metal range concentration in road side, 139t
- Mono functional nano materials, 76
- Monovalent cations, 341
- Mosses, 316t, 317t, 322t, 323t, 340
 - Hylocomium splendens*, 346
 - mass matrix, 347
 - PGE concentration in, 345f
 - Pleurozium schreberi*, 346
- Multidrug resistance proteins (MRPs), 406
- Municipal waste, 10
- Mutagenic effects, 244
 - environmental Pd, 244
- Myoblast cancer cells (C2C12), 409
- N**
- N,N'-diethylthiourea (DET), 73
- N,N-di-(n-hexyl)-N'-benzoylthiourea (DHBt), 192
- N,N-diethyl-N'-benzoylthiourea (DEBT), 190–192
- N-acetyl-D-glucosamine, 37
- Nanoparticles, 68–69, 402
 - competitive sorption, 69

- Nanoparticles (*cont.*)
 hybrid nanomaterials, 69
 magnetic nanoparticles, 70, 70*f*
 physical binding, 69
- Nanotransporters, 402
- National Institute of Standards and Technology (NIST), 456
- Negative thermal ionization mass spectrometry (NTIMS), 353
- Nerium oleander*, 82, 324*t*
 detection of platinum group elements in, 317*t*, 318*t*
- Neutron activation analysis (NAA), 118, 124*t*, 189, 191, 342
- Nickel (Ni), 138, 140, 141
 metal range concentration in road side, 139*t*
 NiS fire assay, 134, 201*t*, 202*t*, 203*t*, 204*t*, 205*t*, 210*t*, 315*t*
- Nitrogen
 containing groups, 71
 N-N-dimethylformamide, 72
 oxides, 79
- Non-covalent forces, 71
- Non-esterified polyuronic acid molecules, 340
- Non-small cell lung cancer (NSCLC), 409
- Norilsk/Talnakh complex in Russia, 20
 operations, 28
- Nutrient anions, 341
- Nutrient like profile, 357
- Nuts, detection of platinum group elements in, 316*t*
- Nuuanu catchment, 165
- Nuuanu Stream, 165, 172
 bivariate bed sediment PGE concentration associations and ratio 'fields', 172–176
 bivariate scattergram, 174*f*
 cation exchange capacity (CEC) in, 181
 enrichment ratios for PGEs, 179*t*
 future research, 182
 grain size distribution and PGE concentrations, 180*t*
 grain size-normalized PGE enrichment ratios, 176
 grain-size fractionated storm-drain associated bed sediment sample, 180
 mass loading percentages of Pd, Pt, and Rh, 181*f*
 monthly variation in Pd and Pt pricing, 176*f*
 PGE concentrations in three storm drain outlets to, 171*t*
 PGE ratios, 175, 177–178*t*
 Pt/Pd ratio, 172, 175
 Pt/Rh field, 172, 175
 spatial variation in Pd concentration, 173*f*
 Nuuanu Valley, 165
- O**
- Occupational exposure limits (OEL), for chloroplatinates, 98, 466
- Occupational medicine, biomarker of exposure blood and serum, 421, 422–425*t*, 426–427
 hair, 435
 urine, 427, 428–431*t*, 432–434
- Ocean. *See also* Marine ecosystems
 biota, 358
 PGE concentration in, 357*f*
- Optical emission spectrometry (OES), 34
- Organic compounds, 80
- Osmium (Os), 3
 accumulation components, 13*f*
 changes in accumulation in Northwest Spain, 13*f*
 in peat record of atmospheric deposition, 12
- Outer city ring (B2R) of Munich, Germany, 189
 chromium, 194*f*
 collection, pretreatment and matrix characterization of tunnel dust samples, 193–194
 constituents of road dust, 194*f*, 195*f*
 copper, 194*f*
 Department of Urban Planning and Building Regulation, 193
 manganese, 194*f*
 palladium content of road dust, 195, 196*f*
 platinum content of road dust, 196*t*
 selective enrichment of PGM using N,N-dialkyl-N'-benzoylthioureas, 190–192
 selective enrichment of platinum species by ligand supported cloud point extraction, 192–193
 special aspects in trace and ultra-trace analysis of palladium, 190–191
 traffic-density, 193*t*
- Oxaliplatin, 402*f*, 404, 407
- Oxidation, 402
- Oxides of nitrogen (NO_x), 289
- Oxygen functional groups, 71
- P**
- p38 MAPK (mitogen-activated protein kinase), 409
- p53 protein, 407, 408, 409, 410
- Palladium (Pd), 3, 147, 188, 266, 278, 311, 419

- in Bavarian roadside soils, 145–150, 148*f*
- biosorption process of, 38–39*t*
- concentration ranges in environmental matrices of, 111*t*
- determination by ETAAS in environmental samples, 56*t*
- digestion procedure for, 55–58
- levels in soils in different countries, 135*t*
- Pd nanoparticles, 329
- rinsing procedure, 59*f*
- solubility, 455
- ternary diagram for various aerosols, 235*f*
- ternary diagram for various tunnel and road dusts, 234*f*
- Palermo (Italy) area, atmospheric particulate in.
See Platinum, associated with atmospheric particulate in Palermo (Italy) area; Rhodium, associated with atmospheric particulate in Palermo (Italy) area
- Parasites, 356, 376
- PARP1/2 (Poly (ADP-ribose) polymerase 1 or 2), 409
- Particulate matter (PM), 79, 132, 340, 448
 - PGE-associated airborne PMs, 133
 - PM_{2.5}, 259–260, 262–263
 - Pt concentration, at MAMC, 262*t*
- Passive monitoring, 341–342
- Pea (*Pisum sativum* L.)
 - detection of platinum group elements in, 317*t*
 - exposure studies for platinum, palladium and rhodium to, 333*t*
- Peripheral blood mononuclear cells (PBMCs), 437, 438
- Periphyton community, 363*t*
- PGE concentration determination, 312
 - analytical methods for detection of, 313–318*t*
 - concentration ranges in plants, 320–321, 322–325*t*, 326
 - exposure studies, 331–334*t*
 - localisation within plants, 320
 - metal uptake rates and localization, 329–330
 - observed effects, 330, 335
 - sampling sites, 326–327
 - seasonality, 328
 - species-specific uptake, 319–320
 - types of PGE exposure, 328–329
- PGE emissions, from non-automobile sources, 8
 - industrial emissions, 9
 - from medical treatment centers, 9–10
 - from mining and production activities, 8–9
 - in urban sewage and waste, 10
 - uses as source indicators, 8
- PGE mining
 - in Russia (*see* Russia, PGE mining in)
 - in South Africa (*see* South Africa, PGE mining in)
- PGE occurrence in remote environment, 10
 - annual global emissions, 14*f*
 - atmospheric dispersion, 11
 - osmium, sources of, 12
 - in rural aerosols, 11
 - in snow and ice, 12–13
- PGE ratio, 137–138, 142
 - Pd/Rh, 137
 - Pt/Pd, 137, 142
 - Pt/Rh, 137, 138
- Physical binding, 69
- Physiologically based extraction test (PBET), 133
- Pinus*, detection of platinum group elements in, 313*t*
- π - π stacking, 71
- Plant material, PGE detection
 - adsorptive pulse voltammetry, 318*t*
 - adsorptive stripping differential pulse voltammetry, 317*t*
 - differential pulse voltammetry, 317*t*
 - ETAAS, 313–314*t*
 - ETV ICP-OES, 318*t*
 - ICP-HR-MS, 316*t*
 - ICP-MS, 315–316*t*
 - ICP-OES, 317*t*
 - inactive biomass derived from, 37–40
 - SF ICP-MS, 318*t*
- Platinum (Pt), 3, 147, 188, 266, 278, 311, 419
 - atomization signals of, 60*f*
 - in Bavarian roadside soils, 145–150, 148*f*
 - cytostatic drugs, 402*f*
 - determination by ETAAS in environmental samples, 56*t*
 - digestion procedure for, 55–58
 - levels in soils in different countries, 135*t*
 - platinum-rhodium ratio, 149, 149*f*
 - rinsing procedure, 59
- Platinum enrichment and separation, ion imprinted polymers (IIPs) for, 75*t*
- Platinum group elements (PGEs), 3, 53, 109, 164, 200, 243, 266, 401, 419, 464
 - automobile catalysts as source of, 4–6
 - in automotive exhaust, 448
 - behavior, 454–456
 - bioaccessibility of, 266, 454–456
 - characterization, 234–236

- Platinum group elements (PGEs) (*cont.*)
- as chemotherapeutic agents, 456
 - concentrations, 278 (*see also* PGE concentration determination)
 - demands, 5*f*, 447
 - detection techniques (*see* Detection techniques, for PGEs)
 - emission rates from automobile catalysts, 6*r*
 - emission sources and distribution pathways of, 110*f*
 - emission, by mining and production activities (*see* Mining and production activities, in PGE emission)
 - emissions from non-automobile sources (*see* PGE emissions, from non-automobile sources)
 - exposures and human health, 458–459
 - future research, 14–15
 - general analytical procedure for, 110, 110*f*
 - genotoxicity for, 457
 - high redox potentials in, 71
 - implication for sources, 10–12
 - isotopes and potential spectral interferences, 216*r*
 - localisation within plants, 320
 - in metallurgy, 33
 - occurrence in remote environments (*see* PGE occurrence in remote environment)
 - pollution stress, 396
 - potential environmental mobility of, 266
 - pre-concentration, 112–114
 - production estimates, by country, 20*f*
 - published ratios, comparison, 7*f*
 - ratio (*see* PGE ratio)
 - removal, microorganism application for, 40–42
 - sample pretreatment, 112–114
 - sampling procedure, 112
 - separation and determination of, 58–60, 112–114
 - solubility post-emission, 455
 - speciation, 454–456
 - species-specific uptake, 319–320
 - traffic related, 361
 - and toxicity, 456–458
 - urban areas, automobile as main source of, 6–8
- Platinum group element (PGE) emission,
- 8, 154
 - analysis, 155–156
 - concentration in soil, 156–159
 - contamination of air and airborne dust, 159–160
 - industrial emissions, 9
 - from medical treatment centers, 9–10
 - from mining and production activities, 8–9
 - preparation of soils, 154–155
 - sampling of airborne dust, 155
 - sampling sites, 154
 - in urban sewage and waste, 10
 - uses as source indicators, 8
- Platinum group metals (PGMs), 80, 188
- based catalysts, 289
- Platinum industry
- biological monitoring, 466–467
 - employees precautions, 471
 - human health risks, 463
 - individual preventive medical examination, 471
 - recommendation for medical examination program, 472
 - workplace air monitoring, 465–466
 - workplace safety measures, 472–473
- Platinum nanoparticles (PtNPs), 409–410
- Platinum on alumina model substance (Pt/Al₂O₃), 278
- analysis, 280
 - comparison of RMI model catalysts, 296*f*
 - influence of anionic species on, 278–287
 - Pt solubility (*see* Platinum solubility on alumina model substance)
 - quality control and quality assurance, 280–281
 - sample extraction, 280
- Platinum (Pt), 80
- acetic acid synthesis, 402
 - allergic response, 98
 - analysis of, 100
 - on biomaterials, biosorption process of, 38–39*r*
 - chloride (PtCl₂), 438, 439
 - concentration ranges in environmental matrices of, 111*r*
 - concentrations in soil and road dust, 99*r*
 - nanoparticles on γ -Al₂O₃, 278
 - n-butanal, 402
 - PtCl₄, 438, 439
 - quantum dots (Pt-QDs), 409–410
 - resistance, 402
 - salt-specific IgE antibodies, 436, 437
 - solubility in H₂SO₄, 284
 - solubility in HNO₃, 284
 - synergic effect of, 402
- Platinum speciation
- with adsorptive voltammetry, 104
 - with CE-ICP-MS, 103

- with LC-ICP-MS, 102
 - Platinum solubility on alumina model substance
 - in aged substance, 281, 282f, 282t
 - in fresh substance, 281, 281t
 - time trends in fresh substance, 283f
 - Platinum ternary diagram
 - for various aerosols, 235f
 - for various tunnel and road dusts, 234f
 - Platinum, associated with atmospheric particulate in Palermo (Italy) area
 - in airborne particulate of different country, 92f
 - calibration graphs for, 88f
 - chemicals, 83
 - correlation between Rh and, 91f
 - enrichment factor for, 93f
 - gasoline catalyst, 91
 - non-homogeneous distribution of, 90
 - particulate collected in, 89t, 90f
 - quality assurance, 83
 - sampling and site, 83–85, 84f
 - treatment of samples, 85
 - voltammetric analysis, 85
 - voltammetric curves of, 87f
 - Plectonema boryanum* (cyanobacteria), interaction with Pt and Pd, 41
 - Pleurozium schreberi* (bryophyte), 341
 - concentration ranges of platinum, palladium and rhodium in, 323t
 - detection of platinum group elements in, 317t
 - Polarography, 81
 - Poly(ethyleneimine) (PEI), 37
 - modified biomass, 41
 - Poly(N-phenylethanolamine), 72
 - Polyallylamine hydrochloride (PAH), 41
 - Polymers, 402
 - polymeric resins, 35
 - Polystyrene, 35
 - divinylbenzene, 35
 - Polytetrafluoroethylene (PTFE), 246
 - Polyvalent cations, 341
 - Pomphorhynchus laevis* (parasite), 356, 376, 391t
 - uptake and bioaccumulation of Pt, Pd and Rh, 368t
 - Ponds, 352–353
 - Potatoes, detection of platinum group elements in, 316t
 - PROBE (PROgramme for Biomonitoring General Population Exposure), 459
 - Profiles of organic contaminants (PAHs), 84
 - Prokaryotic cells, 388
 - Proton induced X-ray emission (PIXE), 342
 - Pseudokirchneriella subcapitata*, 362, 388
 - uptake and bioaccumulation of Pt, Pd and Rh, 363t
 - P-type ATPases, 406
 - Pyrometallurgical processing, 34
- ## Q
- Quality assurance, 83, 220, 280–281
 - Quality control, 166–167, 220, 248, 260, 280–281
 - Quantification, of analytes, 215–216
 - Quantum dots (QDs), 409, 410
- ## R
- Ramshorn snail (*Marisa cornuarietis*), 373, 386, 389, 392t, 394
 - uptake and bioaccumulation of Pt, Pd and Rh by, 365t
 - Rapeseed (*Brassica napus*)
 - detection of platinum group elements in, 317t, 318t
 - exposure studies for platinum, palladium and rhodium to, 331t, 332t, 333, 334t
 - Raster electron microscopy (REM), 280
 - fresh alumina model substance, 283f
 - Reactive oxygen species, 406–408
 - Rejection parameter q (RPq), 219–220
 - Reverse phase sorption, 35
 - Reversed-phase liquid chromatography (RPLC), 102
 - Rhodium (Rd), 3, 147, 188, 266, 278, 311, 419
 - concentration ranges in environmental matrices of, 111t
 - levels in soils in different countries, 135t
 - platinum–rhodium ratio, 149, 149f
 - Rh (III) chloride (RhCl₃), 438–439
 - solubility, 457
 - Rhodium ternary diagram
 - for various aerosols, 235f
 - for various tunnel and road dusts, 234f
 - Rhodium, associated with atmospheric particulate in Palermo (Italy) area
 - in airborne particulate of different country, 92f
 - calibration graphs for, 88f
 - chemicals, 83
 - correlation between Pt and, 91f
 - enrichment factor for, 93f
 - gasoline catalyst, 91
 - non-homogeneous distribution of, 90
 - particulate collected in, 89t, 90f

- Rhodium, associated with atmospheric particulate in Palermo (Italy) area (*cont.*)
 quality assurance, 83
 sampling and site, 83–85, 84f
 treatment of samples, 85
 voltammetric analysis, 85
 voltammetric curves of, 87f
- Rice, 314r
- Rivers, 353–356
 ICP-OES, analysis with, 354
 PGE concentrations in, 354f
 PGE ratio, 355r
- Road dust samples
 analysis of, 60–61
 BCR-723, 319, 455–456
 digestion procedure for, 55–58
 PGE, separation and determination of, 58–60
 platinum concentration in, 22–23
 Pt and Pd content in Białystok, 61, 61f
 Pt and Pd content, ranges of, 62f
- Rome, Italy
 airborne PM, 450r
 moss as PGE monitors, 344r, 345
 Pt content, 91
 tram drivers in (*see* Tram drivers)
- Rural aerosols
 particulate matter in, 228r, 232r
 PGE in, 11
- Russia, PGE mining in
 map of mining areas, 24f
 mining areas, 23–24
 platinum concentrations in vicinity of PGE mines in, 24–25
- Rustenburg, mining operations to human settlements, 25f
- Ruthenium (Ru), 3, 74, 80, 110, 191
- Ryegrass (*Lolium perenne*)
 concentration ranges of platinum, palladium and rhodium in, 322r, 323r
 detection of platinum group elements in, 315r
- S**
- Saccharomyces cerevisiae* (*S. cerevisiae*),
 42, 54
 biomass, 41
 dynamic SPE procedures, 46
 for separation/preconcentration of Pt(IV) and Pd(II), 44–45r
- São Paulo, 132
 cluster analysis of PGE, 139f
 eigenvalues, 141r
 factorial analysis (FA), 140
 high PGE concentrations, 136, 137
 metal range concentration in road side, 139r
- Sector field mass spectrometry with inductively coupled plasma (SF-ICP-MS), 466
- sEH (soluble epoxide hydrolase), 409
- Separation/preconcentration of PGE, analytical application of microorganisms for, 42–48
- Sewage canals, 396
- Silica gels, 35
- Silica supported Pd nanoparticles, 329
- Simulated lung fluids, 455, 456
- Silicon, 190, 193, 329
 dioxide (SiO₂), 68
- Silicone implants, 470
- Skin-prick testing, 435, 471
- Solid phase extraction (SPE), 35, 76, 101, 205r
 activated carbon in, 70
 advantages, 67–68
Aspergillus sp., 48
S. cerevisiae, 46
- Solvent extraction, 34
- Sorption, effect of pH on, 72f
- South Africa, PGE mining in. *See also* Bushveld Igneous Complex (BIC) in South Africa
 mining areas, 20–21
 Pt concentrations (*see* South Africa, Pt concentration in)
 Rustenburg, mining operations to human settlements, 25f
- South Africa, Pt concentration in
 road dust, 22–23, 23f
 top soil, 22f
 vicinity of PGE mines in, 21–22
- Spearman correlation coefficients (rs), 172
- Speciation
 of platinum metals, 454–456
 of solid-state platinum, 289–305
- Speciation analysis of chloroplatinates in environmental matrices, 100–101
 with adsorptive voltammetry, 104
 with CE-ICP-MS, 103
 enrichment methods for pre-concentration of, 101–102
 with LC-ICP-MS, 102
- Static mussel exposure experiment, 375
- Streams, 353–356
- Strontium (Sr), 115
- Sulfate-reducing bacteria (SRB), 39r, 40
- Sulphur oxides, 79

T

- T helper-1 (Th-1) cytokine synthesis, 437
T helper-2 (Th-2) cytokine synthesis, 437
Taraxacum officinale, 246, 251, 252, 253
 concentration of Pd, 171f, 252f
 concentration of Pt, 249f, 250f
Taxi drivers, 432
Teflon-impregnated glass fiber filter, 260
Tellurium (Te), 54
 coprecipitation, 201, 202r, 208t, 210r
Temperature, 377–378
Terrestrial moss (*Racomitrium lanuginosum*),
 biosorption potential of, 39
Thiol
 -containing compounds, 409
 synthesis, 330
Thiourea grafted chitosan (TDC), 37
Three way catalysts (TWCs) VEC, 4, 164, 303
 Fourier transform of Pt L3 and L2 XANES
 data, 301f
 from North America, 301–304
 Pt L3 and L2 XANES data, 301, 302f
 structural parameters of PT L3 and L2-edge
 EXAFS, 303r
Threshold limit values (TLVs), 466
Thulium (Tm), 269
Titanium dioxide (TiO₂), 68
Tobacco mosaic virus (TMV), Pd(II)
 biosorption on, 41
Topoisomerase I inhibitors, 408
Total reflection X-ray fluorescence (TXRF),
 189
Total suspended particles (TSP), 83
Toxicology, 387
Tram drivers, 434, 458
Trans-Golgi network, 406
Transition metals, 215
Transmission electron microscopy (TEM), 280,
 319
 fresh alumina model substance, 285f
Tumor necrosis factor (TNF)- α , 437
- U
- UK Health and Safety Executive (HSE), 466
Ulva lactuca (alga), 364, 391r
 uptake and bioaccumulation of Pt, Pd and
 Rh by, 363r
Unburned hydrocarbons, 79
Upper Group 2 (UG2) chromitite layer, 21
Upper Mystic Lake in Boston, 352
Urban. *See also* Brazil, urban and roadside
soils; Fluvial bed sediments; Honolulu,
Hawaii (USA)

- aerosol, 56r
airborne particulate matter, 116r, 133r, 199r,
 200r, 212r, 228r, 237r
automobile PGEs, 6–8
and industrial environment, 345–346
road dust, 259, 261–262
sewage and waste, 10
soils, 119r
stormwater retention ponds, 396
Urine, biomarker of exposure
 iridium, 434r, 438
 palladium, 429–430r, 433–434
 PGE level monitoring, 440
 platinum, 428, 447–448r, 453–454
 rhodium, 430r, 434
 spot urine samples, 470
Used Auto Catalyst (SRM 2557), 456
- V
- van der Waals forces, 71
Vehicle autocatalyst, 212
Vehicle emission control (VEC) catalysts, 289
 characterisation of, 290, 291
 model catalysts, 296–297
 reference compounds, 293–295
Vehicular exhaust catalysts, 153–154
 PGE analysis, 155–156
 PGE concentration in soil, 156–159
 PGE contamination of air and airborne dust,
 159–160
 preparation of soils, 154–155
 sampling of airborne dust, 155
 sampling sites, 154, 156
Vienna, Austria, 448, 452
 PGE concentrations in airborne PM, 449r
Vineyard site (storm drains), 171, 171r, 172,
 173f
Voltammetric analysis, 79
 instrumental parameters for, 86r
 operating parameters for, 86r
Voltammetry, 115, 118, 463
 curves of platinum, 87f
 curves of rhodium, 87f
- W
- Washburn Tunnel in Houston, TX, 211, 212f
 airborne PM, 235
 non-PGEs, 227
 PGE concentrations in, 227f
 tunnel/road dust, 235
Water hyacinth (*Eichhornia crassipes*),
 362, 373

- uptake and bioaccumulation of Pt, Pd and Rh by, [363t](#)
- Web of Science database, [403f](#)
- Wet chemical digestions, [55](#)
- Wild carrot (*Daucus carota*), [314t](#)
concentration ranges of platinum, palladium and rhodium in, [322t](#)
- Windows STATISTIC® 8.0 program, [142](#)
- X**
- X-ray absorption near edge structure (XANES), [291](#), [292](#), [293](#), [305](#)
at Cl K-edge, [304](#), [304f](#)
comparison of RM1 model catalysts, [296f](#)
LCF method for, [296](#)
Pt L₃ XANES data, [293f](#), [299f](#)
- X-ray absorption spectroscopy (XAS), [291–292](#), [292f](#)
- X-ray diffraction (XRD) technique, [37](#)
- X-ray fluorescence (XRF), [342](#)
- X-ray photoelectron spectroscopy (XPS), [80](#)
Gauss-/Lorentz curve analysis, [285t](#), [286t](#)
oxidation states of outer layer atoms, [291](#)
- particle surface chemistry analysis via, [285–287](#)
quantitative XPS spectral results, [285t](#), [286t](#)
sample preparation for, [279](#)
- X-ray spectrometry, [342](#)
- Y**
- Yeast (*Saccharomyces cerevisiae*), [388](#), [389](#)
model system for cisplatin action, [407](#)
- Yttrium (Y), [115](#)
- Z**
- Zebra mussels (*Dreissena polymorpha*), [386](#)
bioaccumulation factors, [370f](#)
- Zebrafish (*Danio rerio*), [386](#), [389](#), [393t](#)
uptake and bioaccumulation of Pt, Pd and Rh by, [367t](#)
- Zinc (Zn), [138](#), [140](#), [141](#)
metal range concentration in road side, [139t](#)
- Zirconium (Zr), [115](#)
dioxide (ZrO₂), [68](#)