



**UNDER THE AUSPICES OF H. E. THE PRESIDENT OF THE HELLENIC REPUBLIC  
MR PROKOPIOS PAVLOPOULOS**

**17<sup>TH</sup> INTERNATIONAL CONFERENCE  
ON CHEMISTRY AND THE ENVIRONMENT**

**16 - 20 JUNE 2019 THESSALONIKI, GREECE**

Venue:

ARISTOTLE UNIVERSITY RESEARCH DISSEMINATION CENTER  
( KEDEA )



# CONFERENCE PROCEEDINGS

# COMMITTEES

LOCAL ORGANIZING COMMITTEE ASSOCIATION OF GREEK CHEMISTS REGIONAL DEPARTMENT OF CENTRAL AND WESTERN MACEDONIA	
Chair of ICCE 2019 - Ioannis Katsoyiannis	Michael Terzidis
Manolis Daftsis	Athanasia Tolkou
Eleni Deliyanni	Yiannis Vafeiadis
Vasilis Koulos	Aggelos Zamanis
Athanasios Papadopoulos	Victoria Samanidou
SCIENTIFIC COMMITTEE	
Patrik Andersson, Sweden	Ioannis Katsoyiannis, Greece
Thomas Bucheli, Switzerland	Silvia Lacorte, Spain
Boguslaw Buszewski, Poland	Mathias Ernst, Germany
George Cobb, USA	Dimitra Lambropoulou, Greece
Adrian Covaci, Belgium	Gerhard Lammel, Germany
Willem de Lange, Netherlands	Maria Eduarda Pereira, Portugal
Eleni Deliyanni, Greece	Santiago V. Luis, Spain
Dion Dionysiou, USA	Antonio Marcomini, Italy
Fritz Frimmel, Germany	Costas Michael, Cyprus
Philippe Garrigues, France	Nicolas Moussiopoulos, Greece
Walter Giger, Switzerland	Valery Petrosyan, Russia
Vincenzo Torretta, Italy	Aleksander Sabljic, Croatia
Ester Heath, Slovenia	Constantini Samara, Greece
Sirpa Herve, Finland	Michaela Dina Stănescu, Romania
Ivana Ivancev-Tumbas, Serbia	Dimitra Voutsas, Greece
Roland Kallenborn, Norway	Uri Zoller, Israel
Athanasios Katsoyiannis, JRC, ISPRA, Italy	Kostas Triantafyllidis, Greece
Jan Tříska, Czech Republic	Abel Maharramov, Azerbaijan

# TABLE OF CONTENTS

ADVANCES IN WASTEWATER TREATMENT.....	16
Assessment of the application of photodegradation as a green treatment to remove antibiotics from aquaculture effluents .....	17
Biodegradation of organic pollutants using advanced biocatalytic systems .....	18
Interest of drinking water sludges for P removal in wastewaters.....	20
Characterization of aluminum silicate precipitates and its stabilization using anionic scale inhibitors: Relevance to geothermal systems .....	22
Photoelectrochemical catalysis on nanostructured TiO <sub>2</sub> films: Colour and emerging contaminants removal .....	23
The applications of Thermophilic Aerobic Membrane Reactor (TAMR).....	26
Estrogenicity reduction from municipal wastewater: Comparison between conventional and membrane ultrafiltration treatment .....	29
Efficient separation and removal of dyes from single and binary systems by magnetite/silver/carbon nanoparticles .....	32
Membrane BioReactors (MBR): Types, applications and diffusion .....	35
The plasma-based decontamination of waters contaminated with organophosphorus pesticides .....	38
MBR Plants in Italy: Technical features and operational aspects.....	41
Biodegradation of the iodinated contrast media in various wastewater treatment systems.....	42
The study of selective photodegradation of colored pollutants by UV light using cadmium(II) coordination polymers.....	43
Production and characterization of activated biochars from cropresidues for wastewater treatment .....	46
Engineered supramolecular solvents for wastewater treatment.....	47
Sb(III) and Sb(V) Adsorption mechanisms on metalzorb® sponge and spion- metalzorb® system .....	50
Synthesis of novel copolymers based on PEGMEMA, PEGMA and AAc with applications as hydrogels in wastewater treatment for the removal of dyes and heavy metals.....	51
AIR POLLUTION – CHEMISTRY AND HEALTH RISKS.....	53
Pesticides in rural and urban atmospheres: Concentrations and risk assessment .....	54
On-line determination of dicarboxylic acids in atmospheric aerosols using continuous ultrafine aerosol sampler .....	56
Particle emissions measurements on CNG vehicle focusing on, sub-23nm .....	59
Measurements on air quality in different types of buildings .....	61
Suspect screening of soot samples reveals the occurrence of emerging organophosphate ester Tris(2,4-di-tert-butylphenyl) phosphate.....	63
Analysis of vape smoke (Particle Size Distributions and Volatile Organic Compounds) emitted by e-Cigarette and Cigarette Users.....	64
Volatile organic compounds emission and secondary organic aerosols formation from organic waste products .....	65
Global gridded atmospheric emissions of Tris-(1-chloro-2-propyl) phosphate (TCPP) .....	66
Evaluation of phthalates concentrations distribution both in the gas phase and in particles fraction emitted to the air .....	68
Harmful compounds emissions from compression ignition engines fuelled with different mixtures of diesel and biodiesel fuel with nanomodifiers .....	71
Structural features of water-soluble organic aerosols and their relation to air mass origin at the interface ocean-continent during winter .....	73
Structural transformations accompanying the aging of water-soluble organic aerosols collected at the interface ocean-continent .....	75
Decoding the structural features of urban water-soluble organic aerosols by advanced solid-state NMR analysis .....	77
Development of quartz crystal microbalance based sensor for real-time ozone monitoring.....	79
Real-time optical ozone sensor for occupational exposure assessment.....	82
Population exposure to particulate-matter and estimated excess mortality due to the Portuguese wildfires in October 2017 driven by Storm Ophelia .....	85
Temporal impact of wildfires on PM <sub>10</sub> and human mortality in Portugal .....	86
NPAHs and OPAHs in the atmosphere of two central European cities: Seasonality, urban-to-background gradients and gas-to-particle partitioning .....	88
Nitrated and oxygenated mono- and polyaromatic compounds in aerosols of polluted air, their bioavailability through inhalation and related toxic potentials.....	90
Spatial and temporal trends of fine organic carbon volatility fractions (OC <sub>x</sub> ) sources across five sites in the Los Angeles Basin.....	92

Indoor concentrations of PM <sub>2.5</sub> and associated water-soluble and labile heavy metal fractions .....	94
Spatiotemporal Variation of odor active VOCs in Thessaloniki, Greece: Implications for impacts from industrial activities .....	97
Application of real-time measurement techniques in determination of monoterpene oxidation products .....	99
Evaluation of Polycyclic Aromatic Hydrocarbonemissions in particulate phase from diesel/palm oil biodiesel fuel blends using a green methodology .....	102
Exposure to Polycyclic Aromatic Hydrocarbons and the risk of adult Leukemia in Greece .....	105
Atmospheric aqueous-phase reactions of OH radicals with methoxyphenolic compounds:A kinetic and theoretical study .....	106
Assessment of air pollution in the Czech Republic by emerging chlorinated contaminants .....	108
Comparison of 3D printed substrate with conventional extruded honeycomb monolith for catalytic converter applications .....	109
Organic pollutants in indoor dust from the Ecuadorian Amazonia and health implications .....	112
The air quality assessment regarding the occurrence of polycyclic aromatic hydrocarbons (PAHs) and their derivatives in air PM <sub>2.5</sub> in two cities of the Czech Republic .....	115
Chemical and morfho-structural characterization of atmospheric aerosol from a city of São Paulo state, Brazil.....	119
Ornamental trees to mitigate air pollution: Pilot study at EUPHORE facilities .....	121
Photocatalytic technology for purifying air in the interior and exterior of buildings: Overall environmental impact .....	124
Photocatalytic abatement of NO <sub>x</sub> : Suppression of nitrous acid formation .....	127
Cancer risk from PM <sub>2.5</sub> bound compounds in Windsor, Canada.....	130
Chemical characterization of particulate matter from a petrochemical refinery in Brazil: Impacts on human health.....	131
Biogenic volatile organic compounds from plant litter decomposition .....	133
Sorption of volatile organic compounds (VOCs) from cattle manure by biochar.....	134
Multiyear levels of PCDD/Fs, dl-PCBs and PAHs in background air in central Europe and implications for deposition.....	136
Determination of monoterpenes in specific indoor environments – hairdresser and SPA salons.....	138
Low cost gent type sampler constructed for urban atmospheric aerosol sampling .....	139
Evaluating the accuracy of AQMesh pod sensors in capturing road environment NO <sub>2</sub> concentrations.....	141
Commuter exposure to particle-bound Polycyclic Aromatic Hydrocarbons .....	144
in Thessaloniki, Greece .....	144
Hydrodynamic cavitation extractive desulfurization of pyrolysis tire oil with deep eutectic solvent.....	146
<b>ANALYTICAL CHEMISTRY IN ENVIRONMENTAL MONITORING AND CHEMISTRY STUDIES .....</b>	<b>149</b>
Improving the analytical performance of ICP-MS for environmental sample analysis .....	150
Quantification of veterinary antibiotics in animal manure by liquid.....	151
chromatography–mass spectrometry .....	151
Extraction and analysis of high-value compounds in plants using green solvent technology.....	153
DLLME and GC/MS determination of eleven disinfection byproducts in drinking water.....	154
Lead isotope ratios as tool for elucidation of chemical environment in a real system of mushrooms-soil.....	156
Integrated microfluidic device for inline monitoring of glyphosate assisted by surface enhanced Raman spectroscopy (SERS) ...	158
Direct determination of arsenic in high salinity samples by graphite furnace atomic absorption spectrometry .....	160
Determination of cocaine metabolites and pyrolytic products in wastewater to profile prevailing patterns of consumption.....	162
An environmentally-friendly surrogate method to measure the soluble chemical oxygen and the biochemical oxygen demand in wastewater: Use of three-dimensional excitation and emission matrix fluorescence spectroscopy for wastewater treatment monitoring .....	165
An integrated method coupling, accelerated solvent extraction (ASE), solid-phase extraction (SPE), solid-phase microextraction (SPME) and GC-and LC/MSMS for the quantification of multi organic pollutants in air .....	167
Development of a multiplex injector for the analysis of gaseous emissions from lithium ion batteries with gas chromatography	169
A novel method for the evaluation of chlorpyrifos degradation on crop surfaces .....	170
Identification of the factors influencing bioaccessibility of polycyclic aromatic compounds in model sediments and in a river sediment core.....	171
Tracing anthropogenic gadolinium in drinking water.....	174
SPE-ICP-MS determination of rare earth elements in environmental samples using silicas, modified with polyguanidine, Arsenazo I or Arsenazo III .....	175
Determination of inorganic anions in wastewater using capillary ion chromatography.....	178
New approaches to the application of voltammetric and amperometric methods for monitoring of organic environmental pollutants.....	179

Vapor and thermally induced solid-state structural transformations .....	180
Automation and flow methods for screening antibiotics in environmental water .....	182
Validity of Refutas equation to ideal and non- ideal liquid mixtures .....	184
Application of stable isotopes in environmental studies: Sources, transport and fate of pollutants .....	185
Optimization and validation of a UPLC-MS/MS using ESI for the quantification of Perfluoroalkyl substances (PFAS) in surface, ground and drinking waters .....	187
Ionogel fibers for headspace solid-phase microextraction of volatile organic compounds .....	188
Analysis of chlorinated and brominated polycyclic aromatic hydrocarbons in total deposition by GC/MS/MS .....	190
Applying screening methodologies for drinking and raw waters .....	192
Measurements for determining of antioxidants level of new solid fuel formulations by GC-MS and HPLC .....	193
Towards the revision of the Drinking Water Directive 98/83/EC. Development a direct injection ion chromatographic-tandem mass spectrometric method for the monitoring of fifteen common and emerging disinfection by-products along the drinking water supply chain.....	196
Development of a novel methodology for the determination of priority pollutants and emerging contaminants in Asopos river water samples by GC-EI-MS/MS and GC-APCI-QTOFMS .....	198
Chemical characterization of aerosol and gas phase produced by using heat-not-burn tobacco devices.....	200
A comprehensive evaluation of two sample treatment procedures for the determination of emerging and historical halogenated flame retardants in biota .....	202
Meeting requirements of the environmental quality standards directive .....	204
Ireland's priority substance scoping study .....	204
Development and validation of extraction method for the determination of pharmaceuticals uptake in different plant tissues .	205
Isotopic analysis of Lead in apportionment of pollution sources in an industrial contaminated site .....	207
Application of molecular imprinted polymers (MIPs) as extracting media for the chromatographic determination of industrial chemicals: A case study of bisphenol A .....	209
Environmental monitoring of nitrogen oxides (NO <sub>x</sub> ) by passive sampling .....	210
Electrochemical impedance spectroscopy studies in screen printed electrode technology for heavy metal trace analysis .....	211
Fabric phase sorptive extraction followed by high-performance liquid chromatography (HPLC-DAD) for the determination of psychoactive drugs in environmental samples.....	218
Determination of emerging contaminants in apex predators and their prey from European specimen banks and natural history museums by high resolution mass spectrometry techniques .....	219
Development of a PTV-GC-MS method for determination of organophosphorus flame retardants and plasticizers in river water	221
The status of water quality in underground water wells in Berati district .....	224
The availability of metal species in aquatic systems containing nanoparticles and organic matter .....	227
Fabric phase sorptive extraction: A total sample preparation solution to serve high throughput modern analytical laboratories	230
Assessment of basic physical-chemical parameters in drinking water in Tirana, Albania .....	232
Determination of hydrocortisone in wastewater by magnetic solid phase extraction based on beta-cyclodextrin decorated magnetic activated carbon material and liquid chromatographic analysis.....	233
Laser based technique for CO <sub>2</sub> flux measurements .....	234
Fast, sensitive and selective determination of glyphosate in water samples with a white light reflectance spectroscopy biosensor .....	235
Advanced materials for NO <sub>x</sub> determination.....	238
A simultaneous and automated solid phase extraction of organotin compounds, PBDE and PCB in surface water .....	240
Modified graphene oxide for heavy metals' preconcentration method after dispersive solid phase extraction and optimization with full factorial experimental design .....	241
Correlation between process variables and quantity of phytochemicals in red beet ( <i>beta vulgaris</i> ) peel extract .....	242
Comparison of two colorimetric methods for determination of extractable phosphorus in soils .....	250
Synthesis and evaluation of two in-house synthesised zwitterionic sorbents for the solid-phase extraction of acidic, basic and amphoteric compounds. ....	253
Water quality in private and public water sources in Siatista, Voio, Greece .....	255
Comparison of different soil test extractants for determination of phosphorous in soils .....	257
Automatic sol-gel coated capillary microextraction coupled with atomic absorption spectrometry for on-line metal determination in natural waters.....	261



Multi-element stable isotope and enantiomer fractionation for characterisation of HCHs degradation processes along food webs .....	263
Multi-residual method detection and determination antibacterial substances in feed by LC-MS/MS technique .....	265
Gas chromatography – high resolution mass spectrometry determination of metabolites of chlorinated phosphorous flame retardants in sewage .....	267
Trace elements in commonly used medicinal plants from Varna region, Bulgaria .....	270
Simultaneous determination of Fe(II) and Fe(III) in natural water using indicator tubes filled with silica modified with 2,2'-dipyridyl-4,4'-dicarboxylic acid and 7-iodo-8-hydroxyquinoline-5-sulfonic acid .....	271
Arsenic in natural water: A new and simple approach to facilitate its determination and speciation .....	273
Determination of perchlorate by U.S. EPA method 332.0 using an updated IC-MS system .....	276
Organic pollutant concentrations in marine water samples of Adriatic Sea. Case study: Hot-spot of Porto-Romano, Albania .....	277
Green methodology for PAH analysis: Accelerated solvent extraction with dispersive liquid-liquid microextraction prior to chromatographic analysis .....	278
Characterization and distribution of secondary organic aerosol in PM <sub>10</sub> and PM <sub>2.5</sub> in a rural region during the winter period .....	281
Monitoring of toxic substances in the vicinity of landfills in the Czech Republic and Slovakia .....	282
Official testing of pesticide residues in Polish crops .....	283
Comparison of electroanalytical performances of the BiSnFE, BiFE and SnFE modified glassy carbon electrodes for the trace heavy metal analysis: A detailed EIS study .....	285
Monitoring of multiple flame retardants in the black kitchen utensils, plastic toys and objects of everyday use .....	293
Contaminants of emerging concern: Residues of antipsychotics in the Atibaia River, São Paulo, Brazil. ....	296
Comparison of pressurised liquid extraction and QuEChERS for the determination of phthalate diesters and their metabolites in seafood species .....	299
Marine analytical chemistry in the iron age .....	301
Screening, identification & quantitation of target and non-target (suspect) environmental pollutants in waste & drinking water using advances in LC-MS/MS .....	302
Comparative evaluation of super disintegrants and binder with formulation development of orodispersible tablets .....	303
Evaluation of physicochemical quality of Loratadine raw material .....	304
Fluorimetric determination of E132 synthetic dye in wastewater .....	305
Potentiometric fluoride ion (F <sup>-</sup> ) determination in water samples: Interference of aluminium ions (Al <sup>+3</sup> ) .....	307
The importance of having a well-designed and effective air treatment system for avoiding accumulation of trihalomethanes in the air of indoor swimming pools .....	309
<b>EDUCATION IN ENVIRONMENTAL SCIENCES .....</b>	<b>311</b>
Environment and health: Comprehensive interdisciplinary bachelor and master study programmes in Brno, Czech Republic – an integrative approach to higher education in environmental sciences .....	312
Interdisciplinary and international water education at the University of Duisburg-Essen .....	313
Using problem based learning and case studies in teaching environmental chemistry .....	315
Environmental science programs at the Eberhard Karls Universität Tübingen .....	316
The contribution of the university of Novi Sad in ICT networking for overcoming technical and social barriers in instrumental analytical chemistry education .....	317
Recent developments of postgraduate taught programmes in environmental engineering and sustainability engineering in the department of chemical engineering at the university of Bath, UK. ....	319
Wastewater treatment plant as professional training centre .....	320
The higher education in environmental chemistry in Italy: State of the art .....	322
<b>ENVIRONMENTAL APPLICATIONS OF NANOMATERIALS .....</b>	<b>323</b>
Silica capsules as environmentally friendly nanocontainers to reduce toxicity of cationic surfactants in sea water .....	324
Catalytic oxidative desulfurization of 4,6-DMDBT in fuels by activated nanoporous carbons: The role of structural and surface chemistry features .....	326
VOC degradation over Nano CeO <sub>2</sub> photocatalysts under VUV irradiation .....	329
Analysis of factors affecting low concentration formaldehyde removal on porous carbon materials .....	331
Thin-film composite membranes comprising ultrathin polydopamine/halloysite nanotube interlayer for forward osmosis application .....	332

Extraction of perfluorinated compounds in environmental waters with a novel nanostructured liquid .....	334
Fate of silver nanoparticles released from municipal wastewaters .....	337
End-capping of low band gap conjugated polymer for metal-oxide nanoparticles surface modification .....	338
Modified graphene oxide as manganese oxide support for Bisphenol A degradation .....	340
Activated carbons as adsorbates and as metal free catalysts in the oxidation of benzothiophenes for the desulfurization of fuels: The role of solvents .....	341
Degradation of bisphenol-A on an activated carbon-CuFe <sub>2</sub> O <sub>4</sub> catalyst .....	343
Synthesis of silver sulfide nanoparticle through homogeneous precipitation route and the preparation of the Ag <sub>2</sub> S-chitosan nanocomposites for the removal of iron(II) ion from wastewater.....	345
Nanostructured systems for the consolidation of historical objects.....	346
Electrospinning as an advanced technique for production of enzyme supports .....	348
Magnetic graphene oxide-polymer nanocomposites as sorbents for bisphenol A .....	350
Smart multifunctional nano-tailored composite textiles as detoxification medias against Chemical Warfare Agents vapors.....	352
Carbon magnetic nanoparticles for fast and efficient removal of dyes from aqueous solution .....	354
<b>ENVIRONMENTAL PROBLEMS RELEVANT TO MEDITERRANEAN SEA AND GULF OF MEXICO (MEDSEA-GUMEX)</b> .....	<b>356</b>
A buddhist perspective on global warming-Our irresistible fate?.....	357
Radioactivity measurement in agricultural farm lands of a lead mining community in Nasarawa State, Nigeria .....	358
Glyphosate adsorption in continental and mediterranean vineyard soils of Croatia.....	359
The effects of surfactants on the microbial biofilm associated with the benthic isopod <i>Asellus aquaticus</i> .....	360
Detection of domoic acid and lipophilic toxins in plankton and mussel samples from Bulgarian north coast in 2017. Human exposure to marine toxins.....	363
Polar organic micropollutants in the coastal environment .....	365
Partition of polycyclic aromatic hydrocarbons and polychlorinated biphenyls in seawater, sediment and biota of marine ecosystems affected by high anthropic pressure .....	367
<b>ENVIRONMENTAL FATE OF CONTAMINANTS</b> .....	<b>369</b>
SEDIBRIC : Sustainable re-use of marine dredged sediments .....	370
Inhibitory effect of cis-nerolidol on acetylcholinesterase enzyme activity .....	371
Montmorillonite modified with hexadecyltrimethylammonium (HDTMA) as an effective adsorbent of 3,5,6-trichloro-2-pyridinol, the main degradation product of Chlorpyrifos in soil .....	373
Occurrence of organochlorine pollutants levels on water samples of Devolli River, Albania .....	376
Uptake and accumulation of commonly wastewater-derived pollutants in lettuce and radish grown in a controlled environment .....	377
Photodegradation of oxolinic acid in aquatic environments using simulated solar radiation .....	380
Evaluation of antibiotic cefdinir degradation under sunlight irradiation .....	382
Isomer specific reduction of hexabromocyclododecane by Fe(II) in iron oxide suspensions .....	384
Leaching behavior of benzimidazole antiparasitics in soils and sheep excreta amended soil .....	387
Photodegradation and transformation of PAHs under simulated sunlight .....	390
A preliminary study of persistent organic pollutants in waters of Vjosa River, Albania .....	392
Occurrence and environmental risk assessment of pharmaceutical compounds in the influent and effluent of three different Wastewater Treatment Plants (WWTPs), Riyadh, Saudi Arabia.....	393
The role of earthworms in soil biochemistry: Effects of valsartan on different enzymatic biomarkers .....	394
Colloidal stability of uncoated and PVP-coated titanium dioxide nanoparticles in environmental media .....	397
Use of biopolymer in the encapsulation of active ingredients sensitive to the gastrointestinal environment .....	399
<b>GENERAL SESSIONS</b> .....	<b>401</b>
Interaction between plants and pharmaceuticals: Translocation and metabolization of drugs after uptake from water .....	402
Control of organic pollution in pacific salmon as food products of indigenous people from the russian far East.....	404
Organochlorine pesticides in the living and dead human blood from russian far East .....	407
Impact of progestogens contaminations on the development of zooplankton and aquatic invertebrate species .....	409
Metabolic response of fish to the psychiatric drug venlafaxine using a combined target and non-target screening approach .....	411

Biodegradability and aquatic toxicity of new cationic oligomeric surfactants .....	413
Transformation of selected pharmaceuticals and personal care products by trichoderma species.....	414
Recovering the “New Twin”: Analysis of secondary neodymium sources and recycling potentials in Europe .....	416
Desymmetrization of achiral heterobicyclic alkenes via catalytic asymmetric hydrophosphination .....	419
Influence of natural amino acids on CuO nanoparticles antimicrobial activity .....	420
Uptake and metabolization of lamotrigine and diclofenac by <i>Lactuca sativa</i> .....	422
A Study on degradation behavior of the antineoplastic drug Etoposide by low and high resolution mass spectrometry .....	423
Evaluation of the inhibition effectiveness of ampiciline in the corrosion steel in acid solution .....	424
Testing of the efficiency of Margarita Flower leaf extract, against the corrosion of Fe B500 in the H <sub>2</sub> SO <sub>4</sub> in the presence of ions Cl <sup>-</sup> . .....	430
Protection efficiency of Eucalyptus leaf extract against acidic corrosion of Fe B500 .....	433
Translocation and metabolization of UV filters in plants after uptake from water .....	435
Comparison of the Antimicrobial activity of permaleic acid and peracetic acid on <i>Escherichia coli</i> and <i>Staphylococcus aureus</i> ...	437
Thin gold film electrode for voltammetric determination of Chromium (VI).....	439
Cyanotoxins and cyanobacteria. An emerging threat to water resources and human health.....	442
Development of bio-based chemicals to increase the resistance to chlorinated pool water fastness of the textile material .....	445
Radioactivity in the irish marine environment – 35 years of monitoring.....	446
The inhibition effect of the amygdali amare bitter semen extract in the corrosion of carbon steel in 3 wt.% NaCl solution .....	447
Robustness & validation an HPLC method for the determination of digoxin in tablet unit.....	453
Quality assurance of radiopharmaceuticals .....	456
Synthesis, characterization and study of antacid activity of anionic clays with lamellar structure .....	458
<b>GREEN AND SUSTAINABLE CHEMISTRY STRATEGIES FOR AGRICULTURAL AND FOOD WASTE BIOMASS</b>	
<b>VALORIZATIONS.....</b>	<b>460</b>
Design of low toxicity and biodegradable ionic liquids for biomass valorization .....	461
Supramolecular solvent extraction for valorization of coffee husks .....	462
Intensification of oxidative photocatalysis by microflow-reactor and sonochemical pathways: Water detoxification and lignin valorization .....	465
Ultrasound assisted nanocatalyst deposition in photo-microreactor for the photochemical valorization of biomass derived model compounds .....	468
Design of a sono-photo reactor for oxidation of lignin-based molecules .....	470
Light-initiated and additive-free heterogeneous catalytic oxidation at ambient conditionsof 5-hydroxymethylfurfural by manganese oxide nanorods.....	472
Ultrasonic driven synthesis of novel nanocomposites and their utilization for ultrasound assisted photocatalytic upgrade of biomass derived chemicals.....	474
Decentralised thermochemical systems for bioenergy and biochar fuelled with agro-industrial wastes and social acceptance ...	476
The SCG biorefinery concept as a green and sustainable chemistry strategy.....	477
An application of green chemistry with forest biomaterials; Carbon fibers from softwood kraft lignin .....	478
Impact of microbial co-cultivation on biofuel production from agro-peels .....	481
A novel biorefinery integration concept for typical European food processing wastes to produce food ingredients.....	484
Valorization of agricultural and food industry wastes towards the production of value added chemicals: A holistic approach ....	487
Bio-oil upgrading potential via mild-hydrotreatment for refinery integration .....	489
Mild oxidative organosolv pretreatment of lignocellulosic biomass residues for high added value chemicals and food additives via fermentation processes.....	493
Life cycle assessment of industrial syngas production: Comparison between a new steam/dry reforming process and traditional routes .....	496
Mild-hydrotreated bio-oil compatibility evaluation as a renewable co-supply in conventional oil refinery.....	498
Hydrotreated pyrolysis bio-oil stability study towards the logistics for its utilization as refinery intermediate.....	501
Fifty shades of green chemistry.....	504
Mechanistic and kinetic study of glycerol hydrodeoxygenation with in-situ H <sub>2</sub> formation, over Cu-based catalyst .....	505
Alternative feedstock for the production of 2 <sup>nd</sup> generation biodiesel: The case of Greece.....	508
Adsorption of phenolic compounds by activated carbon obtained from <i>Haematoxylum campechianum</i> bark .....	510
Green products from agricultural waste biomass for the wood-based panels industry .....	511



Effect of liquid phase state on organosolv using water/1-butanol co-solvent for cedar wood .....	513
Effect of surface functional groups of activated carbons made from olive residue on the TiO <sub>2</sub> catalyst deposit .....	516
<b>HEAVY METALS AND OTHER INORGANIC POLLUTANTS IN THE ENVIRONMENT AND REMOVAL TECHNOLOGIES</b> .....	<b>517</b>
Gellan Gum based double network hydrogel for removal behaviour of Al(III) ions .....	518
Extraction of valuable metals from spent catalysts : Investigation of Roasting/Oxidation and Leaching stage .....	519
Isolation and characterization of Antimony resistant bacteria from the contaminated soil .....	520
Surface modification of bio-char by dielectric barrier discharge plasmas for mercury removal .....	522
Resource recovery from TiO <sub>2</sub> production acid waste by means of nanofiltration .....	523
Biochar from crop residues for remediation of trace element polluted soils .....	525
Prussian blue-embedded alginate foam for the simultaneous removal of radioactive strontium ( <sup>90</sup> Sr) and cesium ( <sup>137</sup> Cs) from water .....	526
Trace element profile in organs of suckling mice after chronic cobalt exposure .....	528
Biomass/Biochar application in biosorption removal of Pb <sup>2+</sup> , Cd <sup>2+</sup> , Cu <sup>2+</sup> and Cr <sup>3+</sup> from aqueous solutions .....	530
Study of effects non-ferrous metal foundry on local forest ecosystem:Mercury in edible mushroom <i>Craterellus cornucopioides</i> (L.) Pers. and soil profile .....	532
Protective effect of turmeric extracts against lead induced liver damage in rats .....	534
Simultaneous arsenic and chromate removal from ground or surface waters by iron salts .....	535
Concentration ratios of metals between house dust and road dust .....	537
Water purification using zeolites prepared from peat ash .....	541
Effects of consecutive thermal and wet conditioning treatments on the leaching and the microstructure of stabilized cementitious materials obtained from High-Performance S/S (HPSS <sup>®</sup> ) technology applied to dredged freshwater sediment .....	543
Fate and transport of thioarsenates in groundwater and options for in situ remediation .....	545
Uranium removal from waters by oxidized biochar fibers .....	547
Preparation of biochar obtained from <i>Opuntia cladodes</i> and its application for copper(II) removal from aqueous solutions .....	549
Asbestos-containing wastes detoxification technology by microwave heat treatment using inorganic material .....	551
Removal of Cr(VI) from ground waters by pipe flocculation followed by direct sand filtration .....	554
The removal of rare earth elements (REEs) by biosorbents: A bibliographic analysis and a systematic review of recent studies ..	556
Recovery of Molybdenum, Vanadium and Nickel from filter cake .....	559
Adsorption of arsenic (V) by nano scaled activated carbon modified by iron and manganese oxides: Material characterization and arsenic adsorption isotherms .....	560
Effects of oxidation on the fractionation of metals during resuspension of marine sediments .....	562
Carbonaceous nanomaterials for removal of heavy metals from wastewaters .....	566
<b>HUMIC SUBSTANCES: ENVIRONMENTAL DYNAMICS AND IMPACT ON WATER QUALITY</b> .....	<b>568</b>
Photochemical production of sulfate and methanesulfonic acid from dissolved organic sulfur: Occurrence and mechanistic insights .....	569
Humic substances in the environment: Implication on water quality .....	571
Relation between the decomposition rate of soil labile carbon and its chemical composition investigated by fluorescence spectroscopy and PARAFAC .....	572
Characterization of 17 $\alpha$ -ethinylestradiol adsorption on DOM using high performance liquid chromatography and fluorescent spectroscopy .....	574
A NMR perspective on the effects of drinking water treatment on the structure and composition of dissolved organic matter (DOM) .....	575
Spectroscopic, photochemical and photoinactivating properties of dissolved organic matter in a constructed polishing wetland ..	577
Diel monitoring of dissolved organic matter in the Deûle River .....	580
Antioxidant properties of humic acids extracted from saltmarsh soils (Marano and Grado Lagoon, northern Adriatic Sea) .....	582
Fractionation of humic acids on bacterial surfaces .....	585
Toward a better knowledge of domestic sewage fluorescent dissolved organic matter: A study of its biological and physicochemical properties .....	587
Pelagic <i>Sargassum</i> brown algae release significant proportions of phlorotannins into the oceans .....	588

Formation of chlorinated disinfection byproducts (DBPs) in water: The strengths of correlations between DBPs and organic matter-based predictors.....	590
<b>IDENTIFYING CRITICAL NUTRIENT EMISSION ZONES IN LANDSCAPES: A KEY FOR REDUCING WATER EUTROPHICATION?</b> .....	<b>591</b>
Characterization and quantification of mobilizable colloids and associated phosphorus (P) from wet and dried dam sediment ..	592
Phosphorus adsorption capacity of sediment across cascade dam reservoirs: A case study of Age complex (Central France) .....	595
Nanocolloidal phosphorus in soils and streams .....	597
Assessment of protocols for colloid extraction from sediment .....	599
How a three cascade dams impact sediment quality and phosphorus distribution along the Creuse River (France)? .....	602
<b>INNOVATION IN DRINKING WATER TREATMENT</b> .....	<b>605</b>
Removal of cationic dyes by adsorption on semi-IPN alginate beads.....	606
The influence of cellular organic matter on the coagulation of <i>Merismopedia tenuissima</i> cells.....	607
Efficient removal of perfluoroalkyl acids from aqueous solution by surface-modified poly (ethylene terephthalate) textiles .....	609
Microplastic in raw water and finished drinking water: Limits of detection and quantification and what can be concluded regarding removal .....	611
Occurrence and fate of benzophenone and caffeine – from WWTP to potential scenario of direct river water treatment by hybrid ultrafiltration processes .....	613
Effect of water matrix on arsenic removal using three iron oxide-based adsorbents .....	615
Adsorptive water treatment for organic micro-pollutant removal .....	618
The biochar alternative inside tertiary treatments of potabilization plants .....	620
Enhanced removal of crystal violet dye by raw and activated natural clay .....	622
Application of composite pre-polymerized coagulants in fluoride removal from waters.....	623
Rural water usage in Southern India: A comparison of household water .....	626
sources and their health implications .....	626
Improvement of the microbial quality of drinking water in trains .....	629
Highly efficient and selective removal of coloured pollutants from wastewaters by iron oxide mesoporous silica nanocomposites .....	632
Raising synergy effects in hybrid membrane processes.....	634
<b>INVESTIGATING THE ENVIRONMENTAL FATE AND ECOTOXICOLOGY OF GLYPHOSATE</b> .....	<b>635</b>
A review of exposure and effects studies that support pollinator risk assessments for glyphosate globally .....	636
Glyphosate's accumulation in and influence on plant disease, mineral nutrition, and associated microbiota of glyphosate-resistant soybean and maize .....	639
Ecotoxicology of formulated glyphosate: The role of the active and the formulants .....	642
Exposure to glyphosate in humans and residues in food: What are the risks?.....	645
Mitigating glyphosate levels in surface waters in an agricultural catchment .....	648
Glyphosate: Center of a scientific debate .....	651
<b>METABOLOMICS</b> .....	<b>653</b>
Application of the ROIMCR method to MS environmental metabolomics .....	654
Analysis of qualitative phytochemical screening and antioxidant activities from leaves, fruits, and seeds of <i>Momordica charantia</i> (Cucurbitaceae) from Borneo Island.....	656
Metabolomics approach reveals disruption of metabolic pathways in the marine bivalve <i>Mytilus galloprovincialis</i> exposed to WWTP effluent .....	658
Fabric phase sorptive extraction: A paradigm shift sample preparation strategy for pharmacokinetics, pharmacodynamics, toxicokinetics, and therapeutic drug monitoring studies directly from whole blood .....	661
Global metabolomic profiling of MCF-7 responses to “Cocktail” of xenobiotics at human relevant levels.....	664
Fate assessment of pharmaceuticals in the environment: Analytical challenges, ecotoxicological profiling, hydrolytic stability and distribution in soils .....	666
A new approach to bioanalytics of Zearalenone and its metabolites .....	667

MICROPOLLUTANTS AND MICROPLASTICS IN THE AQUATIC ENVIRONMENT .....	668
Organosilicon benzene derivatives – first study on degradation processes .....	669
Synthesis of metal doped nanoplastic particles and microplastic fibers and their utility for investigating plastic fluxes in complex matrices .....	671
Development of a novel technological approach for the reduction of microplastic pollution in seawater desalination plants and for sea salt extraction.....	672
Micropollutants from municipal wastewater treatment plants - a coordinated and harmonised Germany-wide monitoring as a basis for a realistic emission inventory.....	674
Historical evolution of Cu and Zn levels in the gulf of Elefsis in the last 40 years .....	677
Ready biodegradability of the antineoplastic nitrogen mustard cyclophosphamide and its human metabolites.....	680
Emerging organic contaminants in Irish groundwaters: Investigating the occurrence of two commonly used groups of antiparasitic drugs in Irish agriculture, with determination by Solid Phase Extraction (SPE) and UHPLC-MS/MS detection .....	682
Qualitative analysis of municipal solid waste landfill leachate from Vojvodina, Serbia, and identification of endocrine disruptors .....	684
Dynamic passive sampling of POPs in surface seawater along the South Atlantic Ocean east-to-west transect and across the Black Sea .....	688
Relevance of three urban WWTPs in the dispersal of selected antibiotic resistance genes to receiving water bodies .....	691
Do microplastics pose a risk in drinking water? The case study of Barcelona urban area .....	693
Detection of microplastic and tire wear particles in road run-off samples using TED-GC-MS .....	696
Development of methods for the advanced monitoring of emerging contaminants in environmental samples from the Asopos river basin by UPLC-QToF-MS.....	699
Interactions between ammonia and amine-containing micropollutants affect their removal in activated sludge.....	701
Application of passive sampling to evaluate the chemical pollution of treated wastewater intended for reuse.....	704
Microplastics versus drinking water treatment.....	707
Monitoring of pharmaceuticals, pesticides and perfluorinated compounds in the effluent of a municipal wastewater treatment plant using a hydrogel-based passive sampler (o-DGT) .....	709
Sources of contamination of greywater in Paris conurbation .....	712
Identification of polar halogenated micropollutants in surface waters using suspect screening strategies based on regulatory databases.....	715
Occurrence of pharmaceuticals in a river in southern Brazil.....	716
Estimation of accessible and pore water concentrations of persistent organic pollutants in surface layer sediments of the Danube river by multi-ratio equilibrium passive sampling .....	719
Widening the choice of quality assurance/quality control tools for the analysis of brominated flame retardants: Recent examples of sediment and fish certified reference materials .....	722
Separation of plastic solid waste by flotation and its utilization in the preparation of sorbent materials .....	725
First estimation of PCB mass budget in a contaminated Peri-Alpine lake undergoing natural decontamination .....	726
Mechanism of PCBs bioaccumulation in fish under environmentally representative laboratory conditions.....	729
Using detected chemicals in drinking water and groundwater to scientifically justify PMT and vPvM criteria to identify persistent, mobile and toxic substances under REACH .....	732
Determination of emerging contaminants in leachates originated from Greek landfills by LC-QTOFMS and investigation of their potential ecological threat .....	734
An analytical approach for the identification and quantification of microplastic in environmental samples by an automated combination of optical particle analysis with FTIR and Raman microscopy .....	736
Seasonal variability of pesticides contamination of river basin located on nitrate vulnerable zone of Wielkopolska region (Poland) .....	739
Microplastic analysis of water samples – the devil is always in the details .....	742
Quantification and assessment of particle dynamics of tire and road wear particles based on zinc content after density separation .....	745
Trace level analysis of perfluoroalkyl substances in drinking water and their assessment in Metropolitan Area of Turin .....	748
Occurrence and concentration level of microplastic in sediments of Danube river, Hungary .....	751
The interaction of microplastics and wastewater in urban sewers.....	753

Characterization of sources and risks associated with polychlorinated biphenyl (PCBs) in bottom sediments of the Danube river in Serbia .....	755
Adsorption mechanisms of persistent organic pollutants on primary microplastics in the aquatic environment .....	757
Chasing equilibrium passive sampling of hydrophobic organic compounds in water .....	761
The use of biofilm as a potential passive sampler of micropollutants .....	762
Hexabromocyclododecane in the marine environment. Are plastic debris a potential source? .....	765
<b>OXIDATION AND ADVANCED OXIDATION PROCESSES IN WATER AND WASTEWATER TREATMENT .....</b>	<b>767</b>
Inhibitory effect of dissolved organic matter on the transformation of selected anilines and sulfonamide antibiotics induced by the sulfate radical .....	768
Mixing effects on product formation during oxidation .....	770
Effects of organic matter on by-product formation during application of ClO <sub>2</sub> .....	772
Degradation of 1,2,3-trichlorobenzene in synthetic water during the application of sulfate radical-based advanced oxidation ...	774
Ozonation of the antidiabetic sitagliptin: Determination of reaction kinetics and identification of transformation products .....	777
Oxidation of heterocyclic amines with chlorine dioxide, chlorine balance and formation of hypochlorous acid as secondary oxidant .....	780
Oxidative micropollutant abatement: Options and limitations of quantum chemical computations .....	783
The role of “long-lived” photooxidants in the transformation of aquatic organic contaminants photosensitized by dissolved organic matter .....	784
Transformation products in water treatment with ozone and biological post-treatment .....	786
Evaluating the capacity of a drinking water treatment plant to remove the disinfection by-product precursors .....	789
Elucidating the formation and fate of ozonation transformation products in wastewater treatment with high-resolution mass spectrometry .....	791
Hydrodynamic cavitation method for herbicide removal. An example: Diuron .....	793
Evaluation of micropollutants removal in secondary effluent during ozone disinfection .....	796
Elimination of micropollutants in water by cavitation and cavitation-assisted methods .....	798
Photochemical properties of photosensitizers in tropospheric aqueous solution .....	800
Towards a new technology: Ozonation of pharmaceuticals and their by-products in the presence of heterogeneous catalysts ..	801
Removal of contaminants of emerging concern for water reuse .....	804
Antimicrobial activity removal by heterogeneous photocatalysis with N-modified TiO <sub>2</sub> under solar irradiation .....	805
Influence of operating parameters on the sonolytic degradation efficiency of model compound 2,4 dichlorophenol .....	808
Photodegradation of water organic micropollutants by hybrid photosensitizer based on natural Halloysite .....	810
Formation potential of nitrogenous disinfection by-products of surface water under various chlorination conditions and precursors .....	813
Highly efficient TiO <sub>2</sub> layers for complete mineralization of aqueous pollutants .....	816
Immobilized rGO/TiO <sub>2</sub> photocatalyst for decontamination of water .....	819
Synthesis, characterization, and photocatalytic tests of novel photocatalysts .....	821
Photocatalytic degradation of cytostatic/antineoplastic drug mixture by using floating chitosan and TiO <sub>2</sub> -graphene oxide .....	823
Developing a lab-scale continuous ozonation system merged with biofiltration (COMBI) to study biofiltration processes of ozonation products .....	824
Photocatalytic activity of TiO <sub>2</sub> modified by graphene oxide for the degradation of contrast media under visible light .....	826
Overview of sulfate radical-based advanced oxidation processes in treatment of contaminants of emerging concern .....	827
Photocatalytic degradation of Bromazepam by photo-fenton processes at different pH and iron complexes .....	828
Influence of potassium permanganate pre-oxidation on coagulation of organic matter produced by cyanobacterium <i>Microcystis aeruginosa</i> .....	830
<b>RECENT ADVANCES IN TARGETED AND NON-TARGETED SCREENING STRATEGIES BASED ON HIGH RESOLUTION ACCURATE MASS SPECTROMETRY IN ENVIRONMENTAL AND FOOD ANALYSIS .....</b>	<b>833</b>
Levels of dioxins and PCBs in commercial butters samples in Poland .....	834
PCDD/Fs and PCBs in sediments and fresh water fish from Polish rivers and lakes .....	835
HR-MS-suspect screening of phototransformation products of wastewater-borne pharmaceuticals in rivers .....	836
Determination of diclofenac and acetaminophen and their respective metabolites in 20 days old maize and pea with HPLC-DT-IM-QTOF-MS .....	838

Data selection criteria strategy for non-target screening of environmental samples by LC-HRMS: Application for structural elucidation .....	840
From unknowns to knowns – tools for ultimate identification and confirmation of food and environmental contaminants .....	843
Development of a method using QuEChERS and LC-HRMS for the evaluation of the uptake of pharmaceuticals in greenhouse lettuce.....	844
Uptake and accumulation of pharmaceuticals and personal care products (PPCPs) by radish crops irrigated with treated wastewater .....	846
Assessing organic contaminant emissions from pharmaceutical industries based on high-resolution mass spectrometry time series data.....	847
Analysis of emerging bisphenol A replacements (colour developers) in indoor dust from public environments .....	849
Uptake and biological effects of the insecticide Fipronil on seabass .....	852
What's in the wastewater and drinking water? State of the science .....	855
Disinfection by-products in reclaimed water: Integration of high-resolution mass spectrometry and in vitro toxicity assays data to characterize toxic DBPs .....	856
Multi-class LC-MS/MS and GC-MS/MS methodologies for the determination of pesticides and their metabolites in environmental and food matrices.....	857
SPIX, a newly developed free software to overcome operator subjectivity in mass spectrometry and characterize unknown chemical reactions in environmental samples .....	858
Target and non-target analysis of disinfection by-products formed after an innovative drinking water treatment process.....	860
Development of SPE-LC-HRMS method using suspect screening SWATH® technology for the detection of halogenated pharmaceuticals and their phototransformation products in surface waters .....	862
Non-target screening to identify biomagnifying lipophilic organic contaminants in Baltic Sea top consumers .....	864
Combination of high throughput target analysis by laser diode thermal desorption with screening analysis of irbesartan and its degradation products .....	867
Multi-residue analysis of personal care products using UHPLC-HRMS/MS (Orbitrap™) mass spectrometry .....	868
Assessment of multi-contaminant concentrations in indoor dust and air from four European countries .....	871
Target, suspect and non-target screening of dioxin-like compounds in environmental samples using a sensitive high-resolution time-of-flight mass spectrometer.....	872
A novel method for the determination of polar herbicides in feed, milk and honey samples.....	873
Application of mass spectrometry-based approaches to characterize changes in water composition after chlor(am)ination.....	876
Soil contamination of poly- and perfluorinated alkylsubstances (PFAS) due to recycling economy – a mass spectrometric screening study .....	877
Fastmethod for the extraction, clean-up and quantification of human pharmaceuticals residues in biological samples using USE and d-SPE followed by LC-QToFMS analysis in SWATH mode .....	879
<b>RECYCLING AND RESOURCE REUSE AS TOOLS FOR EFFICIENT CIRCULAR ECONOMY .....</b>	<b>881</b>
Selected organic contaminants of emerging concern in digestates from norwegian biogas production .....	882
An overview of good practice on cooling water management in steel hot rolling mill .....	883
Regional circular economy models and good practises for biological streams .....	885
Green cities –hubs in a circular economy .....	886
Light packaging waste from different countries: An application with the scanning electron microscopy.....	887
The immobilization of compounds from heavy polluted wastewater into geotechnical composite .....	889
Evaluating urine-based fertilizers for horticultural crop production.....	891
The Tropenhaus - A 20-year learning case connecting China and Europe .....	892
Urban farming towards 2030: Trends, Weak Signals, business models and scenarios .....	895
Environmental implications of vanadium extraction from spent desulfurization catalyst.....	896
Metallurgical wastes: Metals extraction and leach residue characterization .....	899
Novel trends in the thermo-chemical recycling of plastics from WEEE containing brominated flame retardants .....	901
COMMURBAN: A mobile application aiming to engage citizens in urban agriculture .....	903
Polymer packaging waste recycling: Microwaves and UV-treated materials study .....	905
Treated wastewater in agricultural irrigation practises. Assessment of its impact in the contest of resource reuse .....	907
State-of-art on environmental stability, metal recovery and reuse of spent catalyst.....	909
Unpacking the multiple roles of Urban Agriculture: Insights from experiences in Aarhus, Fredrikstad and Hatay .....	912



The use of UA typologies to inform urban planning: The case of Aarhus .....	915
Household compost mix reduced fruit cracking in greenhouse grown tomato ( <i>Solanum lycopersicum</i> Mill) compared to peat...	918
Nitrification in reactor – a way to treat urine to get stable, smell free nutrient solution for urban greening.....	921
Facilitating cities to deploy urban agriculture technologies in the transition to the circular economy: The SiEUGreen deployment methodology .....	923
Nutrient recovery and improved effluent quality of anaerobically treated blackwater by microalgae biomass production .....	924
Greywater recycling in the green walls - public health and safety issues .....	926
Evaluation of a compact unit for pre-and primary treatment of greywater .....	929
Production of drinking water from greywater .....	930
Precipitation of Fertilizer from concentrated Liquid waste.....	931
Multifunctional nature-based systems for improvement of urban runoff – Examples using constructed wetlands, ponds and biofilters in Norway .....	932
Use of alternative fuels in a cement factory as a contribution to circular economy: Air quality aspects .....	934
Phosphorous recovery by precipitation of struvite using sea water as a magnesium source.....	937
<b>RISK ASSESSMENT OF EMERGING POLLUTANTS EXPERIMENTAL AND MODELLING APPROACHES TO FILL THE DATA GAPS .....</b>	<b>938</b>
Are the 16 EPA PAHs in need of overhaul after 40 years of faithful service?.....	939
Non-extractable residues, an overlooked new hazard in the persistence assessment? .....	940
Contaminants of emerging Arctic concern (CEAC) as indicators for risk evaluation in modern Arctic environmental assessments.....	942
Environmental risk assessment of pharmaceuticals in the largest shallow lake in Central Europe .....	943
Obesogenic effect of environmental pollutants: Molecular interactions with PPAR $\gamma$ in humans and zebrafish .....	946
Influence of the data gaps on the green assessment with multi-criteria decision analysis for ionic liquid as alternative solvents .....	947
Differential toxicity of chlorinated wastewater effluents on genetically modified bacteria and naturally occurring cyanobacteria .....	948
Alternative assessment of hazardous chemicals by combining in silico tools with multicriteria decision analysis .....	950
In silico approaches for the prediction of the removal efficiency of organic contaminants in wastewater treatment plants .....	951
Big challenges create big opportunities .....	953
Persistent, mobile and toxic: A PMT and vPvM assessment of substances registered under REACH.....	954
A novel holistic approach in the governance of environmental pollution events from PMOC.....	956
Uptake and translocation of perfluoroalkyl acids (PFAAs) in red chicory grown under varying contamination conditions: A greenhouse study .....	959
The new QSARINS-Chem standalone version to profile the hazard of organic chemicals .....	963
Towards a watch list for the lagoon of Venice: Identification of contaminants and emissions inventories .....	964
<b>SOIL POLLUTION AND MONITORING .....</b>	<b>966</b>
Environmental risk assessment of pollutants in soil under multiple stress.....	967
Some features of soil pollution based on soil monitoring in Slovakia .....	969
Characterizing the transformation of organophosphorus compounds by compound-specific isotope analysis .....	972
Simulation of time-dependent mixture exposure to pesticides in agricultural landscapes and estimation of effects on terrestrial organisms .....	974
The determination of mercury bioavailability to pea tissues ( <i>Pisum sativum</i> L.) in urban soils .....	976
Long-Term fate of ZnO and CuO nanoparticles in soils: The effect of pH and nutrient content .....	978
Development of a method for glyphosate, glufosinate and aminomethylphosphonic acid analysis in soil samples by LC/MS/MS .....	979
Optimised extraction method for accurate and sensitive analysis of glyphosate and AMPA in high conservation island soils .....	980
Effects of residues chlorothalonil on microbial ecosystem of yellow-brown loam soil .....	982
Development of tiered risk assessment approach for soil organisms of pesticides in China .....	984
Development of a DNA based electrochemical biosensor to determine the overall genotoxicity of multi-pesticide soil extract (Protects) .....	985
Formation of hazardous polycyclic aromatic hydrocarbon breakdown products in contaminated soils using different forms of biotic and abiotic remediation .....	988
Assessment of Hg uptake by lettuce in amended agricultural peri-urban soils using conventional and novel techniques.....	989
Using lake sediments as a complementary tool in soil monitoring to prioritize plant protection products .....	991

Sediment behavior in soil currently collected from the watersheds of the ancient huelgoat mine (Brittany, France): Pb-bearing phases.....	992
Nitrated and oxygenated polycyclic aromatic hydrocarbons in total atmospheric deposition and soils from background and urban sites of Central Europe .....	994
Contamination and profile of polycyclic aromatic hydrocarbons in soil and water samples from the district of an oil refinery in Albania .....	996
Heavy metal levels and pollution assessment in soils of Elbasani industrial area in Albania.....	997
Determination of gasoline range organics in environmental samples using automated head space sampling coupled to gas chromatography .....	998
Tetralin and decalin biodegradation and influence on soil microbial cells .....	999
Development and application of in-cell basic silica clean-up for analysis of polyaromatic compounds in soil samples .....	1001
Determination of carbonate content-as carbon dioxide- in coal and lignite using the FOGL Digital Soil Calcimeter .....	1003
Sewage sludge: The main carrier of microplastics to agricultural soils .....	1004
Influence of different pest management systems in potato production on pesticide residues in Cuban soils (PERECUSO) .....	1006
Assessment of polycyclic aromatic hydrocarbons in soil, grass, and milk in cattle farms of Havana and Mayabeque provinces ...	1008
Developing a long-term exposure monitoring for PPP residues in Swiss soils .....	1010
Comparison of two extraction methods – accelerated solvent extraction and QuEChERS – for pesticide analysis in soil .....	1012

## URBAN CONTAMINANTS: CONTROL MEASURES, REMEDIATION ACTIONS AND TOXICOLOGICAL IMPLICATIONS .....

Contaminants and urban environments.....	1015
Alkyl quaternary ammonium compounds as potential precursors and catalysts for the formation of carcinogenic N-nitrosamines in water.....	1016
Bioaugmentation as a strategy for cleaning up water contaminated with hydrocarbons .....	1018
Polyoxometalate-Ionic Liquids (POM-ILs) as invisible bifunctional protection coatings against acid-corrosion and bio-deterioration of mineral stones.....	1020
Importance of domestic releases in urban sewer networks: Case of alkylphenols, phthalates and parabens in the Paris agglomeration .....	1023
Origins of biocides in combined sewer overflows in urban areas .....	1026
How to quantify polar metabolites of pesticides in water: An analytical challenge .....	1029
The effect of the chemical properties of pharmaceuticals on their adsorption processes to environmental surfaces.....	1032
Studying the Fenton based oxidation of polycyclic aromatic hydrocarbons (PAXHs) as a tool for soil remediation .....	1034
Adsorption of alachlor and pentachlorobenzene on biochar and hydrochar originating from Miscanthus giganteus and sugar beet shreds .....	1036
Zebrafish model to assess ecotoxicological impacts of cosmetic products preservatives: Case of parabens and their substitutes .....	1039
Levels of volatile methylsiloxanes in Atlantic and Mediterranean coastal environments .....	1042
Link anthropization and presence of pollutants on a territory: Example of the ponds of the Plateau de Saclay .....	1044
Spectral characteristics and sources of dissolved organic matter in a heavily polluted urban stream of Chongqing, China .....	1047
Monitoring of volatile organic compounds in industrial and urban atmospheres by using passive sampling.....	1049
Polycyclic aromatic hydrocarbons and heavy metals in urban soils of Havana, Cuba .....	1051

# **Micropollutants and microplastics in the aquatic environment**

# Qualitative analysis of municipal solid waste landfill leachate from Vojvodina, Serbia, and identification of endocrine disruptors

K. Antić<sup>1</sup>, M. Sremački<sup>1</sup>, M. Petrović<sup>1</sup>, M. Turk-Sekulić<sup>1</sup>, D. Adamović<sup>1</sup>, D. Sakulski<sup>2</sup>, J. Radonić<sup>1\*</sup>

<sup>1</sup>University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia

<sup>2</sup>University of Novi Sad, BioSense Institute, Dr. Zorana Đinđića 1, 21000 Novi Sad, Serbia

\*jelenaradonic@uns.ac.rs

## Abstract

Numerous xenobiotic organic components can have a highly detrimental effect on human health and the environment. Endocrine disruptors, a group of chemicals that affect the endocrine system, are a serious cause for concern. The effects of this group of substances often manifest after a certain period of time. The risk arising from the broad use of these substances and the necessity of educating both natural and legal persons have been recognized on the national level. The first step in this direction was the adoption and implementation of the appropriate national legislation, namely the Law on Chemicals ("Official Gazette of RS", Nos. 36/2009, 88/2010, 92/2011, 93/2012, and 25/2015); Law on Biocide Products ("Official Gazette of RS", Nos. 36/2009, 88/2010, 92/2011, and 25/2015); The Lists of Substances of Very High Concern ("Official Gazette of RS", Nos. 94/2013, 101/2016, and 22/2018), which also includes endocrine disruptors; and Candidate List of Substances of Very High Concern ("Official Gazette of RS", Nos. 58/2016 and 22/2018). The national legislation was adopted based on the experience of other countries, primarily the European Union, and appropriate legislation, namely REACH Regulation (Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals), Authorisation List (included in Annex XIV, REACH ("Authorisation List")) and Candidate List of substances of very high concern for Authorisation (published in accordance with Article 59(10) of the REACH Regulation).

For the purpose of detection and identification of endocrine disruptors, qualitative analysis of leachate from non-sanitary (L<sub>1</sub>) and sanitary (L<sub>2</sub>) solid waste municipal landfill from the region of Vojvodina, Serbia, was carried out. In addition, semi-quantitative screening analyses of collected samples were performed using QP2010-Ultra GC-MS. The results are shown in Table 1, 2, 3, and 4, and represent the basis for designing the treatment of solid waste municipal landfill leachate and removal of endocrine disruptors by applying economically cost-effective yet experimental methods of phytoremediation using plants such as *Potamogeton illinoensis*, *Potamogeton crispus* and *Raphanus sativus* (Trueman and Erber, 2013).

**Table 1.** Values of physical and chemical parameters of leachate from the site L1

Parameter	Unit	Value
Temperature of leachate	[°C]	7.3
pH	[-]	7.31
Conductivity	[ $\mu\text{S cm}^{-1}$ ]	10 560
COD	[ $\text{mg l}^{-1}$ ]	3545
BOD <sub>5</sub>	[ $\text{mg l}^{-1}$ ]	1040
BOD <sub>5</sub> /COD	[ $\text{mg l}^{-1}$ ]	0.293
Ammonia nitrogen	[ $\text{mg l}^{-1}$ ]	166
Sulphate	[ $\text{mg l}^{-1}$ ]	188.0
Total Phosphorus	[ $\text{mg l}^{-1}$ ]	26.256
Ortho-phosphate	[ $\text{mg l}^{-1}$ ]	1.964
Turbidity	[NTU]	87.1
Total suspended solids	[ $\text{mg l}^{-1}$ ]	7.4

**Table 2.** Values of physical and chemical parameters ofLeachate from the site L<sub>2</sub>

Parameter	Unit	Value
Temperature of leachate	[°C]	6.2
pH	[-]	8.51
Conductivity	[ $\mu\text{S cm}^{-1}$ ]	16 230
COD	[ $\text{mg l}^{-1}$ ]	4380
BOD <sub>5</sub>	[ $\text{mg l}^{-1}$ ]	180
BOD <sub>5</sub> /COD	[ $\text{mg l}^{-1}$ ]	0.04
Ammonia nitrogen	[ $\text{mg l}^{-1}$ ]	38.15
Sulphate	[ $\text{mg l}^{-1}$ ]	102.7
Total Phosphorus	[ $\text{mg l}^{-1}$ ]	66.256
Ortho-phosphate	[ $\text{mg l}^{-1}$ ]	2.561
Turbidity	[NTU]	17.8
Total suspended solids	[ $\text{mg l}^{-1}$ ]	4.29

**Table 3.** Values of microbiological parameters of leachate from landfill sites L<sub>1</sub> and L<sub>2</sub>

Parameter	Method	Unit	L <sub>1</sub>	L <sub>2</sub>	Limit value <sup>1</sup>	Limit value <sup>2</sup>
Number of aerobic heterotrophs	Kohl	UCF/1mL	32.227.273	302.272	-	-
Total Coliform Bacteria	Membrane filtration	UCF/100mL	20.000.000	200	10.000	10.000
Fecal Coliform Bacteria	Membrane filtration	UCF/100mL	9.000.000	100	2.000	2.000
Detection and enumeration of intestinal enterococci	Membrane filtration	UCF/100mL	8.000.000	200	400	200

<sup>1</sup>Regulation on emission limit values for pollutants in waters and deadlines for their reaching ("Official Gazette of the RS" No. 67/11, 48/12 and 01/16), article 13, Table 4; Annex II, Chapter III Urban wastewaters

<sup>2</sup>Bathing Water Directive (CD 76/160/EEC), Table 10; Directive concerning the quality of Bathing Water COM (2002) 581, Annex I, Table 11



On the basis of microbiological examination, the sample of leachate from the landfill site L<sub>1</sub> does not correspond to limit values stipulated by corresponding national and EU regulations. *Escherichia coli* (37°C, 44°C) represents a type of microorganisms identified in the sample L<sub>1</sub> and L<sub>2</sub>, and the presence of another type of microorganisms - *Klebsiellapneumoniae* (37°C, 44°C) was identified only in the sample L<sub>2</sub>.

**Table 4.** Organic analysis of the sample of leachate from landfill sites L<sub>1</sub> and L<sub>2</sub>

Compound	Retention time [s]	CAS number	Molecular formula	Molecular weight [g mol <sup>-1</sup> ]	GHS Classification
<b>L<sub>1</sub></b>					
7-Hexadecenal, (Z)-	10.068	56797-40-1	C <sub>16</sub> H <sub>30</sub> O	238.41	/
Guanosine	11.57	118-00-3	C <sub>10</sub> H <sub>13</sub> N <sub>5</sub> O <sub>5</sub>	283.24	Signal: Danger
Phenol	17.468	108-95-2	C <sub>6</sub> H <sub>6</sub> O	94.11	Signal: Danger
Phenol, 4-methyl-	25.145	106-44-5	C <sub>7</sub> H <sub>8</sub> O	108.14	Signal: Danger
Triisopropylphosphate	35.017	513-02-0	C <sub>9</sub> H <sub>21</sub> O <sub>4</sub> P	224.23	Signal: Warning
Indole	40.948	120-72-9	C <sub>8</sub> H <sub>7</sub> N	117.15	Signal: Danger
2,4,7,9-Tetramethyl-5-decyn-4,7-diol	50.005	126-86-3	C <sub>14</sub> H <sub>26</sub> O <sub>2</sub>	226.36	Signal: Danger
2,6-Dimethylphenyl isocyanate	53.973	28556-81-2	C <sub>9</sub> H <sub>9</sub> NO	147.17	Signal: Danger
Methyl (4S,5R)-2,2,5-trimethyl-1,3-dioxolane-4-carboxylate	56.063	38410-80-9	C <sub>8</sub> H <sub>14</sub> O <sub>4</sub>	174.19	Signal: Warning
Tributyl phosphate	56.628	126-73-8	C <sub>12</sub> H <sub>27</sub> O <sub>4</sub> P	228.31	Signal: Warning
4-Oxo-4-(para-tolyl)-butyric acid	59.698	4619-20-9	C <sub>11</sub> H <sub>12</sub> O <sub>3</sub>	192.21	Signal: Danger
s-Trioxane, 2,4,6-triethyl-	68.275	2396-42-1	C <sub>9</sub> H <sub>18</sub> O <sub>3</sub>	174.24	Signal: Warning
Phthalic acid, monoethyl ester	76.093	2306-33-4	C <sub>10</sub> H <sub>10</sub> O <sub>4</sub>	194.18	Potential effect on thyroid gland activity in pregnant women
Propyphenazone	80.12	479-92-5	C <sub>14</sub> H <sub>18</sub> N <sub>2</sub> O	230.31	Signal: Warning
Phenol, 4,4'-(1-methylethylidene)bis-	90.153	80-05-7	C <sub>15</sub> H <sub>16</sub> O <sub>2</sub>	228.29	Signal: Danger
Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl-	131.478	995-82-4	C <sub>12</sub> H <sub>36</sub> O <sub>5</sub> Si <sub>6</sub>	428.92	/
<b>L<sub>2</sub></b>					
Dodecanoic acid, 3-hydroxy-	11.188	1883-13-2	C <sub>12</sub> H <sub>24</sub> O <sub>3</sub>	216.32	Signal: Warning
Trans-2-undecenoic acid	11.47	15790-94-0	C <sub>11</sub> H <sub>20</sub> O <sub>2</sub>	184.28	Signal: Warning
Nonanal	27.243	124-19-6	C <sub>9</sub> H <sub>18</sub> O	142.24	Signal: Warning
Undecanal	27.28	112-44-7	C <sub>11</sub> H <sub>22</sub> O	170.29	Signal: Warning
Pentadecanoic acid	27.33	1002-84-2	C <sub>15</sub> H <sub>30</sub> O <sub>2</sub>	242.40	Signal: Warning
2-Undecanone, 6,10-dimethyl-	55.363	1604-34-8	C <sub>13</sub> H <sub>26</sub> O	198.35	Signal: Warning
Octanoic acid, 7-oxo-	55.465	14112-98-2	C <sub>8</sub> H <sub>14</sub> O <sub>3</sub>	158.19	Signal: Warning
Benzenesulfonamide	57.803	98-10-2	C <sub>6</sub> H <sub>7</sub> NO <sub>2</sub> S	157.19	Signal: Warning
7-Hexadecenal, (Z)-	58.188	56797-40-1	C <sub>16</sub> H <sub>30</sub> O	238.41	/
Gabapentin	58.76	60142-96-3	C <sub>9</sub> H <sub>17</sub> NO <sub>2</sub>	171.24	Signal: Danger
1-Hexadecanol	59.648	36653-82-4	C <sub>16</sub> H <sub>34</sub> O	242.44	Signal: Warning
1,2-Epoxy-5,9-cyclododecadiene	64.145	943-93-1	C <sub>12</sub> H <sub>18</sub> O	178.27	Signal: Warning
Glycine, N-[(4-methylphenyl)sulfonyl]-	67.105	1080-44-0	C <sub>9</sub> H <sub>11</sub> NO <sub>4</sub> S	229.25	Signal: Warning
Cyclopentadecanone	67.213	502-72-7	C <sub>15</sub> H <sub>28</sub> O	224.38	Signal: Warning
Benzenesulfonamide, N-butyl-	70.905	3622-84-2	C <sub>10</sub> H <sub>15</sub> NO <sub>2</sub> S	213.30	Signal: Warning
Propyphenazone	80.083	479-92-5	C <sub>14</sub> H <sub>18</sub> N <sub>2</sub> O	230.31	Signal: Warning
Card-20(22)-enolide, 3,5,14,19-tetrahydroxy-, (3.beta.,5.beta.)-	85.58	560-54-3	C <sub>23</sub> H <sub>34</sub> O <sub>6</sub>	406.51	Signal: Danger
Di-n-octyl phthalate	106.145	117-84-0	C <sub>24</sub> H <sub>38</sub> O <sub>4</sub>	390.56	Signal: Danger
9-Octadecenamide	114.68	301-02-0	C <sub>18</sub> H <sub>35</sub> NO	281.48	Signal: Warning
Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl-	135.38	995-82-4	C <sub>12</sub> H <sub>36</sub> O <sub>5</sub> Si <sub>6</sub>	428.92	/

By performing organic analyses of leachate samples from landfill sites L<sub>1</sub> and L<sub>2</sub>, the presence of 39 substances was detected in the sample L<sub>1</sub> and 55 substances were detected in the sample L<sub>2</sub>. Table 4 shows detected xenobiotic organic compounds with GHS classification, namely the proven hazardous effects on the environment and human health. 7-Hexadecenal, (Z)- and Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl- were detected in both samples. One endocrine disruptor, Phenol, 4,4'-(1-methylethylidene)bis- (Bisphenol A), was detected in the sample L<sub>1</sub>. Identification of endocrine disruptor Bisphenol A, a compound

that is proven toxic to reproduction, is a very important basis for realisation of future research related to the treatment of landfill leachate.

*Keywords: Landfill leachate, Municipal solid waste landfill, Xenobiotic, Endocrine disruptors*

### **Acknowledgments**

This study has been financially supported by Ministry of Education, Science and Technological Development, Republic of Serbia (Projects III46009 and TR34014).

### **References**

Trueman, J.R. and Erber, L. 2013. Invasive species may offer advanced phytoremediation of endocrine disrupting chemicals in aquatic ecosystems. *Emirates Journal of Food and Agriculture*, 25 (9):648-656.