



2nd European Meeting on Environmental Chemistry

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2nd European Meeting on Environmental Chemistry

Cellier de l'Espace Grévin

December 12-15, 2001

Dijon, FRANCE

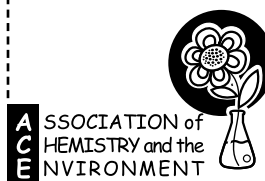
PROGRAM



INVITED SPEAKER:

Environmental biomonitoring by instrumental analysis and bioassays.

Prof. Dr. Antonius KETTRUP



ASSOCIATION of
CHEMISTRY and the
ENVIRONMENT

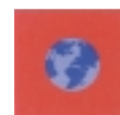
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cea Valduc



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WEDNESDAY AFTERNOON

17.00-21.00 WELCOME PARTY, POSTER SESSION, EXHIBITION

THURSDAY MORNING

08.30-09.00 OFFICIAL OPENING

- Eric LICHTFOUSE
Chairperson, European Association of Chemistry and the Environment (ACE)
- Francis ANDREUX
Vice-Director, Laboratory of Soil Microbiology and Soil-Water Geochemistry
- Gérard CATROUX
Director, Laboratory of Soil Microbiology and Soil-Water Geochemistry
- Bernard ITIER
Head, Department of Agronomy and Environment (INRA)
- Jean-Claude BERNIER
Director, Chemical Sciences, National Center of Scientific Research (CNRS)
- Christian FOUILLAC
Scientific Director, Bureau for the Sustainable Management of Natural Resources of the Surface and Subsurface Domains (BRGM)
- Pierre RADANNE
President, French Agency for Environment and Energy Management (ADEME)
- Bernard LAURIN
President, University of Burgundy
- François REBSAMEN
Mayor, Town of Dijon
- Louis de BROISSIA
Senator, General Council of Côte-d'Or
- Jean-Pierre SOISSON
President, Burgundy Region

09.00-10.30

Oral session 01. **AIR POLLUTION - ORGANIC POLLUTANTS**

Chair: Marie-Alexandrine SICRE, Roland KALLENBORN, Sonja LOJEN

- 09.00-09.15** Synthetic musks as new contaminant group in the Norwegian Environment.
Roland KALLENBORN, Robert GATERMANN, Torgeir NYGÅRD
- 09.15-09.30** Atmospheric pollution from oil shale combustion in Estonia.
Uuve KIRSO, Erik TEINEMAA, Michael R. STROMMEN, Richard M. KAMENS
- 09.30-09.45** Polycyclic aromatic hydrocarbons (PAHs) in French Alpine valleys.
Nicolas MARCHAND, Jean-Luc BESOMBES, Pierre MASCLET,
Jean-Luc JAFFREZO

- 09.45-10.00** The pyrolysis of catechol: characterisation of decomposition products and the formation of polycyclic aromatic hydrocarbons.
Elmer B. LEDESMA, Nathan D. MARSH, Alyssa K. SANDROWITZ, Mary J. WORNAT
- 10.00-10.15** General reactive transport model for inter-reacting multiple air pollutants in non-conservation system and its application to toluene chemistry in urban areas.
Koichi IINUMA, Yoshiyuki SATOH, Shunsuke UCHIDA
- 10.15-10.30** The influence of the Kostomuksha factory on the air pollution in Karelia and Finland.
Albert LEBEDEV, Natalia SINIKOVA, Svetlana NIKOLAEVA, Olga POLIAKOVA, Maria HRUCHSHEVA, Sergey POZDNYAKOV

10.30-11.00

COFFEE BREAK, POSTER SESSIONS, EXHIBITION

11.00-13.00

Oral session 02.

WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS

Chair: Georg M. GUEBITZ, Cyril FEIDT, Sylvie DOUSSET

- 11.00-11.15** Enzymatic treatment and recycling of textile effluents.
Georg M. GUEBITZ
- 11.15-11.30** Risk assessment of polycyclic aromatic hydrocarbons (PAHs) transfer from feed to milk.
Nathalie GROVA, Cyril FEIDT, Claire LAURENT, Pedro ARRONIZ-RIQUELEME, Guido RYCHEN
- 11.30-11.45** Control of halogenated by-products during surface water potabilisation.
Eric CHAUVEHEID
- 11.45-12.00** Several ways to treat industrial wastewaters containing aprotic solvents: example of the dimethylsulfoxide.
Patrick BALDONI-ANREY, Stephan PLISSON -SAUNE, Frederic PERIE
- 12.00-12.15** Quantification of in situ trichloroethene dilution versus biodegradation using a novel chloride concentration technique.
Claudia WALECKA-HUTCHISON, James L. WALWORTH
- 12.15-12.30** Disappearance of polycyclic aromatic hydrocarbons (PAHs) during anaerobic digestion of naturally contaminated sewage sludges.
E. TRABLY, N. DELGENES, D. PATUREAU, J. P. DELGENES
- 12.30-12.45** Transformation of carbendazim by UV/H₂O₂ in aqueous solution.
Patrick MAZELLIER, Emilie LEROY, Joseph DE LAAT, Bernard. LEGUBE
- 12.45-13.00** UV/H₂O₂ chemical oxidation for high loaded effluents: application to surfactants in water.
J. SANZ, J. I. LOMBRAÑA, R. RODRÍGUEZ

13.00-15.00

LUNCH, POSTER SESSIONS, EXHIBITION

THURSDAY AFTERNOON

15.00-17.00

Oral session 03. **SOIL POLLUTION - TOXIC METALS**

Chair: Achim ALBRECHT, Bernard FABRE, Philippe AMIOTTE-SUCHET

- 15.00-15.15** Electrodialytic remediation of different heavy metal polluted soils.
Lisbeth M. OTTOSEN, Arne VILLUMSEN, Anne J. PEDERSEN, Iben V. KRISTENSEN
- 15.15-15.30** Selection of microorganisms for their ability to bioremediation of agricultural soils contaminated by cadmium.
Didier BAGOT, Thierry LEBEAU, Karine JEZEQUEL, Bernard FABRE
- 15.30-15.45** Preferential transport of strongly sorbing contaminants in structured soils; field evidence and modeling.
Achim ALBRECHT, Tiziana CENTOFANTI, Anna FEHLMANN, Hannes FLÜHLER, Emmanuel FROSSARD, Jörg LEUENBERGER, Robin PENFIELD, Hannes WYDLER
- 15.45-16.00** New hydrometallurgical process for zinc and lead recovery from electric arc furnace dust.
Eric MEUX, Nathalie LECLERC
- 16.00-16.15** Microstructural study of accelerated carbonated soil from a former pyrotechnic plant in S.E. England.
Colin D HILLS, Kate WHITEHEAD, Cecilia L MACLEOD
- 16.15-16.30** Heavy metal mobilisation in soils covering ore mining dumps.
Jörg DILLING, Klaus KAISER, Ludwig HAMAIER, Wolfgang ZECH
- 16.30-16.45** Centrifuge measurement of copper and nickel solute transport in London Clay.
John D. MCKINLEY, Vasilis ANTONIADIS
- 16.45-17.00** Micro-total analytical systems (TAS) systems with electrogenerated chemiluminescence detection for environmental analysis.
Gillian M. GREENWAY, Paul A. GREENWOOD

17.00-17.30

ORANGE JUICE BREAK, POSTER SESSIONS, EXHIBITION

17.30-19.30

Oral session 04.

ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Chair: Philippe SCHMITT-KOPPLIN, Eric LICHTFOUSE

- 17.30-17.45** Manganese-catalysed degradation of phosphonic acids.
Bernd NOWACK, Alan T. STONE
- 17.45-18.00** On line spectrophotometric method for the monitoring of industrial wastewater discoloration processes.
Yves COQUE, Evelyne TOURAUD, Olivier THOMAS
- 18.00-18.15** Insights into the measurement of the octanol-water partition coefficient, K_{ow} , from detailed experiments.
Keith B. LODGE, David J. EDELBACH
- 18.15-18.30** Examinations on derivatisation and GC/CI/MS detection of selected synthetic and natural endocrine disrupters.
Oliver LERCH, Peter ZINN
- 18.30-18.45** Measuring free cupric concentrations with diffusion gradient in thin films (DGT): numerical estimation of the labile complexes contribution.
M.-H. TUSSEAU-VUILLEMIN, J.-L. ROULIER, P. LABADIE
- 18.45-19.00** Comparison of ion chromatography (ISO 14911) with inductively coupled plasma-optical emission spectrometry (ICP-OES, ISO 11885) and continuous flow analysis (CFA, ISO 11732).
Franz SCHMITZ
- 19.00-19.15** Pesticide residue analysis in foodstuffs; advantages of elevated resolution and exact mass capability.
Anthony NEWTON, John WILKINS
- 19.15-19.30** Bacteria-degraders based amperometric biosensors for detection of anionic surfactants.
Anatoly RESHETILOV, Ludmila TARANOVA, Nikolay KORJUK,
Vyacheslav BORISOV, Pavel ILIASOV

FRIDAY MORNING

08.15-08.50

INVITED LECTURE

Environmental biomonitoring by instrumental analysis and bioassays.

Prof. Dr. Antonius KETTRUP

Professor for Ecological Chemistry and Environmental Analysis,
Technical University of Munich, Germany.

08.50-09.00

Next ACE Meetings

- 2002 Geneva, Switzerland, Montserrat FILELLA

- 2003 Plymouth, United Kingdom, Mark FITZSIMONS

09.00-10.30

Oral session 05. **GREEN CHEMISTRY**

Chair: Michele ARESTA, Michel LACROIX, Didier ROBERT

09.00-09.15

Zero emission process for the catalytic transformation of dimethyldisulfide into methylmercaptan.

Michel LACROIX

09.15-09.30

Photocatalytic degradation of humic acids in aqueous solution with illuminated TiO₂.

Jarek WISZNIEWSKI, Didier ROBERT, Joanna SURMACZ-GORSKA,
Korneliusz MIKSCH, Jean-Victor WEBER

09.30-09.45

Use of solid catalysts in the reactions of transesterification and etherification of glycerol.

Sébastien BANCQUART, Céline VANHOVE, Jean-Marc CLACENS,
Yannick POUILLOUX, Joël BARRAULT

09.45-10.00

Carbon dioxide utilization for the synthesis of organic cyclic carbonates under homogeneous and heterogeneous conditions.

Angela DIBENEDETTO, Michele ARESTA

10.00-10.15

Solid base catalysts for the selective synthesis of phytosterols esters.

Yannick POUILLOUX, Gilles COURTOIS, Mickaël BOISSEAU,
Antoine PICIRILLI, Joël BARRAULT

10.15-11.00

COFFEE BREAK, POSTER SESSIONS, EXHIBITION

11.00-13.00**Oral session 06. ECOTOXICOLOGY**

Chair: Fabrice MARTIN, Matthias EBERIUS

- 11.00-11.15** Duckweed growth inhibition test - Using higher plants and image analysis for sensitive detection of contaminants in water and soil.
Matthias EBERIUS, Ilka REUTER, Guido MENNICKEN, Ingolf SCHUPHAN
- 11.15-11.30** RecA-lux fiber-optic biosensors to genotoxicants.
R. S. MARKS
- 11.30-11.45** Phytoplanktonic lipid oxidation products: novel bioindicators of organic matter's quality.
Daphné MARCHAND, Gérald GREGORI, Jean-Claude MARTY,
Juan Carlos MIQUEL, Jean-François RONTANI
- 11.45-12.00** Bacterial detection of the toxicity of dioxins, furans, and polychlorobiphenyls.
Jiho MIN, Man Bock GU, Chi Hoa PHAM, Yoon-Seok CHANG
- 12.00-12.15** Early embryonic cell cycle for risk assessment of pesticides.
Julie MARC, Odile MULNER-LORILLON, Gaël DURAND, Robert BELLÉ
- 12.15-12.30** Effect of pH on As(III) and As(V) toxicity on luminescent bacteria.
Elena FULLADOSA, Ana ENRIQUE, Jean Claude MURAT, M. MARTÍNEZ,
Isabel VILLAESCUSA
- 12.30-12.45** Effects of repeated applications of copper sulfate on the Rhizobium leguminosarum populations.
Sophie HACHAIR, Gisèle LAGUERRE, Rémi CHAUSSOD
- 12.45-13.00** The LUX-FLUORO test as a bioassay for shedding light on environmental pollutants.
Petra RETTBERG, Christa BAUMSTARK-KHAN, Elke RABBOW, Angela RODE,
Gerda HORNECK

13.00-15.00**LUNCH, POSTER SESSIONS, EXHIBITION**

FRIDAY AFTERNOON

15.00-17.00

Oral session 07.

STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

In the memory of Dr. Gareth RIELEY

Chair: Stephanie DUDD, Jan SCHWARZBAUER, Jean LEVEQUE

- 15.00-15.15** *Introduction to the European Young Researcher of the Year Award.*
Stephanie DUDD
- 15.15-15.30** $^{13}\text{C}/^{12}\text{C}$ ratios of individual low-molecular weight organic compounds in river water.
Jan SCHWARZBAUER, Larissa DSIKOWITZKY GIEREN, Kate FREEMAN,
Ralf LITKE
- 15.30-15.45** Assuming equal ^{13}C discrimination during decomposition for C_3 and C_4 residues significantly affects replacement calculations.
Renato ROSCOE, Peter BUURMAN
- 15.45-16.00** Isotope fractionation of organic contaminants, a perspective to characterise microbial in-situ degradation.
Andrea VIETH, Matthias KÄSTNER, Rainer U. MECKENSTOCK,
Hans H. RICHNOW
- 16.00-16.15** Cadmium isotopic fractionation in terrestrial materials.
Christophe INNOCENT
- 16.15-16.30** N, O, C and S isotopes as tracers of agricultural contamination in ground water.
Laura VITÓRIA, Albert SOLER, Ramón ARAVENA, Àngels CANALS
- 16.30-16.45** Use of stable isotopes to evaluate the origin and fate of chlorinated hydrocarbons in groundwater.
Daniel HUNKELER, Ramon ARAVENA
- 16.45-17.00** Historical reconstruction of metallic pollution using a geo-ombrogenic peat bog in Eduens Gallic territory (Bibracte, France).
Cédric BLANCHOT, Jean-Paul GUILLAUMET, Fabrice MONNA, Christophe PETIT,
Jean LEVEQUE, Isabelle JOUFFROY, Janusz DOMINIK

17.00-17.30

ORANGE JUICE BREAK, POSTER SESSIONS, EXHIBITION

17.30-19.30**Oral session 08. WATER POLLUTION - TOXIC METALS**

Chair: Montserrat FILELLA, Jean-Claude BOLLINGER

- 17.30-17.45** Arsenic removal from drinking water: adsorption onto pillared clays.
Véronique LENOBLE, Omar BOURAS, Véronique DELUCHAT, Bernard SERPAUD,
Jean-Claude BOLLINGER
- 17.45-18.00** Electrodialytic removal of Cu, Cr and As from treated waste wood.
Iben V. KRISTENSEN, Lisbeth. M. OTTOSEN, Alexandra RIBEIRO,
Arne VILUMSEN
- 18.00-18.15** Photocatalytic degradation of sulfonylureas in TiO₂ aqueous suspension.
Emmanuelle VULLIET, Corinne EMMELIN, Jean-Marc CHOVELON,
Jean-Marie HERRMANN, Chantal GUILLARD
- 18.15-18.30** Influence of road deposited sediment on trace element concentrations in suspended
particulate matter in streams of an urban subtropical watershed, Honolulu, Hawaii.
Eric HEINEN DeCARLO, Vincent L. BELTRAN, Michael S. TOMLINSON
- 18.30-18.45** Bromate study in three water treatment plants.
S. BOULAND, J.-P. DUGUET, A. MONTIEL
- 18.45-19.00** Silver solubility resulting from acanthite (Ag₂S) dissolution in dilute KNO₃ is
reduced by model sulfides and humic acid.
Astrid R. JACOBSON, Carmen E. MARTINEZ, Matteo SPAGNUOLO,
Murray B. MCBRIDE, Philippe BAVEYE
- 19.00-19.15** Recycling of waste iron sulfate via synthesis of potassium ferrate.
Ndue KANARI, Omer EVRARD, Nathalie NEVEUX, Léon NINANE
- 19.15-19.30** Trace element signatures of suspended matter from six major rivers in
southwest France.
Jörg SCHÄFER, Gérard BLANC, Gilbert LAVAUX, Cécile BOSSY

20.00-23.00**CONFERENCE DINER**

Cellier Sainte-Bénigne, Hostellerie du Chapeau Rouge

SATURDAY MORNING

08.30-10.30

Oral session 09.

ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Chair: Philippe SCHMITT-KOPPLIN, Francis ANDREUX

- 08.30-08.45** Capillary electrophoresis - electrospray ionization / mass spectrometry of natural organic matter (NOM): a challenge in analytical chemistry.
Philippe SCHMITT-KOPPLIN, Jens JUNKERS, Mike PERDUE, Norbert HERTKORN, Antonius KETTRUP
- 08.45-09.00** Metalloid speciation for environmental biomonitoring: analytical challenges and new approaches.
Hendrik EMONS
- 09.00-09.15** Assessment of composts maturity by spectroscopic and thermal analyses.
Maria Rosaria PROVENZANO, Sandra Cristina de OLIVEIRA, Nicola SENESI
- 09.15-09.30** Detecting endocrine disrupting compounds by fast impedance measurements.
Vered GRANEK, Judith RISHPON
- 09.30-09.45** Environmental data management: case studies in USA and Europe.
Michael BROSSE
- 09.45-10.00** A novel technique for optical diagnostics of air pollutants by microwave breakdown spectroscopy.
Koichi IINUMA, Hiroshi SUTO, Shunsuke UCHIDA, Ken TAKAYAMA
- 10.00-10.15** Biodegradation of 2-substituted benzothiazoles by two strains of *Rhodococcus* : study by nuclear magnetic resonance (¹H-NMR).
Nicolas HAROUNE, Pascale BESSE, Bruno COMBOURIEU, Martine SANCELME, Anne-Marie DELORT
- 10.15-10.30** Multi-component gas analysis with novel infrared detectors.
Angela J. GRIFFIN, Gillian M. GREENWAY, Anthony D. WALMSLEY, Stephanie HAYWOOD

10.30-11.00

COFFEE BREAK, POSTER SESSIONS, EXHIBITION

11.00-13.00**Oral session 10. SOIL POLLUTION - ORGANIC POLLUTANTS**

Chair: Christian MOUGIN, Mark FITZSIMONS, Guido RYCHEN

- 11.00-11.15** Micro-organic contaminant fluxes in simulated sediment-water columns.
Nicky WARREN, Ian J. ALLAN, Joy E. CARTER, W. Alan HOUSE, Andrew PARKER
- 11.15-11.30** Investigations of the use ethylene oxide-propylene oxide block copolymeric surfactants for the removal of coal tars from manufactured gas works' soils.
Jingfeng DONG, Stephen LEHARNE
- 11.30-11.45** Solid state technology for the reductive elimination of polychlorobiphenyls (PCBs) from contaminated soils.
Michele ARESTA, Tiziano PASTORE
- 11.45-12.00** Physico-chemical behaviour of anionic surfactants in coal tar contaminated soil systems.
K. HAGENHOFF, S. REID, J. DONG, S. A. LEHARNE
- 12.00-12.15** Biotransformation of nonylphenol surfactants in soils amended with contaminated sewage sludges.
Christian MOUGIN, Jacqueline DUBROCA, Agathe BRAULT, Albert KOLLMANN, Claude JOLIVALT, Véronique CHAPLAIN
- 12.15-12.30** Use of Fenton's reagent to degrade polycyclic aromatic hydrocarbons in sludge samples.
Vanina FLOTRON, Ikram MRANI ALAOUI, Alain BERMOND, Valérie CAMEL
- 12.30-12.45** Degradation of phenylurea pesticides under oxidative conditions: influence of the structural factors.
Sylvie NÉLIEU, Laure Amir TAHMASSEB, Jacques EINHORN
- 12.45-13.00** Pesticide residue analysis of fruit and animal extracts using liquid chromatography-orthogonal acceleration time of flight mass spectrometry (LC-oaTOFMS).
Ashley B. SAGE, Michael TAYLOR

13.00-13.15**2nd ACE ENVIRONMENTAL CHEMISTRY AWARD**

13.15-13.30**CLOSURE OF THE MEETING**

POSTER SESSIONS

Poster session 01. **AIR POLLUTION - TOXIC METALS**

- 001** Speciation of trace and major elements in coal ash of "Nikola Tesla" power plants (Obrenovac, Yugoslavia).
Aleksandar POPOVIC, Dragana DJORDJEVIC, Branimir JOVANCICEVIC, Predrag POLIC
- 002** Influence of acidity of extractant on leaching of trace and major elements from coal ash "Kosovo A" power plant in Obilic (Yugoslavia).
Aleksandar POPOVIC, Dragana DJORDJEVIC, Branimir JOVANCICEVIC, Predrag POLIC
- 003** A clean and cost effective approach for electric arc furnaces dust treatment.
Devabrata MISHRA, Ndue KANARI, Ibrahim GABALLAH, Rodolfo SOLOZABAL, Alberto UGARTE
- 004** Tree rings microanalysis by energy dispersive X-ray spectroscopy: towards an historical reconstruction of pollution impact on chemical composition of wood.
Christophe ROSE, Jean-Luc DUPOUEY, Nathalie NINGRE, Marianne PEIFFER, Jean-Pierre GARREC
- 005** Electrodialytic removal of heavy metals from municipal solid waste incineration (MSWI) fly ash.
Anne Juul PEDERSEN, Lisbeth M. OTTOSEN, Arne VILLUMSEN

Poster session 02. **AIR POLLUTION - ORGANIC POLLUTANTS**

- 006** Decontamination of fly ash via the dechlorination/degradation of dioxins in subcritical water.
I. WINDAL, S. HAWTHORNE, E. DE PAUW
- 007** Seasonal variation of organic aerosol in urban Algiers and waste landfill of Algiers city area.
Nouredine YASSAA, Brahim Youcef MEKLATI, Angelo CECINATO
- 008** Photodegradation of pyrene on solid phase.
Aurore BOSCHER, Bernard DAVID, Sylvie GUITTONNEAU.
- 009** Incorporation and destocking of dioxin in isolated adipocytes of pigs during the lipogenesis and of the lipolysis.
P. IRIGARAY, C. FEIDT, G. RYCHEN, F. LAURENT, L. MÉJEAN
- 010** Lipophilicity and hydrogen-bond basicity of nicotine.
Jérôme GRATON, Christian LAURENCE, Michel BERTHELOT
- 011** Exposure to pesticides during amateur applications of home and garden products.
Paul HARRINGTON, James MATHERS, Rachel LEWIS, Sonia PEREZ DURAN, Richard GLASS
- 012** Heavy polycyclic aromatic hydrocarbons (PAHs) in the environment of Czech Republic.
Josef CASLAVSKY, Pavla KOTLARIKOVA
- 013** Towards biological or physico-chemical screening for dioxins?
G. EPPE, Jean-François FOCANT, Edwin DE PAUW
- 014** Prevention of dioxins de novo formation on sintering process fly ash by using amines compounds.
Céline XHROUET, Caroline NADIN, Edwin DE PAUW
- 015** Organic petrology in service of environment.
Bertrand LIGOUIS, Sybille KLEINEIDAM, Rita KIEM, Peter GRATHWOHL, Claudia NIEMZ
- 016** Milk-arterial plasma transfer of dioxins (PCDDs) and furans (PCDFs) in the growing pig (A).
Claire LAURENT, Guido RYCHEN, Cyril FEIDT, Nathalie GROVA, Paul-Eric LAFARGUE, François LAURENT

- 017** Behaviour of three ^{14}C -radiolabelled polycyclic aromatic compounds in the presence of an inoculum of mixed rumen bacteria.
M. SALES-DUVAL, G. BLANCHART, C. FEIDT
- 018** In vitro study of organic micropollutants through intestinal barrier.
S  verine CAVRET, Cyril FEIDT, Guido RYCHEN, Fran  ois LAURENT
-

Poster session 03. **WATER POLLUTION - TOXIC METALS**

- 019** Elimination of heavy metals in wastewater sludge by incineration in a fluidised bed reactor.
Seltana BOUNIT, Mohamed EL MERAY, Ahmed CHEHBOUNI, Daniel STEINMETZ, Mehrdji HEMATI
- 020** Removal of heavy metals in water by use of roasted coffee beans.
Mayumi MINAMISAWA, Sugiko NAKAJIMA, Hiroaki MINAMISAWA, Shoichro YOSHIDA, Nobuharu TAKAI
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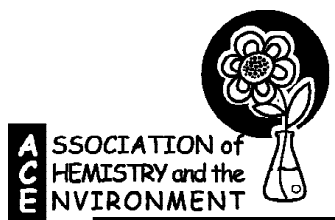
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**POLLUTION OF AIR, WATER, FOOD, SOIL AND SEDIMENTS.
GREEN CHEMISTRY, ECOTOXICOLOGY, STABLE ISOTOPES,
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119	04. WATER POLLUTION - ORGANIC POLLUTANTS
148	05. SOIL POLLUTION - TOXIC METALS
166	06. SOIL POLLUTION - ORGANIC POLLUTANTS
173	07. SEDIMENT POLLUTION
180	08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE
192	09. GREEN CHEMISTRY
199	10. ECOTOXICOLOGY
221	11. ANALYTICAL METHODS - ORGANIC POLLUTANTS
240	12. ANALYTICAL METHODS - TOXIC METALS

INVITED LECTURE

- 14 Environmental biomonitoring by instrumental analysis and bioassays.
A. A. KETTRUP

ORAL SESSION 01 - AIR POLLUTION - ORGANIC POLLUTANTS

- 16 Synthetic musks as new contaminant group in the Norwegian Environment.
Roland KALLENBORN, Robert GATERMANN, Torgeir NYGÅRD
- 17 Atmospheric pollution from oil shale combustion in Estonia.
Uuve KIRSO, Erik TEINEMAA, Michael R. STROMMEN, Richard M. KAMENS
- 18 Polycyclic aromatic hydrocarbons (PAHs) in French Alpine valleys.
Nicolas MARCHAND, Jean-Luc BESOMBES, Pierre MASCLET, Jean-Luc JAFFREZO
- 19 The pyrolysis of catechol: characterisation of decomposition products and the formation of polycyclic aromatic hydrocarbons.
Elmer B. LEDESMA, Nathan D. MARSH, Alyssa K. SANDROWITZ, Mary J. WORNAT
- 20 General reactive transport model for inter-reacting multiple air pollutants in non-conservation system and its application to toluene chemistry in urban areas.
Koichi IINUMA, Yoshiyuki SATOH, Shunsuke UCHIDA
- 21 The influence of the Kostomuksha factory on the air pollution in Karelia and Finland.
Albert LEBEDEV, Natalia SINIKOVA, Svetlana NIKOLAEVA, Olga POLIAKOVA, Maria HRUCHSHEVA, Sergey POZDNYAKOV

ORAL SESSION 02 - WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS

- 22 Enzymatic treatment and recycling of textile effluents.
Georg M. GUEBITZ
- 23 Risk assessment of polycyclic aromatic hydrocarbons (PAHs) transfer from feed to milk.
Nathalie GROVA, Cyril FEIDT, Claire LAURENT, Pedro ARRONIZ-RIQUELEME, Guido RYCHEN
- 24 Control of halogenated by-products during surface water potabilisation.
Eric CHAUVEHEID
- 25 Several ways to treat industrial wastewaters containing aprotic solvents: example of the dimethylsulfoxide.
Patrick BALDONI-ANREY, Stephan PLISSON -SAUNE, Frederic PERIE
- 26 Quantification of in situ trichloroethene dilution versus biodegradation using a novel chloride concentration technique.
Claudia WALECKA-HUTCHISON, James L. WALWORTH
- 27 Disappearance of polycyclic aromatic hydrocarbons (PAHs) during anaerobic digestion of naturally contaminated sewage sludges.
E. TRABLY, N. DELGENES, D. PATUREAU, J. P. DELGENES
- 28 Transformation of carbendazim by UV/H₂O₂ in aqueous solution.
Patrick MAZELLIER, Emilie LEROY, Joseph DE LAAT, Bernard. LEGUBE
- 29 UV/H₂O₂ chemical oxidation for high loaded effluents: application to surfactants in water. Kinetics of decomposition.
J. SANZ, J. I. LOMBRANA, R. RODRIGUEZ

ORAL SESSION 03 - SOIL POLLUTION - TOXIC METALS

- 30 Electrodialytic remediation of different heavy metal polluted soils.
Lisbeth M. OTTOSEN, Arne VILLUMSEN, Anne J. PEDERSEN, Iben V. KRISTENSEN
- 31 Selection of microorganisms for their ability to bioremediation of agricultural soils contaminated by cadmium.
Didier BAGOT, Thierry LEBEAU, Karine JEZEQUEL, Bernard FABRE
- 32 Preferential transport of strongly sorbing contaminants in structured soils; field evidence and modeling.
Achim ALBRECHT, Tiziana CENTOFANTI, Anna FEHLMANN, Hannes FLÜHLER, Emmanuel FROSSARD, Jörg LEUENBERGER, Robin PENFIELD, Hannes WYDLER
- 33 New hydrometallurgical process for zinc and lead recovery from electric arc furnace dust.
Eric MEUX, Nathalie LECLERC
- 34 Microstructural study of accelerated carbonated soil from a former pyrotechnic plant in S.E. England.
Colin D HILLS, Kate WHITEHEAD, Cecilia L MACLEOD
- 35 Heavy metal mobilisation in soils covering ore mining dumps.
Jörg DILLING, Klaus KAISER, Ludwig HAMAIER, Wolfgang ZECH
- 36 Centrifuge measurement of copper and nickel solute transport in London Clay.
John D. MCKINLEY, Vasilis ANTONIADIS
- 37 Micro-total analytical systems (TAS) systems with electrogenerated chemiluminescence detection for environmental analysis.
Gillian M. GREENWAY, Paul A. GREENWOOD

ORAL SESSION 04 - ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

- 38 Manganese-catalysed degradation of phosphonic acids.
Bernd NOWACK, Alan T. STONE
- 39 On line spectrophotometric method for the monitoring of industrial wastewater discoloration processes.
Yves COQUE, Evelyne TOURAUD, Olivier THOMAS
- 40 Insights into the measurement of the octanol-water partition coefficient, Kow, from detailed experiments.
Keith B. LODGE, David J. EDELBACH
- 41 Examinations on derivatisation and GC/CI/MS detection of selected synthetic and natural endocrine disrupters.
Oliver LERCH, Peter ZINN
- 42 Measuring free cupric concentrations with diffusion gradient in thin films (DGT): numerical estimation of the labile complexes contribution.
M.-H. TUSSEAU-VUILLEMIN, J.-L. ROULIER, P. LABADIE
- 43 Comparison of ion chromatography (ISO 14911) with inductively coupled plasma-optical emission spectrometry (ICP OES, ISO 11885) and continuous flow analysis (CFA, ISO 11732).
Franz SCHMITZ
- 44 Pesticide residue analysis in foodstuffs; advantages of elevated resolution and exact mass capability.
Anthony NEWTON, John WILKINS
- 45 Bacteria-degraders based amperometric biosensors for detection of anionic surfactants.
Anatoly RESHETILOV, Ludmila TARANOVA, Nikolay KORJUK, Vyacheslav BORISOV, Pavel ILIASOV

ORAL SESSION 05 - GREEN CHEMISTRY

- 46 Zero emission process for the catalytic transformation of dimethyldisulfide into methylmercaptan.
Michel LACROIX
- 47 Photocatalytic degradation of humic acids in aqueous solution with illuminated TiO₂.
Jarek WISZNIEWSKI, Didier ROBERT, Joanna SURMACZ-GORSKA, Korneliusz MIKSCHE, Jean-Victor WEBER
- 48 Use of solid catalysts in the reactions of transesterification and etherification of glycerol.
Sébastien BANCQUART, Céline VANHOVE, Jean-Marc CLACENS, Yannick POUILLOUX, Joël BARRAULT.
- 49 Carbon dioxide utilization for the synthesis of organic cyclic carbonates under homogeneous and heterogeneous conditions.
Angela DIBENEDETTO, Michele ARESTA
- 50 Solid base catalysts for the selective synthesis of phytosterols esters.
Yannick POUILLOUX, Gilles COURTOIS, Mickaël BOISSEAU, Antoine PICIRILLI, Joël BARRAULT

ORAL SESSION 06 - ECOTOXICOLOGY

- 51 Duckweed growth inhibition test - Using higher plants and image analysis for sensitive detection of contaminants in water and soil.
Matthias EBERIUS, Ilka REUTER, Guido MENNICKEN, Ingolf SCHUPHAN
- 52 RecA-lux fiber-optic biosensors to genotoxins.
R. S. MARKS
- 53 Phytoplanktonic lipid oxidation products: novel bioindicators of organic matter's quality.
Daphné MARCHAND, Gérald GREGORI, Jean-Claude MARTY, Juan Carlos MIQUEL, Jean-François RONTANI
- 54 Bacterial detection of the toxicity of dioxins (PCDDs), furans (PCDFs), and polychlorobiphenyls (PCBs).
Jiho MIN, Man Bock GU, Chi Hoa PHAM, Yoon-Seok CHANG
- 55 Early embryonic cell cycle for risk assessment of pesticides.
Julie MARC, Odile MULNER-LORILLON, Gaël DURAND, Robert BELLÉ
- 56 Effect of pH on As(III) and As(V) toxicity on luminescent bacteria.
Elena FULLADOSA, Ana ENRIQUE, Jean Claude MURAT, M. MARTÍNEZ, Isabel VILLAESCUSA
- 57 Effects of repeated applications of copper sulfate on the *Rhizobium leguminosarum* populations.
Sophie HACHAIR, Gisèle LAGUERRE, Rémi CHAUSSOD
- 58 The LUX-FLUORO test as a bioassay for shedding light on environmental pollutants.
Petra RETTBERG, Christa BAUMSTARK-KHAN, Elke RABBOW, Angela RODE, Gerda HORNECK

ORAL SESSION 07 - STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE*In the memory of Dr. Gareth RIELEY*

- 59 $^{13}\text{C}/^{12}\text{C}$ ratios of individual low-molecular weight organic compounds in river water.
Jan SCHWARZBAUER, Larissa DSIKOWITZKY GIEREN, Kate FREEMAN, Ralf LITTKKE
- 60 Assuming equal ^{13}C discrimination during decomposition for C_3 and C_4 residues significantly affects replacement calculations.
Renato ROSCOE, Peter BUURMAN
- 61 Tracing atmosphere - biosphere sulphur exchange: S and O isotope ratios in spruce needles.
Mariusz Orion JEDRYSEK, Adam KALUZNY, Jochen HOEFS
- 62 Isotope fractionation of organic contaminants, a perspective to characterise microbial in-situ degradation.
Andrea VIETH, Matthias KÄSTNER, Rainer U. MECKENSTOCK, Hans H. RICHNOW
- 63 Cadmium isotopic fractionation in terrestrial materials.
Christophe INNOCENT
- 64 N, O, C and S isotopes as tracers of agricultural contamination in ground water.
Laura VITÒRIA, Albert SOLER, Ramón ARAVENA, Àngels CANALS
- 65 Use of stable isotopes to evaluate the origin and fate of chlorinated hydrocarbons in groundwater.
Daniel HUNKELER, Ramon ARAVENA
- 66 Historical reconstruction of metallic pollution using a geo-ombrogenic peat bog in Eduens Gallic territory.
Cédric BLANCHOT, Jean-Paul GUILLAUMET, Fabrice MONNA, Christophe PETIT, Jean LEVEQUE, Isabelle JOUFFROY, Janusz DOMINIK

ORAL SESSION 08 - WATER POLLUTION - TOXIC METALS

- 67 Arsenic removal from drinking water: adsorption onto pillared clays.
Véronique LENOBLE, Omar BOURAS, Véronique DELUCHAT, Bernard SERPAUD, Jean-Claude BOLLINGER
- 68 Electrodialytic removal of Cu, Cr and As from treated waste wood.
Iben V. KRISTENSEN, Lisbeth. M. OTTOSEN, Alexandra RIBEIRO, Arne VILUMSEN
- 69 Photocatalytic degradation of sulfonylureas in TiO_2 aqueous suspension.
Emmanuelle VULLIET, Corinne EMMELIN, Jean-Marc CHOVELON, Jean-Marie HERRMANN, Chantal GUILLARD
- 70 Influence of road deposited sediment on trace element concentrations in suspended particulate matter in streams of an urban subtropical watershed, Honolulu, Hawaii.
Eric HEINEN DeCARLO, Vincent L. BELTRAN, Michael S. TOMLINSON
- 71 Bromate study in three water treatment plants.
S. BOULAND, J.-P. DUGUET, A. MONTIEL
- 72 Silver solubility resulting from acanthite (Ag_2S) dissolution in dilute KNO_3 is reduced by model sulfides and humic acid.
Astrid R. JACOBSON, Carmen E. MARTINEZ, Matteo SPAGNUOLO, Murray B. MCBRIDE, Philippe BAVEYE
- 73 Recycling of waste iron sulfate via synthesis of potassium ferrate.
Ndue KANARI, Omer EVRARD, Nathalie NEVEUX, Léon NINANE
- 74 Trace element signatures of suspended matter from six major rivers in southwest France.
Jörg SCHÄFER, Gérard BLANC, Gilbert LAVAUX, Cécile BOSSY

ORAL SESSION 09 - ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

- 75 Capillary electrophoresis - electrospray ionization / mass spectrometry of natural organic matter (NOM): a challenge in analytical chemistry.
Philippe SCHMITT-KOPPLIN, Jens JUNKERS, Mike PERDUE, Norbert HERTKORN, Antonius KETTRUP
- 76 Metalloid speciation for environmental biomonitoring: analytical challenges and new approaches.
Hendrik EMONS
- 77 Assessment of composts maturity by spectroscopic and thermal analyses.
Maria Rosaria PROVENZANO, Sandra Cristina de OLIVEIRA, Nicola SENESI
- 78 Detecting endocrine disrupting compounds by fast impedance measurements.
Vered GRANEK, Judith RISHPON
- 79 Environmental data management: case studies in USA and Europe.
Michael BROSE
- 80 A novel technique for optical diagnostics of air pollutants by microwave breakdown spectroscopy.
Koichi IINUMA, Hiroshi SUTO, Shunsuke UCHIDA, Ken TAKAYAMA
- 81 Biodegradation of 2-substituted benzothiazoles by two strains of *Rhodococcus* : study by nuclear magnetic resonance ($^1\text{H-NMR}$).
Nicolas HAROUNE, Pascale BESSE, Bruno COMBOURIEU, Martine SANCELME, Anne-Marie DELORT
- 82 Multi-component gas analysis with novel infrared detectors.
Angela J. GRIFFIN, Gillian M. GREENWAY, Anthony D. WALMSLEY, Stephanie HAYWOOD

ORAL SESSION 10 - SOIL POLLUTION - ORGANIC POLLUTANTS

- 83 Micro-organic contaminant fluxes in simulated sediment-water columns.
Nicky WARREN, Ian J. ALLAN, Joy E. CARTER, W. Alan HOUSE, Andrew PARKER
- 84 Investigations of the use ethylene oxide-propylene oxide block copolymeric surfactants for the removal of coal tars from manufactured gas works' soils.
Jingfeng DONG, Stephen LEHARNE
- 85 Solid state technology for the reductive elimination of polychlorobiphenyls (PCBs) from contaminated soils.
Michele ARESTA, Tiziano PASTORE
- 86 Physico-chemical behaviour of anionic surfactants in coal tar contaminated soil systems.
K. HAGENHOFF, S. REID, J. DONG, S. A. LEHARNE
- 87 Biotransformation of nonylphenol surfactants in soils amended with contaminated sewage sludges.
Christian MOUGIN, Jacqueline DUBROCA, Agathe BRAULT, Albert KOLLMANN, Claude JOLIVALT, Véronique CHAPLAIN
- 88 Use of Fenton's reagent to degrade polycyclic aromatic hydrocarbons in sludge samples.
Vanina FLOTRON, Ikram MRANI ALAOUI, Alain BERMOND, Valérie CAMEL
- 89 Degradation of phenylurea pesticides under oxidative conditions: influence of the structural factors.
Sylvie NÉLIEU, Laure Amir TAHMASSEB, Jacques EINHORN
- 90 Pesticide residue analysis of fruit and animal extracts using liquid chromatography-orthogonal acceleration time of flight mass spectrometry (LC-*oa*TOFMS).
Ashley B. SAGE, Michael TAYLOR

POSTER SESSION 01 - AIR POLLUTION - TOXIC METALS

- 91 Speciation of trace and major elements in coal ash of "Nikola Tesla" power plants (Obrenovac, Yugoslavia).
Aleksandar POPOVIC, Dragana DJORDJEVIC, Branimir JOVANCICEVIC, Predrag POLIC
- 92 Influence of acidity of extractant on leaching of trace and major elements from coal ash "Kosovo A" power plant in Obilic (Yugoslavia).
Aleksandar POPOVIC, Dragana DJORDJEVIC, Branimir JOVANCICEVIC, Predrag POLIC
- 93 A clean and cost effective approach for electric arc furnaces dust treatment.
Devabrata MISHRA, Ndue KANARI, Ibrahim GABALLAH, Rodolfo SOLOZABAL, Alberto UGARTE
- 94 Tree rings microanalysis by energy dispersive X-ray spectroscopy: towards an historical reconstruction of pollution impact on chemical composition of wood.
Christophe ROSE, Jean-Luc DUPOUEY, Nathalie NINGRE, Marianne PEIFFER, Jean-Pierre GARREC
- 95 Electrodialytic removal of heavy metals from municipal solid waste incineration (MSWI) fly ash.
Anne Juul PEDERSEN, Lisbeth M. OTTOSEN, Arne VILLUMSEN

POSTER SESSION 02 - AIR POLLUTION - ORGANIC POLLUTANTS

- 96 Decontamination of fly ash via the dechlorination/degradation of dioxins in subcritical water.
I. WINDAL, S. HAWTHORNE, E. DE PAUW
- 97 Seasonal variation of organic aerosol in urban Algiers and waste landfill of Algiers city area.
Noureddine YASSAA, Brahim Youcef MEKLATI, Angelo CECINATO
- 98 Photodegradation of pyrene on solid phase.
Aurore BOSCHER, Bernard DAVID, Sylvie GUITTONNEAU
- 99 Incorporation and destocking of dioxin in isolated adipocytes of pigs during the lipogenesis and of the lipolysis.
P. IRIGARAY, C. FEIDT, G. RYCHEN, F. LAURENT, L. MÉJEAN
- 100 Lipophilicity and hydrogen-bond basicity of nicotine.
Jérôme GRATON, Christian LAURENCE, Michel BERTHELOT
- 101 Exposure to pesticides during amateur applications of home and garden products.
Paul HARRINGTON, James MATHERS, Rachel LEWIS, Sonia PEREZ DURAN, Richard GLASS
- 102 Heavy polycyclic aromatic hydrocarbons (PAHs) in the environment of Czech Republic.
Josef CASLAVSKY, Pavla KOTLARIKOVA
- 103 Towards biological or physico-chemical screening for dioxins?
G. EPPE, Jean-François FOCANT, Edwin DE PAUW
- 104 Prevention of dioxins de novo formation on sintering process fly ash by using amines compounds.
Céline XHROUET, Caroline NADIN, Edwin DE PAUW
- 105 Organic petrology in service of environment.
Bertrand LIGOUIS, Sybille KLEINEIDAM, Rita KIEM, Peter GRATHWOHL, Claudia NIEMZ
- 106 Milk-arterial plasma transfer of dioxins (PCDDs) and furans (PCDFs) in the growing pig (A).
Claire LAURENT, Guido RYCHEN, Cyril FEIDT, Nathalie GROVA, Paul-Eric LAFARGUE, François LAURENT

- 107 Behaviour of three ^{14}C -radiolabelled polycyclic aromatic compounds in the presence of an inoculum of mixed rumen bacteria.
M. SALES-DUVAL, G. BLANCHART, C. FEIDT
- 108 In vitro study of organic micropollutants through intestinal barrier.
S  verine CAVRET, Cyril FEIDT, Guido RYCHEN, Fran  ois LAURENT

POSTER SESSION 03 - WATER POLLUTION - TOXIC METALS

- 109 Elimination of heavy metals in wastewater sludge by incineration in a fluidised bed reactor.
Seltana BOUNIT, Mohamed EL MERAY, Ahmed CHEHBOUNI, Daniel STEINMETZ, Mehdi HEMATI
- 110 Removal of heavy metals in water by use of roasted coffee beans.
Mayumi MINAMISAWA, Sugiko NAKAJIMA, Hiroaki MINAMISAWA, Shoichiro YOSHIDA, Nobuharu TAKAI
- 111 Copper fate and mobility in the water column and the surface sediment of a polymictic lake following copper sulfate treatment (Courtille Lake, France).
Eric Van HULLEBUSCH, Fran  ck AUVRAY, Fran  ois BORDAS, V  ronique DELUCHAT, Philippe CHAZAL, Michel BAUDU
- 112 Heterogeneity and lability aspects of nickel interactions with natural organic matter.
Montserrat FILELLA, Raewyn M. TOWN
- 113 A study on lead removal from battery manufacturing wastewater using modified cyclodextrins comparatively with barium carbonate.
Andr  e GADELLE, Jean Claude DEBOUZY, Florence FAUVELLE, Bernard MARTEL
- 114 Metal uptake from aqueous solution by olive pits wastes.
N  ria Fiol, Jordi POCH, Joan SERAROLS, N  ria MIRALLES, Mar  a MART  NEZ, Isabel VILLAESCUA
- 115 Covalent surface confinement of silver thiolato complexes. Pollutant metal uptake application.
Marie-Jo  lle MENU, Y. DARTIGUENAVE, M. DARTIGUENAVE, Letitia M. GRUIA, A. L. BEAUCHAMP
- 116 Environmental chemical study on the marsh of Fatimid cemetery at Aswan city, Egypt.
M. E. SOLTAN
- 117 Mercurial waste waters treatment using an immobilisation process.
Jos   Maria MONTEAGUDO, Jesus FRADES, Miguel Angel ALONSO, Luis RODRIGUEZ, Roland SCHAWB, Pablo HIGUERAS
- 118 Computer model (MAM-PEC) to predict environmental concentrations of antifoulants.
Bert VAN HATTUM, Arthur BAART

POSTER SESSION 04 - WATER POLLUTION - ORGANIC POLLUTANTS

- 119 Depollution of olive mill wastewaters by catalytic hydrogenation. Kinetics of the degradation of a model molecule: tyrosol.
Dominique RICHARD, Maria de Lourdes DELGADO-NUNEZ
- 120 Trihalomethane formation in ozonated and chlorinated surface water.
Unai IRIARTE, Jon I  aki   LVAREZ-URIARTE, Rub  n L  PEZ-FONSECA, Juan Ram  n GONZ  LEZ-VELASCO
- 121 Decomposition of orange II dye by reduction and oxidation pathways with zero-valent iron.
Gilles ROY, Jerzy A. MIELCZARSKI
- 122 Optimised management of granular activated carbon filtration step for atrazine and its by-products removal in a drinking water plant.
Pascal ROCHE, Christelle de TRAVERSAY, H. BUISSON
- 123 Aerobic azo-dye degradation in dyehouse effluents with newly isolated Bacillus sp.
Juergen MAIER, Andreas PAAR, Georg M. GUEBITZ
- 124 Quantification of the polycyclic aromatic hydrocarbons (PAHs) bioavailable fraction in aquatic environments using semi permeable membrane device (SPMD).
C  cile MI  GE, Corinne NESA, Bernard MIGEON, Rapha  l MONS, Jeanne GARRIC
- 125 Expert system of water treatment management.
Ludmila FROLOVA
- 126 Photochemical degradations of biorecalcitrant ethers: ethyl tert-butyl ether (ETBE), methyl tert-butyl ether (MTBE) and tert-amyl methyl ether (TAME).
Virginie LE MIGNOT, Meriem BEKRI, Mourad KAROUNE, Andr   PAUSS
- 127 Natural organic matter from surface water (Algeria) extraction-characterisation-coagulation.
A. AOUABED, S. BOUGUERRA, R. BEN A  M, D. E. HADJ BOUSSAAD
- 128 Use of organophilic pillared clays for the adsorption of diuron and its degradation products
Omar BOURAS, Jean-Claude BOLLINGER, Michel BAUDU, Hussein KHALAF
- 129 Catalytic wet peroxide oxidation of phenol on iron based catalysts.
J. M. TATIBOU  T, E. GUELOU, A. MAJEST  -LABOURDENNE, J. BARRAULT, J. FOURNIER
- 130 Evaluating surfactant modified pillared clays for organic pollutants control.
Hussein KHALAF, Mohamed HOUARI, Omar BOURAS

- 131 Competitive photodegradation of benzamide and parahydroxybenzoic acid mixture in TiO_2 aqueous solution.
Antoine PISCOPO, Didier ROBERT, Jean Victor WEBER
- 132 Compared growth of ethyl tert-butyl ether-degrading bacterial consortia in gas and liquid lab-scale fixed bed reactors.
Meriem BEKRI, Virginie LE MIGNOT, Mourad KHAROUNE, André PAUSS
- 133 Study and comparison of two advanced oxidation processes in the treatment of polluted effluents.
J. SANZ, J.I. LOMBRANA, A. M. DE LUIS, F. VARONA, M. ORTUETA
- 134 Influence of a co-solvent on the solubilization of organic pollutants (PAHs) included in stabilized/solidified materials.
Catherine FANTOZZI, Christine de BRAUER, Radu BARNÁ
- 135 Titanium dioxide photocatalytic degradation of petroleum in water.
Elene SAMOILOVA, Svetlane BACHAREVA, Maria DEGTJAREVA, Yuri MESHALKIN
- 136 Geochemistry of the Têt River in Southern France: natural controls and anthropogenic impacts.
Javier GARCIA, Wolfgang LUDWIG
- 137 In situ partition of nonpolar pollutants in river systems.
Milena FERNANDES, Marie-Alexandrine SICRE, Anne LORRE, Didier PONT
- 138 Degradation of azo dyes in aqueous media by Electro-Fenton process.
Elodie ZAWLOTZKI, Stéphane TREVIN, Claude LAHITTE, Mehmet OTURAN
- 139 Effect of pH on the elimination of linear alkylbenzene sulphonates (LAS) in water by hydroxyl radicals produced by combination of UV irradiation plus hydrogen peroxide.
A. MENÉNDEZ, J. I. LOMBRANA, E. VELASCO, F. VARONA
- 140 Trends and main temporal cycles of water temperature, salinity, oxygen concentration and pH in Polar and Atlantic water masses in North Atlantic.
Leonid CHERNISHOV, Vladimir LAPSHIN
- 141 Study of biodegradation on cellulosic solid support in presence of 4-ethylphenol.
Rabaa FDI, El kbir LHADI, Jean MORVAN, Laayachi KHAMLICHE
- 142 Photodecomposition of chloroorganic compounds in the aqueous solution in the presence of titania catalysts.
B. MALINOWSKA, J. WALENDZIEWSKI, D. ROBERT, J. V. WEBER, M. STOLARSKI
- 143 Activation of hydrogen peroxide for the bleaching of the azo dyes.
Naima CHAHBANE, Dieter LENOIR, Karl-Werner SCHRAMM, Terrence COLLINS, Salah SOUABI, Hakim ALMERDHY, Antonius KETTRUP
- 144 Photodegradation of arazine.
Jean-Pierre AGUER, Daté TETEGAN, Bernadette LAVEDRINE, Claire RICHARD
- 145 Acetate in deep peat bog environments - Seasonal variation and implications for methanogenesis.
Bernd EILRICH, Philipp STEINMANN
- 146 Functional microbial agents for the treatment of malodor of piggery slurry waste.
Eun Yeol LEE, Eugene KIM, Eun Jung LEE, Choi Hee KIM, Sunghoon PARK
- 147 Monooxygenase-catalyzed cometabolic biodegradation of trichloroethylene.
Eun Yeol LEE, Hyun-Chul BAE, Eun-Hee SEOL, Hyun-Suk KIM, Sunghoon PARK

POSTER SESSION 05 - SOIL POLLUTION - TOXIC METALS

- 148 Interactive influence of cadmium and humic acids on wheat: effect on metals acquisition and sequestration related to the production of metal ion ligands.
Fabienne BARAUD, Teresa W.-M. FAN, Richard M. HIGASHI
- 149 Study of cadmium adsorption on different granulometric fraction of soil.
Estelle ROTH, Bernard FABRE, Rodrigue HÉE
- 150 Influence of soil copper level, soil organic matter level and soil pH on copper concentration in maize.
Peggy GUNKEL, Bernard FABRE
- 151 Role of soil components in immobilisation of Mn, Zn and Pb in gray forest soil under the broad-leaved forest.
Leonid PERELOMOV
- 152 Adsorption-desorption experiments to estimate the relative heavy-metal mobility in soils.
Jordi SASTRE, Miquel VIDAL, Gemma RAURET
- 153 Dynamics of the interaction of trace elements in contaminated agricultural soils.
Eva HERNÁNDEZ, Jordi SASTRE, Miquel VIDAL, Gemma RAURET
- 154 Heavy metals in contaminated soils near a wire-drawing factory, Marseille, France.
Audrey HUMBERT, Yves NOACK
- 155 Forecast estimation of heavy metals values in a soils.
Tatiana KOROLEVA
- 156 Use of sodium carboxylates for selective precipitation of metallic cations in industrial liquid wastes.
Franck PENELIAU, Eric MEUX

- 157 In-situ transformation of heavy metal phases in soils.
Andreas BIRKEFELD, Bernd NOWACK, Rainer SCHULIN
- 158 Preliminary study of cadmium electrodialytic removal from soil.
M. J. CONCALVES, P. GUNKEL, E. ROTH, B. FABRE
- 159 Simulation of the migration of heavy metals through podzol soils by centrifugation.
Olivier ETCHEBERS, Christine RIOU, Frédéric CAZAUX, Ronan LE FANIC, Jean-Claude CHOSSAT,
Philippe LE COUSTUMER, Monika KEDZIOREK, Alain BOURG
- 160 Heavy metal speciation in composting process.
Gillian M GREENWAY, Qi Jun SONG
- 161 Green fluorescent protein expression in a cadmium resistant *Streptomyces* R25 sp. strain.
Louis M. SIOERIZ, M., T. LEBEAU, M. J. AMOROSO, C. M. ABATE
- 162 Phytoremediation of thallium contaminated soils: effect of binding forms on thallium uptake of Brassicaceae.
Husam AL-NAJAR, Rudolf SCHULZ, Volker RÖMHELD
- 163 Mercury recovery from soils by phytoextraction.
Luis RODRIGUEZ, Francisco J. LOPEZ-BELLIDO, Pablo L. HIGUERAS, José M. MONTEAGUDO, Javier CABRERA,
Angel CARNICER, Juliana PARRAS, Victoriano ALCALDE-MORANO
- 164 Chromium behaviour in an aquifer under an industrial site.
Caroline REYNAL, Monika KEDZIOREK, Claire ROLLIN, Alain BOURG
- 165 Heavy metal mobilisation in soil after slurry spreading.
Anne JAFFREZIC, Gwenaëlle JARRIGE, Yannick FAUVEL

POSTER SESSION 06 - SOIL POLLUTION - ORGANIC POLLUTANTS

- 166 Net nitrogen mineralisation and nitrification in Alpine soils in the Northern Caucasus.
Mikhail MAKAROV, Tatiana MALYSHEVA, Alexander VOLKOV, Irina BULATNIKOVA
- 167 Mobility of C-14-alachlor in unsaturated-soils during horizontal infiltration
H. M. SELIM
- 168 Contaminated soil bioremediation: comparison study of biodegradation rates in stirred and fixed-bed reactors.
Julien TROQUET, Fabrice POUTIER
- 169 Petroleum biodegradation: mass and chemical composition changes.
Yury TUROV, Marine GOOZNJAEVA
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- 171 Dialysis and sorption studies on the binding of phenolic xenobiotics to dissolved organic matter.
Andreas HÖLLRIGL-ROSTA, Ralph VINKEN, Markus LENZ, Andreas SCHÄFFER
- 172 Abiotic degradation of the herbicide Rimsulfuron on adsorbed phase.
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- 176 Determination of optimal experimental conditions for the study of the kinetics of the EDTA-trace metals extractions from contaminated sediments.
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- 177 Desorption of dioxin and the organic-carbon normalised partition coefficient, K_{oc}.
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Neus OTERO, Laura VITÓRIA, Núria ANTICH, Albert SOLER, Angels CANALS.
- 186 Production and export of dissolved organic carbon (DOC) from an ombrotrophic peat bog.
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- 195 Anaerobic biodegradation of phenols.
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Danielle BALLIVET-TKATCHENKO, Séverine CAMY, Jean-Stéphane CONDORET
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- 200 The effects of short time exposure of several plant species to ethylene
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- 206 Development of environmental toxicity biosensors using genetically-engineered bioluminescent bacteria.
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- 208 Relational database of information on potential endocrine disrupters (REDIPED).
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- 210 Use of a unicellular organism, *Euglena*, as a water pollution marker.
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- 212 Biological assessment of pollutants in water samples from rural and urban origin using the Lux-Fluoro Test.
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- 213 Impact of a sulfonylurea herbicide on growth of photosynthetic protozoa.
Tomonori KAWANO, Toshikazu KOSAKA, Hiroshi HOSOYA
- 214 Oxidative burst induced by metal cation stress in tobacco BY-2 cells and mitigation by zinc and manganese ions.
Nakako KAWANO, Tomonori KAWANO, Frederic LAPEYRIE
- 215 A new bioassay system of chemical substances in environment using green paramecia, *Paramecium bursaria*.
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- 216 Erika crude petroleum genotoxic impact on fish (*Sola sola*) and relationship with cytochrome P450 1A1 expression.
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- 219 Impedance based biomonitoring of the environmental toxicants
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- 220 Fate of imidacloprid in fields and toxicity for honeybees.
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- 224 Determination of the sewage indicator compound, aminoacetone, its environmental lifetime, and its correlation with faecal bacterial indicators in sewage effluent.
Mark F. FITZSIMONS, Mekibib DAWIT, Aboubakar SAKO, Jennifer JACOBS
- 225 Microwave breakdown spectroscopy (MBS) applied to the detection of halides in air: dual-beam intersection method
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- 227 Spectroscopic tools for the remote sensing of some greenhouse gases: CH_4 , CF_4 , SF_6 ...
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- 228 Infrared detection of chlorinated hydrocarbons in water at part per billion concentrations.
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Nicolas HAROUNE, Pascale BESSE, Bruno COMBOURIEU, Martine SANCELME, Anne-Marie DELORT
- 230 Adjustment of parameters involved in the detection and the identification of biomarker proteins of pathogenic bacteria by matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry.
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- 234 Interaction of beta-naphthol with humic acid.
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- 235 Determination of nicosulfuron and atrazine evolution in mesocosms.
Sylvie NÉLIEU, Roselyne GUICHON, François PERREAU, Christian BRY, Jacques EINHORN
- 236 Trace analysis of fluorescent substances in groundwater by combined high-performance liquid chromatography (HPLC) luminescence technique.
Fanny LEUENBERGER, Werner BALDERER
- 237 Analysis of coal tar contamination in soils and water using solid phase microextraction and gas chromatography-mass spectrometry (GC-MS).
S. REID, S. A. LEHARNE, K. HAGENHOFF, J. DONG
- 238 Rapid extraction of halogenated aromatic compounds by accelerated solvent extraction (ASE) in multi-polluted incinerator furnace bricks.
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- 239 Quantification of glycoalkaloids from different genetically modified potatoes by capillary electrophoresis coupled with electrospray ionization ion trap mass spectrometry (CE-ESI/ion trap MS)
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POSTER SESSION 12 - ANALYTICAL METHODS - TOXIC METALS

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Jean-louis ROULIER, Pierre LABADIE
- 241 Comparison of three mild extraction procedures used to assess the heavy metal availability in soils.
Mónica PUEYO, José Fermín LÓPEZ-SÁNCHEZ, Gemma RAURET
- 242 Determination of chromium and copper using cathodic stripping voltammetry with mixed ligands.
Catherine ELLEOUET, François QUENTEL, Christian Louis MADEC
- 243 Speciation analysis for organometallic compounds in the environment by gas chromatography with microwave assisted plasma atomic emission spectrometry (MIP AES) and inductively coupled plasma mass spectrometry (ICP MS).
Brice BOUYSSIERE, Véronique VACCHINA, Ryszard LOBINSKI
- 244 Detection and identification of heavy metal complexes in plants exposed to heavy metal stress.
Brice BOUYSSIERE, Véronique VACCHINA, Ryszard LOBINSKI
- 245 Direct elemental analysis of aerosols collected on silicone wafer carriers by total-reflection X-ray fluorescence spectrometry.
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- 246 Combining Raman imaging and electron microprobe microanalysis to characterise dusts emitted by a lead and zinc smelter.
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- 247 Detection of toxic pollution by respirometry in wastewater treatment plants.
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- 249 Detection of transition metals in water samples using a sensitised tetracyanoquinodimethane chemiluminescence reaction and flow injection analysis.
Mario A. YARTO-RAMIREZ, John B. DAWSON, Richard D. SNOOK
- 250 Engineering new metal specificity in the EF-hand motif of calmodulin.
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- 251 Comparison of three sequential extraction methods of metals from sandy soils.
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-

INVITED LECTURE

Environmental biomonitoring by instrumental analysis and bioassays.

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In the past, environmental monitoring of heavy metals, metal species and organic pollutants, e.g. persistent organic pollutants - POP's, was developed and optimised. But, in addition, we need environmental effect monitoring by bioanalytical methods. In this connection hyphenated analytical techniques were developed, e.g. on-line coupling of chromatography with respective detection methods. So, high-resolution gas chromatography (HRGC)/high-resolution mass spectrometry (HRMS) and high performance liquid chromatography (HPLC)/MS-MS are used for analysing emissions or xenobiotics in environmental samples as well as for biological monitoring. By the combination of high sensitive analytical methods and bioassays it is possible to get information on the concentration of pollutants and their effects. In the case of dioxins and furans (PCDD/F's) the chemical analysis includes clean up procedures following the concept of the isotope dilution method. At least HRGC/HRMS is performed for the identification and quantification of congeners. In vitro tests are included in the analytical procedures. Analysis of environmental samples usually requires time consuming sample preparation and clean-up procedures prior to an instrumental detection step.

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ORAL SESSION 01

AIR POLLUTION - ORGANIC POLLUTANTS**Synthetic musks as new contaminant group in the Norwegian Environment.**

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The presence of synthetic musks in the environment was proven for the first time in the early 1980s. Within the past decades, a large number of ecotoxicological and trace analytical investigations identified synthetic musk compounds as important environmental contaminants. Today, synthetic musks are still widely used as artificial fragrances added to perfume-, household-, hygienic- and cosmetic products. No comprehensive information about the occurrence of synthetic musks in the Norwegian environment is present up-to-date. Thus, in a comprehensive study, levels and distribution of the 6 synthetic musk derivatives 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethyl-cyclo[g]-2-benzopyrane (HHCB, Galaxolide®), 1-[2,3-dihydro-1,1,2,6-tetramethyl-3-(1-methyl-ethyl)-1H-inden-5-yl]-ethanone, (AII, Traseolide®), 1-(5,6,7,8-tetrahydro-3,5,5,6,8,8-hexamethyl-2-naphthalenyl)-ethanone (AHTN, Tonalide®), 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethylcyclopenta[g]-2-benzopyran-1-one (HHCB-lactone), 4-acetyl-1-tert-butyl-3,5-dimethyl-2,6-dinitrobenzene (Musk-ketone, MK) and 1-tert-butyl-3,5-dimethyl-2,4,6-trinitrobenzene (Musk-xylene, MX) was determined and evaluated in selected environmental samples. The distribution of synthetic musks in ambient and indoor air as well as in various biota samples was investigated. Method limitations as well as pattern distribution, possible sources, bioaccumulation and environmental implications will be discussed in the presentation.

Keywords: Synthetic musks, Norwegian Environment, ecotoxicological assessment, contaminants, fragrances.

ORAL SESSION 01. AIR POLLUTION - ORGANIC POLLUTANTS**Atmospheric pollution from oil shale combustion in Estonia.**

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The worldwide reserves of oil shale are huge. In Europe oil shale is found in Scotland, Sweden, France, Russia and Estonia. Electric power generation in Estonia is almost entirely by direct combustion of pulverized oil shale. As the content of organic matter in oil shale is relatively low, the total amount of residues, including gaseous and dust products (fly ash) is very large. In the present work the atmospheric fate of oil shale fly ash in a large outdoor smog chamber is studied and compared with the real monitoring data. The chemical composition of various size fractions of fly ash was different, the concentration of toxic trace elements increases with decreasing particle size. Several carcinogenic organic compounds were identified in particulate phase of fly ash aerosol. The experimental results demonstrate that the role of the respirable fraction of particles significantly increased in time.

Keywords: fossil fuels, contaminaton of atmosphere, organic pollutants, toxic metals.

ORAL SESSION 01. AIR POLLUTION - ORGANIC POLLUTANTS

Polycyclic aromatic hydrocarbons (PAHs) in French Alpine valleys.

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Following the closure of the tunnel du Mont-Blanc in March 1999, the traffic was heavily perturbed in several French alpine valleys. The program POVA (Pollution des Vallées Alpines) was undertaken to investigate the change in atmospheric chemistry associated with these perturbations. Aerosols were collected during one week at 4 sites in each of the Chamonix and Maurienne valleys during August 2000 and January 2001. Particularly, the concentrations of PAH were investigated with high performance liquid chromatography (HPLC) and fluorescence detection. Correlations with O_3 and NO_x were also established. In all series, the 5 most abundant PAH are Fluoranthene and Pyrene (coming from fuel combustion), BenzoghiPerylene (coming from light duty vehicles), and Benzo Fluoranthenes (coming from diesel engines). Higher concentrations were observed near the tunnel of Fréjus (at Modane) and in the center of the city of Chamonix. In summer and in winter, the total PAH concentrations were $1,2 \text{ ng.m}^{-3}$ and $15,5 \text{ ng.m}^{-3}$ in Modane, and $2,2 \text{ ng.m}^{-3}$ and 155 ng.m^{-3} in Chamonix, respectively. However, significant concentrations were also observed at the remote sites, especially at altitude sites. The highest concentrations were observed during winter, indicating that residential heating may be the major sources of these carcinogenic pollutants.

Keywords: PAHs, atmosphere.

ORAL SESSION 01. AIR POLLUTION - ORGANIC POLLUTANTS

The pyrolysis of catechol: characterisation of decomposition products and the formation of polycyclic aromatic hydrocarbons.

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As a predominant structural entity in lignin, coal, and biomass tars, catechol is a suitable model compound for investigating the formation of polycyclic aromatic hydrocarbons (PAH) from the combustion and pyrolysis of solid fuels. Due to the dependence on solid fuels combustion as a source of energy, and the carcinogenic and mutagenic activity of many PAH, an understanding of reaction mechanisms leading to PAH formation is necessary. In the present work, we have performed gas-phase pyrolysis experiments on catechol, using a tubular-flow reactor at temperatures of 500 - 1000 C and at a residence time of 0.4 s. Condensed-phase aromatic products were analysed by GC-FID, GC-MS, and HPLC-UV. Hydrocarbon gases were analysed by GC-FID, and CO was quantified by NDIR analysers. We report the identification of several PAH compounds. We present the yields of light gases and aromatic products as functions of temperature, and we discuss possible reaction mechanisms for PAH formation.

Keywords: pollutants, PAH, HPLC analysis, solid fuels.

ORAL SESSION 01. AIR POLLUTION - ORGANIC POLLUTANTS

General reactive transport model for inter-reacting multiple air pollutants in non-conservation system and its application to toluene chemistry in urban areas.

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A general solution of coupled diffusion-reaction equations governing the spatiotemporal evolution of an arbitrary number of inter-reacting air pollutants has been analytically derived in a framework of non-conservation system, where the solution includes their time/position dependent production and removal processes. The analytical solution derived using a Fourier transform technique and matrix algebra enables the rigorous analysis of non-homogeneous gas-phase reactions for multiple air pollutants intertwined with their diffusion and advection processes in a complex way. Also the steady state solution approaching to dynamic balance between their transport and reaction process has been explicitly derived. A general equilibrium constant can be defined in terms of the reaction rates determinants. A chemical conversion model, based on this solution, from toluene to benzaldehyde involving two intermediate radicals with six reaction rates has been examined in normal air conditions.

Keywords: pollutants, reactive transport theory, equilibrium, toluene.

ORAL SESSION 01. AIR POLLUTION - ORGANIC POLLUTANTS

The influence of the Kostomuksha factory on the air pollution in Karelia and Finland.

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The ore refinement factory in Kostomuksha (Russian-Finnish border) was built in 1982 and seriously aggravated chemical burden on the environment of the region. The main product of the factory is beneficiated iron ore, while the principal atmospheric exhausts involve sulfur dioxide (60000 tons/year) and technogenic dust (5000 tons/year). However there were no serious studies on the individual toxicants in the emissions so far. Analysis of snow samples is a reliable method to estimate long-term air pollution. The required samples were collected in March 2001. ICP-MS was used to get information on 72 elements, while GC-MS allowed identifying and quantifying more than 200 individual organic compounds. Analysis of the data obtained permitted to create a list of priority pollutants for the region based on the their levels and toxicities (maximal allowable concentration values). Due to the predominant North-Eastern winds the impact of the factory on the Finnish territory appeared to be rather small.

Keywords: air pollution, priority pollutants, ICP-MS, GC-MS.

ORAL SESSION 02

WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS**Enzymatic treatment and recycling of textile effluents.**

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Enzymes can be used to specifically degrade pollutants in textile effluents while valuable effluent components are not attacked and can thus be recycled. Due to decreasing production costs using e.g. genetic engineering, enzyme remediation is becoming an attractive alternative to microbial methods. Laccases isolated from lignocellulolytic fungi decolourised a number of textile dyes from different classes (e.g. azo, anthraquinonic, triarylmethane, indigoid). Redox potential differences rather than steric effects seem to determine the degradation velocity. Similarly, peroxidases and azoreductases from a newly isolated *Bacillus* sp. growing at pH 10 and 65°C have a potential for textile dye degradation, while alkalithermostable catalases from this organism were used for the elimination of hydrogen peroxide in bleaching effluents. Effluents from both bleaching and dyeing were treated in enzyme reactors with immobilised enzymes at industrial scale and re-use in dyeing lead only to minor colour differences of fabrics with acceptable dE-values below 1.

Keywords: enzyme remediation, textile dyes, effluent treatment.

ORAL SESSION 02. WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS

Risk assessment of polycyclic aromatic hydrocarbons (PAHs) transfer from feed to milk.

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During a previous study in dairy farms, PAHs profile has shown great differences between grass and milk. The aim of this work was to determine the influence of the food way in milk contamination by PAHs. ^{14}C -phenanthrene, ^{14}C -pyrene, ^{14}C -benzo[a]pyrene and ^{14}C -2,3,7,8-TCDD were used to characterise transfer in lactating goats after a single oral ingestion (2.5 106 Bq). Blood, milk, urine and faeces have been collected for five days and radioactivity was then identified in milk fat and skimmed milk. After ^{14}C -PAHs oral ingestion, radioactivity has been very quickly detected in milk, urine and plasma (seven hours after administration), let us suppose ruminal absorption of the molecules. From feed to milk, the highest transfer occurred with 2,3,7,8-TCDD (7.8%), phenanthrene and pyrene have similar behaviour, with a high excretion through urine and a low milk transfer (40.4% and 1.6% for phenanthrene and 11.4% and 1.9% for pyrene respectively). Apparent digestibility of these three molecules was close to 75% whereas benzo[a]pyrene digestibility was very low (12%). Radioactivity due to benzo[a]pyrene was not significantly detected in milk. This study suggests a differential behaviour of PAHs, which will be discussed according to their absorption, metabolisation and excretion abilities.

Keywords: PAHs, dioxin, food, milk, animal, transfer.

ORAL SESSION 02. WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS**Control of halogenated by-products during surface water potabilisation.**

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The production of potable water from the river Meuse is realised through a complex treatment plant located in Tailfer, using pre-ozonation, filtration, ozonation and CAG filtration. The strategy to control the formation of halogenated product, such as bromate and trihalomethanes, will be presented with results on the produced water and the distributed water through the Brussels distribution network. The chlorination strategy of distributed water in the network will also be presented, in relation with the evolution of THM. Finally, comparison of halogenated by-products will be made with groundwater supply in the same city. This presentation will show that the combination of ozonation and chlorination disinfecting of surface water, with a careful control, can lead to low levels of halogenated by-products.

Keywords : surface water, halogenated by-products, disinfecting, distribution

ORAL SESSION 02. WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS**Several ways to treat industrial wastewaters containing aprotic solvents: example of the dimethylsulfoxyde**

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The increasing use of aprotic solvents in the industry leads to the set up of new wastewater treatment technologies adapted to the specificities of these compounds. The case of DMSO is particularly interesting due to specific properties of this component. Depending on concentration and the presence of other compounds in the effluent, several technologies can be chosen: concentration with reverse osmosis, biodegradation with specific process to avoid DimethylSulfide (DMS) odours, oxidation in DimethylSulfone (DMSO₂) with several oxidants. The choice as to be made according economical and technical considerations. In this paper, the different ways are detailed with advantages and drawbacks.

Keywords: DMSO, wastewater treatment, biodegradation, reverse osmosis, oxidation

ORAL SESSION 02. WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS

Quantification of in situ trichloroethene dilution versus biodegradation using a novel chloride concentration technique.

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The purpose of this study was to evaluate limiting parameters of in situ trichloroethene (TCE) bioremediation, and to determine whether the decrease in TCE concentrations was attributable to biological degradation versus abiotic processes. An enhanced in situ TCE bioremediation study was analysed in which groundwater, amended with microbe-stimulating compounds, was injected into the contaminated subsurface. Low estimated hydraulic conductivity (1.5×10^{-5} cm/sec) was the most limiting parameter in the bioremediation study. Dilution, attributed to mixing between the injected clean and contaminated waters, was calculated using a modified groundwater mixing equation and chloride concentrations of the waters at various times in the study. Over the course of the trial, spatially averaged TCE concentrations within the aquifer decreased by 41%. The chloride calculations indicated that a 27% reduction may be attributable to dilution, thereby suggesting that only a 14% decrease in concentrations may be attributable to biological degradation.

Keywords: trichloroethene, biodegradation, groundwater mixing, chloride, dilution.

ORAL SESSION 02. WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS

Disappearance of polycyclic aromatic hydrocarbons (PAHs) during anaerobic digestion of naturally contaminated sewage sludges.

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Widely distributed in the environment, polycyclic aromatic hydrocarbons (PAHs) are known for their toxic and carcinogenic properties at low concentration. Moreover, due to a low water solubility and a high affinity to organic matter, PAHs tend to be easily concentrated in sewage sludges and consequently in agricultural soils by spreading. The aim of this study was to determine the behaviour of 13 PAHs during anaerobic treatment of a naturally contaminated sludge. Although many PAHs are known to be biodegraded under aerobic conditions, only little is known about PAHs degradation under strict anaerobic conditions. So, for the first time, statistically significant disappearance of PAHs was observed under methanogenic conditions in laboratory-scale continuous bioreactors. It was concluded that PAHs disappearance resulted from biological activity. Moreover, comparison of PAHs elimination by acclimated and non acclimated ecosystems shown that long term adaptation of the ecosystem is necessary to improve significantly high PAH removal.

Keywords: acclimated ecosystem, continuous bioreactors, methanogenic conditions, PAHs, sewage sludge.

ORAL SESSION 02. WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS

Transformation of carbendazim by UV/H₂O₂ in aqueous solution.

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Carbendazim is a widely used fungicide for the preservation of fruits that can be released in the environment. It is of great concern to investigate the processes leading to its elimination. We will present results of carbendazim transformation induced by hydroxyl radicals. The experiments are carried out in a batch cylindrical photoreactor the volume of which is 2L. The lamp is located at the axis of the reactor and is emitting a quasi-monochromatic radiation at 254 nm. Carbendazim concentration is followed by HPLC, hydrogen peroxyde by spectrophotometric method. Degradation products are identified by LC-MS. The absorption of light by hydrogen peroxyde leads to the production of hydroxyl radicals, very powerful oxidants. The second order rate constant of hydroxyl radicals reaction with carbendazim has been evaluated equal to $2.2 \cdot 10^9 \text{ M}^{-1}\text{s}^{-1}$. Degradation products have been identified. The effect of initial concentrations hydrogenocarbonate ions has also been studied and it has been shown that their presence leads to an additional pathway of carbendazim disappearance. A kinetic model taking into account all the carbendazim degradation pathways has been established.

Keywords: pesticide, carbendazim, induced transformation, hydroxyl radicals, carbonate radicals.

ORAL SESSION 02. WATER AND FOOD POLLUTION - ORGANIC POLLUTANTS

UV/H₂O₂ chemical oxidation for high loaded effluents: application to surfactants in water. Kinetics of decomposition.

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In the preceding paper, a laboratory study has been conducted to elucidate the possibility of carrying out the removal of pollutants in high loaded solutions through an advanced oxidation process (AOP). The application of UV combined with hydrogen peroxide to oxidize a surfactant effluent (linear alkylbenzene sulphonates, LAS) has shown to be suitable as a primary oxidation step (oxidation pre-treatment) since conversions around 50% are achieved in the most favourable cases. Direct photolysis has been performed to determine the quantum yield in the single photodecomposition reaction. A kinetic model that takes into account both the contributions of the direct photolysis and the radical attack has been worked out, thus the rate constant of the reaction between hydroxyl radicals on LAS in the combined system H₂O₂/UV has been determined. Finally, the influence of the operating variables on the degradation levels is analysed in this work, through the determination of the rate constant of the total decomposition. In addition, an improvement in the biodegradability of the treated solutions is achieved in all cases.

Keywords: advanced oxidation process (AOP) H₂O₂/UV, pollutants in high load, linear alkylbenzene sulphonates (LAS), hydroxyl radicals, quantum yield, degradation levels, influence of variables.

ORAL SESSION 03

SOIL POLLUTION - TOXIC METALS**Electrodialytic remediation of different heavy metal polluted soil.**

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Heavy metal polluted soils can be remediated by application of an electric DC field where ions in the soil solution will migrate towards the electrodes. To be mobile in the electric field heavy metals must be desorbed to ionic form in the soil solution and this is the decisive factor for the remediation. During the remediation the soil is acidified, and in many cases this is sufficient to mobilise the heavy metals. In some cases though, it is necessary to add complexing agents to the soil, e.g. soils polluted with Cu, Cr and As from wood preservation. As is not mobilised by the acidification but addition ammonia citrate can mobilise all three pollutants at the same time. For a Cu polluted calcareous soil addition of ammonia improves the remediation markedly. Soil and pollution characterisation is thus necessary to choose the best remediation parameters for an actual soil.

Keywords: heavy metals, soil contamination, remediation

ORAL SESSION 03. SOIL POLLUTION - TOXIC METALS**Selection of microorganisms for their ability to bioremediation of agricultural soils contaminated by cadmium.**

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Accumulation of heavy metals in agricultural soil is an important issue because of the difficulty of cleaning-up. An alternative consists in the limitation of heavy metals transfer from soil to plant by inoculating soil with micro-organisms selected for their ability to biosorb heavy metals. We tested 5 micro-organisms (1 fungus, 2 actinomycetes and 2 bacteria) isolated from contaminated soil revealing ability to grow in the presence of high Cd level in laboratory conditions. We tested their growth capacity on rich synthetics media and on a soil extract medium (poor) at pH 5, 6 and 7 in presence of 1 and 10 mg Cd/l. We compared their growth rate that is representative of their ability to soil colonisation. The percentage of Cd biosorbed in the medium and the specific biosorption (mgCd/g biomass) lead to choose the most efficient micro-organism(s) that will be used to later bioremediation experiments in soil microcosms.

Keywords: cadmium, bioremediation, micro-organisms, heavy metals biosorption.

ORAL SESSION 03. SOIL POLLUTION - TOXIC METALS

Preferential transport of strongly sorbing contaminants in structured soils; field evidence and modeling.

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Zinc, cobalt, manganese and cesium are particle reactive heavy metals with high particle/solution partition coefficients (K_d) determined in batch experiments. Experimental work ^{65}Zn , ^{57}Co , ^{54}Mn and ^{134}Cs shows significant depth migration. Monolith experiments using Gley Soil from an agricultural site indicate bypass of up to 70 cm of soil. Field experiments with untilled Eutric Cambisol show similar results, with radionuclides reaching a depth down to 50 cm. In all cases were radionuclide activities higher in the preferential flow paths, identified with dye tracers, compared to the soil matrix. These results can be explained by preferential flow, where a portion of the soil matrix is bypassed. The soil filter capacity is reduced accordingly. MACRO, a model developed to distinguish flow through macropores and through the soil matrix (Jarvis, <http://130.238.110.134/bgf/defeng.htm>) has been used to carry out model simulations. Solute transport is modeled using the convection-dispersion equation and sorption using the Freundlich isotherm (instantaneous equilibrium assumed). Measured and modeled data for both bulk distribution and for individual flow domains are comparable if K_d s remain significantly below measured values.

Keywords: solute transport, soil structure, preferential flow, radiotracer, metal.

ORAL SESSION 03. SOIL POLLUTION - TOXIC METALS

New hydrometallurgical process for zinc and lead recovery from electric arc furnace dust.

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The aim of this work is to study the feasibility of a new hydrometallurgical process for treating Electric Arc Furnace Dust (EAFD). At first, a leaching is carried out with hydronitrilotriacetate anion. The treatment of different samples allows the total leaching of ZnO and PbOHCl without solubilizing iron. Zinc and lead are recovered in the leachate by precipitation of metallic sulfides with Na_2S_4 , which can be used in their own metallurgy as raw materials whereas the reagent is recycled in the process. Solid residue still contains an important amount of zinc under ZnFe_2O_4 form. The extraction of this element requires the destruction of the ferrite structure which is performed using FeCl_3 , 6 H_2O and allowing the recovery of zinc as ZnCl_2 and iron as Fe_2O_3 . Separation of both products is obtained by simple aqueous leaching. The whole zinc is extracted and ultimate solid residues, which are iron-rich, can be recycled in steel industry.

Keywords: heavy metal, EAF dust, waste recycling, lead, zinc, selective leaching.

ORAL SESSION 03. SOIL POLLUTION - TOXIC METALS

Microstructural study of accelerated carbonated soil from a former pyrotechnic plant in S.E. England.

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Accelerated carbonation technology (ACT) can be used to remediate contaminated soil and hazardous wastes in a process step lasting only a few minutes. ACT has recently been used to treat a heavy metal contaminated clayey-soil at a former pyrotechnics manufacturing plant in S. E. England. The use of an ACT remediation step, employing gaseous carbon dioxide and a reactive cementitious binder is unique in the treatment of contaminated soil and is described. Microstructural data from soils taken during treatment and again after 6 months exposure in the field are presented, in addition to chemical leaching data. A distinct difference in the morphology and chemistry of the treated soils was displayed. For example, in the ACT remediated soil, particles were covered with a thick composite carbonate coating or intimately bound with carbonate reaction products, which also encapsulated plant debris. These and the results obtained from control mixtures are discussed in detail.

Key words: remediation, contamination.

ORAL SESSION 03. SOIL POLLUTION - TOXIC METALS

Heavy metal mobilisation in soils covering ore mining dumps.

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In the former ore mining area of Freiberg (Saxonia, Germany) soils covering the plateaus of mining dumps were sampled and the mobilisation of heavy metals was investigated in batch and in column experiments. We determined the pH, electrical conductivity and the concentrations of Al, Ca, Cd, Co, Cu, Fe, Mn, Pb, Sn, Th, U, DOC, CO_3^{2-} , SO_4^{2-} , and PO_4^{3-} in equilibrium solutions and column leachates. Both batch and the column experiments revealed enhanced mobilisation of heavy metals at concentrations $>10^{-3}$ M as compared with deionised water. A concentration of HCO_3^- of 10^{-2} M induced an increase of the U concentration by factor 2-4 in the column experiments and 4-10 in the batch assays indicating the formation of easily soluble uranium-carbonate complexes. However, the reduced concentration of Pb in the leachate of the coupled columns indicated retention in the C horizon.

Keywords: heavy metals.

ORAL SESSION 03. SOIL POLLUTION - TOXIC METALS**Centrifuge measurement of copper and nickel solute transport in London Clay.**

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Sorption of contaminants onto soil constituents significantly affects contaminant transport. The retardation factor is often used in contaminant transport modelling to quantify the mobility of the contaminant. Infiltration tests were conducted to study the transport of Cu and of Ni through consolidated London Clay. Centrifuge accelerations in the range of 1300 to 5280 gravities were used to attempt a prediction of the heavy metals' mobility in real field conditions. The retardation factor was estimated from the breakthrough curves and was compared with batch test findings on the same soil. The apparent retardation factor reduced as the centrifuge acceleration increased, indicating a reduction in sorption at the higher accelerations.

Keywords: heavy metals, contamination of soils, sorption, centrifuge.

ORAL SESSION 03. SOIL POLLUTION - TOXIC METALS

Micro-total analytical systems (TAS) systems with electrogenerated chemiluminescence detection for environmental analysis.

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A portable low cost portable microTAS system is described for the environmental analysis of metals in waters using luminol electrogenerated chemiluminescence. This approach can also be extended to gas analysis where luminol can be used to determine NO₂ at very low levels. Chemiluminescence is a promising method of detection for micro-total analytical systems due to its high sensitivity and the simplicity of the measurement technique. The low reagent consumption in micro-total analytical systems is advantageous in chemiluminescence reactions as they are irreversible and in conventional flow injection systems there is high reagent consumption, with large amounts of waste produced.

Keywords: microTAS, metals, NO₂, electrogenerated chemiluminescence.

ORAL SESSION 04

ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE**Manganese-catalysed degradation of phosphonic acids.**

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The non-biodegradable phosphonates are used in a variety of industrial applications including cooling waters, oil production, and textile industry. We show here that they are degraded in the presence of Mn(II) and oxygen with a half-life of 10 minutes at neutral pH. The presence of cations such as Ca(II) and Zn(II) considerably slows down the reaction by competition with Mn(II) for the phosphonate. The reaction involves the oxidation of complexed Mn(II) by oxygen to Mn(III) and the subsequent oxidation of the phosphonate by Mn(III) yielding two phosphonic acid breakdown products. The oxidation also proceeds in the presence of the manganite, Mn(III)OOH, and yields the same breakdown products. The use of a newly developed HPLC method revealed the presence of the breakdown products in wastewater. The results show that thermal oxidation might be an important pathway for chelating agent removal in natural waters.

Keywords: chelating agents, chemical degradation, environmental fate, analytical method, field measurements.

ORAL SESSION 04. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

On line spectrophotometric method for the monitoring of industrial wastewater discoloration processes.

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Coloured industrial wastewater may require colour removal before discharge in the receiving medium. Currently accepted spectrophotometric methods are available to determine colour. Standard EN ISO 7887 (section 3) measures the sample absorbance at 3 wavelengths in the visible range. Standard Method 2120 (section C) determines a colour value from trichromatic coefficients. In the CIEL a^* b^* space, using 30 wavelengths, colour variation between sample and a colourless reference can be calculated as a third dimension distance. From this distance value, a discoloration yield, R , has been determined. A kinetic study allows to detect potential incident during the treatment process ($dR/dt = 0$). The process will be stopped when it reaches the value for which a sample is colourless in reference to Standard Method 2120C. This on line monitoring of colour measurement is easy to run and fitted to all kind of colour removal processes.

Keywords: on line monitoring, colour, water

ORAL SESSION 04. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Insights into the measurement of the octanol-water partition coefficient, K_{ow} , from detailed experiments.

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A new apparatus for the measurement of K_{ow} , was used to monitor the approach to equilibrium, using the optical absorbance of the aqueous phase; it also permitted K_{ow} to be measured over a range of concentration. In addition to analysing both the octanol and aqueous phase for the test chemicals, the aqueous phase was analysed for octanol. Experiments with a series of acrylate esters, spanning a large range of hydrophobicity, $-0.5 < \log K_{ow} < 9$, show evidence for association in the octanol phase. Dimerisation is important for less hydrophobic chemicals and tetramerisation is important for more hydrophobic chemicals. The optical absorbance of the aqueous phase follows the Beer-Lambert law at low concentrations. At high concentrations, the less hydrophobic cases show negative deviations; in contrast, the more hydrophobic cases show strong positive deviations from the Beer-Lambert law. The latter observation, considered with octanol-in-water concentrations, provides evidence for micelle formation.

Keywords: laboratory experiments, surfactants, $\log P$, toxicology, risk assessment, hydrophobicity

ORAL SESSION 04. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE**Examinations on derivatisation and GC/CI/MS detection of selected synthetic and natural endocrine disrupters.**

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Sensitive methods for analysis of endocrine disruptive chemicals (EDC) are needed because of their low level of impact. We chose 21 EDC, amongst them 17-beta-estradiol, 17-alpha-ethinylestradiol, testosterone and bisphenol A. Derivatisation with 8 different fluoro containing compounds were examined. All EDC could be derivatised automatedly (autosampler) with heptafluorobutyric anhydride (HFBA) and trifluoroacetic anhydride (TFAA) respectively. 14 different reaction gases were tested for detection of the HFBA derivatives in negative chemical ionisation mode (NCI). All derivatives could be detected sensitively but all mass spectra contained non-characteristic fragments as base peaks. The TFAA derivatives were measured in NCI mode as well but sensitivity was not sufficient. Finally the TFAA derivatives were measured in positive chemical ionisation mode (PCI). In this mode methane and water provide a sensitive detection of all 21 hormones and create mass spectra with few fragmentation and characteristic mass peaks. That can be the basis for MS/MS measurements with very low limits of detection.

Keywords: endocrine disrupters, GC/MS, derivatisation, chemical ionisation.

ORAL SESSION 04. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Measuring free cupric concentrations with diffusion gradient in thin films (DGT): numerical estimation of the labile complexes contribution.

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The Diffusion Gradient in Thin films technique was recently developed as an alternative to more complicated systems for in situ quantifying of concentrations and speciation of trace metals in waters. The device concentrates the metal (free metal ion plus labile complexes) on a chelex resin at a controlled rate of mass transport through a hydrogel. The lability of Cu-EDTA, Cu-HPO₄ and Cu-Citrate complexes was experimentally evaluated in controlled water solutions. The results of the experiments were analysed with a dynamical modelling of the fate of metal species within the DGT hydrogel that includes ligand-metal dissociating and binding kinetics as well as diffusion processes. Numerical modelling allows quantifying the contribution of labile complexes (Cu-citrate in this study) to the DGT measurement, provided that the rate constant for the dissociation of the complex is known. This is a further step toward the routine quantification of free metal ion concentrations with DGT.

Keywords: metal, pollutants, contamination, new analytical approaches.

ORAL SESSION 04. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Comparison of ion chromatography (ISO 14911) with inductively coupled plasma-optical emission spectrometry (ICP-OES, ISO 11885) and continuous flow analysis (CFA, ISO 11732).

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Analytical results can be falsified by random and systematic errors. The application of different analytical methods may lead to deviating results. ISO 14911 is applicable to the determination of lithium, sodium, ammonium, potassium, manganese, calcium, magnesium, strontium and barium using Ion chromatography. Several alternative standard methods may be applied, too, e.g. photometry for the determination of ammonium (reference method in Germany: CFA) atomic absorption spectrometry (AAS), ICP-OES (reference method in Germany) and ICP-MS for the determination of the remaining eight elements mentioned above. Experiments with different water matrix types have been carried out in order to check the equivalence of results obtained using ion chromatography with those using ICP-OES for the elements and with those using CFA for ammonium. The results of the statistical evaluation according to different statistical methods, e.g. orthogonal regression method, so-called difference method, will be presented.

Keywords: ion chromatography, water analysis, method comparison, check for equivalence of analytical results.

ORAL SESSION 04. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Pesticide residue analysis in foodstuffs; advantages of elevated resolution and exact mass capability.

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Pesticide residue analysis in foodstuffs, to meet statutory requirements, can be extremely challenging sometimes involving in excess of one hundred target compounds. A majority of the targets are amenable to analysis by gas chromatography-mass spectrometry (GC-MS) with a combination of ionisation and scan techniques. Regulation also imposes the necessity of unambiguous confirmation of residues identified in the screening process. In this paper we describe a novel screening method for pesticides in fruit and vegetable extracts using elevated resolution and exact mass measurement on a GC-TOFMS (TOF: time-of-flight). We demonstrate the advantages of exact mass chromatograms versus nominal mass chromatograms for the determination of residues in the low ppb range. We also discuss the implications of high full scan sensitivity and the absence of spectral skew on productivity. All experiments were performed on an orthogonal acceleration time of flight mass spectrometer (Micromass UK, Manchester) equipped with chemical ionisation (CI) and electron ionisation (EI) ion sources and interfaced to an Agilent 6890 gas chromatograph.

Keywords : mass spectrometry, exact mass, pesticide residues, foodstuffs.

ORAL SESSION 04. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Bacteria-degraders based amperometric biosensors for detection of anionic surfactants.

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Surface active compounds are a wide-spread group of organic pollutants. The biosensoric analysis corresponds to the high specificity, efficiency and technical simplicity that makes it promising for fast and sensitive surfactants detection. The purpose of this work was to study parameters of biosensors based on selected bacterial strains *P. rathonis* T, *Pseudomonas* sp. 2T/1, *P. putida* K, *P. aeruginosa* 1C and *A. eurydice* TK cells harboring plasmids of surfactants biodegradation. The models of microbial biosensors allowed surfactant detection with high selectivity, sensitivity (lower limit at 5 microMoles of SDS) and reproducibility. Based on the results obtained at laboratory tests the uniform biosensor device for in situ measurements consist of recognition element and microprocessor unit was constructed. The device is considered as a prototype of analyzer for industrial scale production. The work was supported by the INCO-Copernicus grant "Biosensor feedback control of wastewater purification: photooxidation followed by biological degradation using surfactant-degrading bacteria" (BIOFEED) ICA2-1999-10017.

Keywords: microbial biosensor, bacteria-degraders, anionic surfactants.

ORAL SESSION 05

GREEN CHEMISTRY**Zero emission process for the catalytic transformation of dimethyldisulfide into methylmercaptan.**

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Methanethiol is largely produced because of its utilisation as intermediate for the synthesis of both methionine and dimethyldisulfide (DMDS). Due to its obnoxious odour and drastic toxicity its transportation will be faced to increasing environmental requirements. The transformation of CH_3SH into a safer compound like alkali mercaptide was industrially envisaged. However, the back formation of CH_3SH requires a hydrolysis step leading to the unavoidable formation of alkali salt wastes. The challenge of this work was to find out a selective catalytic process working in mild conditions and where the catalyst was stable in the presence of a sulfur containing atmosphere. Using a sulfided NiMo catalysts, a molar ratio of $\text{H}_2/\text{DMDS} = 2$, a reaction temperature as low as 433 K and a continuous flow reactor, we were able to completely transform DMDS into CH_3SH without any side products.

Keywords: zero emission process, catalysis, thiochemistry.

ORAL SESSION 05. GREEN CHEMISTRY

Photocatalytic degradation of humic acids in aqueous solution with illuminated TiO_2 .

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For different reasons, the humic substances (HS) play a major role in the aquatic systems. However, they are also precursors of mutagen products. As a matter of fact they can react with Cl_2 used for the disinfecting of water, for given organochloride compounds. The heterogeneous photocatalysis can be an alternative in the elimination of HS. This process allows degrading most of organic molecules, without adding of supplementary products but the photocatalyst (TiO_2). We have studied the influence of different factors on the photodegradation of commercial humic acids (HA). The studied parameters are $[\text{TiO}_2]$, $[\text{HA}]$ and the addition of chloride anions (Cl^- are photocatalysis inhibitors). The degradation kinetics are measured by HPLC, TOC and by DBO_5 .

Keywords: humic substances, water treatment, photochemistry.

ORAL SESSION 05. GREEN CHEMISTRY

Use of solid catalysts in the reactions of transterification and etherification of glycerol.

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Glycerol monoesters, polyglycerols and polyglycerols esters are valuable products synthesised from inexpensive and renewable raw materials (glycerol and methyl esters, which are derivatives from vegetables oils). However, the catalysts used for these reactions are often homogeneous strong bases and acids, which need to be neutralised and generate a huge amount of wastes. We have shown that some basic solids such as metal oxides can easily replace homogeneous catalysts. These solid catalysts are reusable, don't generate toxic wastes and can perform similar activities and selectivities as those of homogeneous catalysts. Moreover, for the glycerol etherification, we developed porous catalysts, based on the MCM-41 structure, giving better selectivity into di- and triglycerol without an expensive purification. Finally, new and less expensive catalytic processes giving a less amount of wastes are proposed.

Keywords: renewable raw material, solid catalysts, glycerol.

ORAL SESSION 05. GREEN CHEMISTRY

Carbon dioxide utilization for the synthesis of organic cyclic carbonates under homogeneous and heterogeneous conditions.

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In this paper we discuss the possibility to use carbon dioxide for the synthesis of cyclic carbonates either from optically active or racemic epoxides and CO₂, or CO₂/O₂ and olefins catalyzed by niobium compounds. These approaches can be considered as innovative and environmentally friendly synthetic strategies and are carried out under quite mild conditions. The oxidative carboxylation of olefins has a great potential. It uses cheap materials, as olefins, carbon dioxide and oxygen, to afford valuable chemicals and couples two processes: the epoxidation of the olefin and the carboxylation of the epoxides. Very few data are present in the literature. Nb₂O₅, Nb(IV) and Nb(V) compounds have been used as catalysts in the fixation of carbon dioxide in several epoxides (cyclic and linear) and in the direct oxidative carboxylation of olefins. Homogeneous catalysts with optically active ligands also have been used.

Keywords: carbon dioxide, olefins, organic cyclic carbonates, oxidative carboxylation.

ORAL SESSION 05. GREEN CHEMISTRY

Solid base catalysts for the selective synthesis of phytosterols esters.

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The main objective of this study deals with the synthesis of phytosterols esters from natural sterols and fatty methyl esters (12-18C) by transesterification reaction over basic solid catalysts. These phytosterols esters are effective in reducing both blood cholesterol levels and triglycerides but they can be also used as biological compounds in pharmaceuticals and cosmetics. This study showed that the best yield of phytosterols esters (above 90%) was obtained over rare earth oxides and that the global yield does not change with the nature of esters or of sterols. The physicochemical properties of rare earth oxides can also influence the activity without changing the selectivity to phytosterols esters. Moreover such catalysts are easily reusable without significant change of the catalytic properties.

Keywords: synthesis, green chemistry, catalyst, medicine, phytoester.

ORAL SESSION 06

ECOTOXICOLOGY**Duckweed growth inhibition test - Using higher plants and image analysis for sensitive detection of contaminants in water and soil.**

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The duckweed growth inhibition test (ISO/WD 20079) was used as part of different test batteries to assess the contamination of soil eluates. Soils, contaminated with different original contamination of PAH, mineral hydrocarbons, heavy metals and explosives, were tested. The fast (168 h) and reproducible chronic test with a higher plant revealed to be highly sensitive to contaminants but tolerant to non-toxic interferences like fertilising compounds, coloured or turbid solutions. The duckweed tests fill the large gap of higher plant in routine toxicity testing of wastewater and soil eluates. Using image analysis all observations were quantified automatically, in full compliance with OECD and ISO standards thus minimising workload and maximising significance of the results. Image analysis is a new key technology to assess effects (size, colour, number, mobility) in tests with higher organisms like daphnids, collembols and nematodes.

Keywords: duckweed, bioassay, image analysis, soil, risk assessment, heavy metal, PAHs.

ORAL SESSION 06. ECOTOXICOLOGY

RecA-lux fiber-optic biosensors to genotoxics.

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Conservation of water resources calls for stricter regulatory measures and better monitoring systems. Whole-cell bacterial sensors have been genetically engineered by Prof. Shimshon Belkin (Hebrew University) to react to target toxicants by the induction of a selected promoter and the subsequent production of bioluminescent light through a recombinant lux reporter. Our laboratory has designed a one-step assay, that is self-contained, disposable and based on an optical fiber sensor module that integrates these microorganisms and a customised photodetector system. A first generation field-operable single photon-counting photomultiplier tube-based instrument has been constructed and tested in the field. Optical fiber cores and endfaces were covered with multiple adlayer films consisting of calcium alginate containing bioluminescent bacterial bioreporters to genotoxics. These whole cell optrodes have been shown to be responsive to external traces of DNA damaging agents, such as mitomycin C. Light production is dose-dependent and proportional to the number of bacterial layers. In order to standardize the data, all fiber probes were assayed for colony forming unit counts by dissolving the calcium alginate layers right after use and plating the cells onto growth agar media. A number of experiments have been carried out on the optimisation of the system, that include finding the right bacterial population density count in the starter probe construction and to evaluate the physiological phase which would provide us with the most efficient luminescence, including early, medium and late exponential. In addition, we have synthesised a number of chemically modified alginates in order to bring about some new properties such as the binding of biotinylated alginate beads to avidin-coated fiber optics and PEG-alginates to modulate the chemical properties of the entrapment matrix. Our system has been tested at TECHNOTOX in both Mol (Belgium) and at the Hackensack Meadowlands in New Jersey (USA) using both spiked and real life samples.

Keywords: biosensor, DNA, genotoxicity.

ORAL SESSION 06. ECOTOXICOLOGY

Phytoplanktonic lipid oxidation products: novel bioindicators of organic matter's quality.

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The study of the photodegradation of lipids in senescing cells of phytoplankton allowed to identify a pool of photoproducts, enough stable and specific to play the role of tracers of photodegradative processes. These biomarkers, associated with autooxidation products of the same parent compounds, appeared to be useful to estimate the physiological state of phytoplanktonic communities, as well as the residence time of organic matter in the marine environment [Marchand & Rontani, 2001, Org. Geochem.]. In order to check the potentialities of these tracers, two types of studies were realised: (i) the follow-up of the natural senescence of phytoplanktonic culture, to draw a parallel between the evolution of the compounds and the mortality and (ii) the analysis of particulate matter samples, to compare the sensitivity of these tracers with that of the traditional indicators of detrital properties (C/N, pheopigments). These compounds constitute useful and sensitive bioindicators of the state of organic matter.

Keywords: biogeochemical cycles, tracers, oxidation products, organic matter, detrital characteristics.

ORAL SESSION 06. ECOTOXICOLOGY

Bacterial detection of the toxicity of dioxins (PCDDs), furans (PCDFs), and polychlorobiphenyls (PCBs).

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Polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDD/Fs) and biphenyls (PCBs) are three related compounds of toxic organochlorinated pollutants that are often found together in environmental and biological samples. To date, hazardous effects due to these compounds have been studied using higher eukaryotic cells and have been shown to cause several adverse responses due to physiological changes, such as chromatin disruption, and induction in the transcription of specific genes. However, in this study, it was found that these compounds also induce several specific stresses in bacterial cells, as they do to fish or mammalian cells. Four different recombinant *Escherichia coli* with specific stress promoters, *recA* (responsive to DNA damage), *katG* (oxidative damage), *fabA* (membrane damage) and *grpE* (protein damage) promoters fused to the *lux* operon from *Vibrio fischeri* were used in this study to classify the stress responses due to dioxins. In addition, a recombinant bacterium with the *lac* promoter fused to the *lux* operon was used to detect cellular toxicity due to PCDD/Fs and PCBs.

Keywords: PCDD/Fs, PCBs, cellular toxicity, stress response, recombinant bioluminescent bacteria.

ORAL SESSION 06. ECOTOXICOLOGY

Early embryonic cell cycle for risk assessment of pesticides.

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Cell cycle mechanisms are highly conserved from unicellular eucaryotes to complex metazoans including humans. Abnormalities in the regulation of the cell cycle result in death or diseases such as cancer. We have analysed pesticide-induced dysfunction in the first cell division following fertilisation in sea urchin, proved to be a powerful model for cell division studies and which offers the opportunity to analyse synchronous cell division in the absence of transcriptional control. We show that some pesticides provoke a change in the timing of the first cleavage, without affecting chromosome behaviour during the mitotic process. The effect was further analysed at the molecular level and was shown to impede the activation of the CDK1/ cyclin B complex, the universal regulator of M-phase. Embryonic cell cycle therefore allows assessment of risk from environment pollutants at the molecular level.

Keywords: pesticide, ecotoxicology, bioassay.

ORAL SESSION 06. ECOTOXICOLOGY

Effect of pH on As(III) and As(V) toxicity on luminescent bacteria.

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Arsenic is widely distributed in the environment because of its natural existence and its use as herbicide and pesticide in agriculture. The toxic effect of arsenic cannot be merely accounted for by measuring its concentration since toxicity, bioavailability and mobility will also depend on chemical speciation. The toxicity of selected ionic compounds arsenite and arsenate was investigated by use of Microtox bioassay, which uses the luminescent bacteria *Vibrio fischeri* as the test organism. For these two compounds, the effect of pH on toxicity was investigated. Concerning As(V) toxicity, a diminution of toxicity with the decrease of pH corresponding to H_3AsO_4 , H_2AsO_4^- , HAsO_4^{2-} and AsO_4^{3-} species was found. In the case of As(III), in the range of pH studied, any significant difference on toxicity was noticed. EC50 and threshold concentrations for both As(III) and As(V) in each experimental conditions were determined.

Keywords: arsenic speciation, toxicity, *Vibrio fischeri*.

ORAL SESSION 06. ECOTOXICOLOGY

Effects of repeated applications of copper sulfate on the *Rhizobium leguminosarum* populations.

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Copper sulfate has been used in vineyard soils since 1885 resulting in copper accumulation in soils. The impact of copper contents was investigated on the size and the diversity of *Rhizobium leguminosarum* biovar *trifolii* populations in Burgundian vineyard soils with increasing copper concentrations (range 50-340 ppm). The populations were characterised with the most probable number method and with the 16S-23S rDNA IGS types. The results show that high copper contents may modify both the size and the structure of these rhizobial populations.

Keywords: copper, *Rhizobium*, impact.

ORAL SESSION 06. ECOTOXICOLOGY

The LUX-FLUORO test as a bioassay for shedding light on environmental pollutants

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The LUX-FLUORO-Test is a combination of two bioassays in genetically modified bacteria, that measures genotoxicity (SOS- LUX-Test) and cytotoxicity (Lac-FLUORO Test) of substances and mixtures of substances simultaneously. In the SOS-LUX Test the SOS-response, a cascade of functions, which is induced in bacterial systems in presence of DNA-damaging agents, is coupled to the expression of lux genes responsible for the formation of bioluminescence. The light emission is damage-proportional. The analogue LAC-FLUORO Test detects the cellular responses to cytotoxins. It is based on the constitutive expression of green fluorescent protein (GFP) and reacts with a dose-dependent reduction of GFP-fluorescence in response to cytotoxic agents. Both bioassays can be performed in parallel in the same well of a microplate in a luminometer-fluorometer-photometer combination. Its potential for automation predestines this test for routine application in environmental monitoring.

Keywords: new analytical approaches bioassay, genotoxicity, cytotoxicity, gfp, lux, LUX-FLUORO Test

ORAL SESSION 07

STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE*In the memory of Dr. Gareth RIELEY*

This special session on applications and developments in stable isotope mass spectrometry in the field of environmental science is being held in memoriam to Dr Gareth Rieley (1969 - 1998). Gareth's tragically short but immensely successful career was aimed at understanding the factors which control the isotopic fractionations at the molecular level in organic components of biological and environmental significance. We celebrate his dedication to research in this field through this stable isotopes session and also through an award being launched at this year's meeting. We are proud to announce the European Young Researcher of the Year Award, which will recognise the achievements of young researchers who have made an outstanding contribution to our scientific understanding of Environmental processes. Nominations are invited through the ACE website (www.u-bourgogne.fr/ACE). The first award will be presented in Geneva in 2002.

 $^{13}\text{C}/^{12}\text{C}$ ratios of individual low-molecular weight organic compounds in river water

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Recently compound-specific carbon isotope analyses were applied to organic pollutants in sediments and groundwater in order to differ sources of organic pollutants or to evaluate biodegradation processes. This study provides a method for the determination of individual $\delta^{13}\text{C}$ -values of lipophilic organic contaminants in river water. Water samples were taken from a longitudinal section of the Lippe River (Germany). After extraction GC-MS and irm-GC-MS analyses were carried out to identify a wide range of anthropogenic pollutants and to determine their $\delta^{13}\text{C}$ -values. Standard deviation of $\delta^{13}\text{C}$ -values for an internal standard substance was less than 1 ‰ showing the reliability of the method. In contrast, $\delta^{13}\text{C}$ -values of riverine contaminants showed variations of up to 4 ‰. Hence, different sources of organic matter along the river are reflected by measurable changes of carbon isotope signatures. Molecular distributions and isotopic analyses can therefore be used to identify significant point-sources of riverine organic pollutants.

Keywords: stable isotopes, $\delta^{13}\text{C}$, river water, organic pollutants, compound specific carbon isotope analysis

ORAL SESSION 07. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Assuming equal ^{13}C discrimination during decomposition for C_3 and C_4 residues significantly affects replacement calculations.

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We studied the effect of assuming equal ^{13}C discrimination upon decomposition of C_3 and C_4 residues on the calculations of source (C_3 or C_4 plants) proportions in soil organic matter (SOM) dynamic studies. Two linear mixing models currently used in the literature were tested. One assumed equal discrimination, and the other absence of fractionation of the newly introduced C_4 material. Taylor series approximations were used to assess source proportion uncertainties. For two data sets, including different soil depths and SOM fractions, both estimates of source proportions (%) and stocks of new C_4 material (kg m^{-2}) were significantly affected by the different linear mixing models. Despite the large uncertainty in outputs, assuming equal discrimination systematically underestimates replacements. This has serious implications for estimating SOM half-life based on the stable isotope approach, especially when different soil depths and SOM fractions are concerned.

Keywords: stable isotopes, soil organic matter, uncertainty, linear mixing models.

ORAL SESSION 07. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Tracing atmosphere - biosphere sulphur exchange: S and O isotope ratios in spruce needles.

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Sulphur cycle was investigated in a polluted area of Karkonosze Mts., SW Poland. During spring, sulphate contents were lower and organic sulphur contents were higher compared to winter sampling. In contrast to both concentration values and O-isotope ratios in sulphate, S isotope ratios in sulphate and organic sulphur increased with increasing altitude. Spring S-sulphate isotope ratios ($\delta^{34}\text{S-SO}_4$) were about 1.9 permill higher than that in winter, but S organic isotope ratios ($\delta^{34}\text{S-S}_o$) were similar in both seasons. Older needles show higher S-isotope values than younger ones. These relationships argue for an intense reduction of sulphate, which is the source of hydrogen sulfide and ^{34}S -depleted organic sulphur. Winter and older needles indicate an advanced oxidation. Higher differences between $\delta^{34}\text{S-SO}_4$ and $\delta^{34}\text{S-S}_o$ are observed when dust is more abundant. We believe that dust may limit foliar ventilation and may reflect conditions, which are closer to S-isotope equilibrium in the sulphate-organic sulphur system.

Keywords: stable isotopes, sulphur, oxygen, plants response, SO_2 .

ORAL SESSION 07. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Isotope fractionation of organic contaminants, a perspective to characterise microbial in-situ degradation.

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In contaminated aquifers a decrease of pollutant concentration downstream of the contaminant plume could have many reasons like dilution, sorption and biological degradation. However, only biodegradation leads to a sustainable contaminant reduction. Biodegradation of some typical groundwater contaminants like aromatic hydrocarbons and chlorinated solvents leads to an enrichment of ^{13}C and ^2H in the residual fraction. This fractionation process can be described by the Rayleigh-Equation. To characterise biodegradation in-situ, a concept based on the isotope fractionation of organic contaminants has been developed. A variety of contaminated aquifers with distinct geochemistry and hydrology were examined for isotopic fractionation in order to assess in-situ biodegradation. This paper discusses the various aspects of using isotope fractionation to characterise in-situ biodegradation in the context of Natural Attenuation. This concept has the potential to greatly improve ground water remediation strategies.

Keywords: stable isotopes, bioremediation.

ORAL SESSION 07. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Cadmium isotopic fractionation in terrestrial materials.

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Cadmium is a geochemical tracer of natural processes (biological productivity and paleoproductivity) and of anthropogenic emissions (Cd is a toxic heavy metal). It is thus important to know whether Cd fractionates isotopically or not. Fractionation processes have been evidenced in non-terrestrial rocks (Sands et al., Earth Planet. Sci. Lett, 2001, 103-111 and references therein), but this has not been clearly emphasised yet for terrestrial materials (Rosman and De Laeter, Int. J. Mass Spectrom. Ion Phys., 1975, 385-394; Wombacher et al., 2001, Abs. EUG XI, 689). Cadmium isotopes have been measured in a number of terrestrial materials, using a double-spike thermal ionisation mass spectrometry (TIMS) methodology. Preliminary results, obtained on sedimentary materials, suggest that limestones and quaternary corals have isotopic compositions significantly different from shales and greywackes. Very low Cd concentrations are reported for detrital rocks and corals (about 10 ppb), whereas limestones display much higher concentrations, suggesting that Cd is probably trapped during diagenesis.

Keywords: isotope geochemistry, cadmium, terrestrial materials.

ORAL SESSION 07. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

N, O, C and S isotopes as tracers of agricultural contamination in ground water.

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Nitrate is one of the most common and major ground water pollutants of agricultural activities. In Europe, the maximum accepted concentration of NO_3^- in drinking waters is 50 mg/l but often, concentrations in aquifers are higher (up to 500 mg/l). The origin of this contamination could be different: the use of synthetic fertilisers, disposal of animal manure in agricultural fields, livestock manure piles... Two agricultural zones with different fertilisation practises, use of synthetic fertilisers and disposal of pig manure in fields, have been studied. The nitrogen and oxygen isotopic composition of fertilisers and ground waters allow us to distinguish the contamination's origin such as organic or inorganic fertiliser. Chemical analyses coupled with these and other isotopic analysis (^{34}S and ^{13}C) permit to evaluate the fractionation processes (volatilisation, nitrification and denitrification) that change the isotopic composition of pollutant from its disposal on the fields to the contaminated ground water.

Keywords: ground water, nitrate contamination, stable isotopes, tracers.

ORAL SESSION 07. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE**Use of stable isotopes to evaluate the origin and fate of chlorinated hydrocarbons in groundwater.**

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Chlorinated hydrocarbons are among the most common organic contaminants in groundwater. Stable isotope analysis of individual compounds is a new tool to differentiate between different sources of organic contaminants in groundwater and/or to assess biodegradation of these compounds. In the presentation, the effect of dissolution, transport and biodegradation on isotope ratios of chlorinated hydrocarbons is discussed using results from laboratory and field experiments. Furthermore, the application of the isotope method to trace biodegradation is illustrated for a site contaminated with a complex mixture of chlorinated hydrocarbons.

Keywords: groundwater, stable isotopes, chlorinated hydrocarbons, biodegradation.

ORAL SESSION 07. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Historical reconstruction of metallic pollution using a geo-ombrogenic peat bog in Eduens Gallic territory (Bibracte, France).

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Bibracte (Massif Central, Morvan France) was the capital of the Eduens, a great Celtic tribe. An issue is still remaining in this well-known site. It concerns the reasons of the settlement particularly at that place. Beyond the favourable situation, between the valleys of Loire and Saône, the recent discovery of antic mines close to the oppidum opens new prospects. Therefore we measured trace element concentrations and lead isotopic compositions in a peat bog core, located at a few kilometres from the site, to assess the chronology of the anthropisation. Geochemical signals clearly show polymetallic pollution distributed in different periods, from antiquity to modern times. All these phases undoubtedly indicate local mining activities. Although radiocarbon dates are not available yet, pollen analysis seems to indicate that the first pollution occurs before the foundation of the city. Eduens would have been attracted by mineral resources : mainly silver and lead.

Keywords: lead pollution, peat bogs, lead isotopes, antiquity, Eduens, Bibracte.

ORAL SESSION 08

WATER POLLUTION - TOXIC METALS

Arsenic removal from drinking water: adsorption onto pillared clays.

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An Algerian montmorillonite was intercalated either with Fe(OH), Al(OH) or Ti(H) pillars in order to expand the inter-layer space. These microporous solid matrixes were characterised by current physico-chemical solid surfaces techniques. They were used in order to study the adsorption of either As(III) or As(V), at the 200-750 ppb level, from synthetic solutions at various pH values. A comparison was made with common As adsorbents: goethite and ferrihydrite. Although the Al-pillared clay showed bad results, As adsorption rates are 90-99% for all other solids.

Keywords: metal, water treatment, pollutants, contamination.

ORAL SESSION 08. WATER POLLUTION - TOXIC METALS**Electrodialytic removal of Cu, Cr and As from treated waste wood.**

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When CCA (Cu Cr As)-treated wood is removed from service, the contents of copper, chromium and arsenic is still high in many cases, due to the strong fixation of CCA in wood. A method for safe handling of the waste wood and preferable reuse of the resources the wood contains (energy and metals) would be environmentally beneficial. Electrodialytic remediation uses a low level direct electric current as a cleaning agent combined with the use of ion exchange membranes. Electrodialytic remediation of wood chips were investigated. It is found that more than 90% Cu and approximately 85% Cr and As was removed from the wood during remediation. The removed metals are collected into liquids. The use of ion exchange membranes to separate the wood from the electrolytes makes the collection of the metals easier, and reuse of the metals, for e.g. new CCA, may be possible.

Keywords: heavy metals, remediation, waste recycling.

ORAL SESSION 08. WATER POLLUTION - TOXIC METALS**Photocatalytic degradation of sulfonylureas in TiO₂ aqueous suspension.**

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In the last decade, a new class of herbicide, sulfonylureas, has been developed. Under certain conditions, sulfonylureas may persist excessively and interfere with next culture, furthermore they are sufficiently soluble to reach the aquifer. Since heterogeneous photocatalysis is a good technique to destroy organic pollutants in water, we have studied photocatalytic degradation of sulfonylureas using TiO₂ as semi-conductor. In particular, identification of the intermediates allowed us to propose a degradation pathway leading to cyanuric acid as final product. Also attention has been paid to understand the influence of parameters such as adsorption on TiO₂, initial concentration and photonic flux on the photodegradability of sulfonylureas.

Keywords: photocatalytic degradation, TiO₂, sulfonylureas.

ORAL SESSION 08. WATER POLLUTION - TOXIC METALS

Influence of road deposited sediment on trace element concentrations in suspended particulate matter in streams of an urban subtropical watershed, Honolulu, Hawaii.

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The rugged topography of the Hawaiian Islands and frequent high-intensity but short duration orographic rainstorms lead to a high erosion potential. Thus, rainstorms often mobilize significant pulses of terrestrial material and transport them to the ocean. Streams of the small Ala Wai watershed originate near 900 meter elevation, drop to below 100 m over a distance of about 2 km, then continue to the ocean over the next 7 km, passing through the highly urbanized landscape of the capital city of Honolulu. Although the watershed is approximately evenly divided between conservation and urban lands, a population in excess of 250000 and commensurate daily vehicle trips contribute to significant amounts of road deposited sediment (RDS) in urban areas. The RDS contain elevated concentrations of heavy metals, enter storm drains that feed into streams, and contribute to enhanced metal concentrations in suspended particulate matter (SPM) in streams during storms. In this presentation we compare and contrast concentrations of trace elements in RDS and in SPM collected during storms in conservation and urban areas of the watershed.

Keywords: metals, sediment, water.

ORAL SESSION 08. WATER POLLUTION - TOXIC METALS**Bromate study in three water treatment plants.**

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Bromate formation in water is due to bromide oxidation during the ozonation step. They also can come from sodium hypochlorite solution (having a chlorine concentration of 150 g/L) added during the chlorination of water. Bromate has been classified as a supposed carcinogen compound for human by IARC in 1990. Bromate has been introduced in the last European directive 98/83/CE. The concentration shouldn't exceed 10 µg/L in 2008. For this reason, a campaign has been undertaken since April 2000 in the SAGEP water treatment plants: Ivry and Orly plants which are supplied by the river Seine and Joinville plant fed with the river Marne. The most important parameters seem to be the temperature. Bromate concentration is higher in summer than in winter. Bromate concentration present in sodium hypochlorite solution could be important, as high as 700 mg/L. To reduce bromate concentration, ozonation has to be optimised without compromising the disinfecting and the best sodium hypochlorite is recommended.

Keywords: water treatment, bromate, hypochlorite.

ORAL SESSION 08. WATER POLLUTION - TOXIC METALS

Silver solubility resulting from acanthite (Ag_2S) dissolution in dilute KNO_3 is reduced by model sulfides and humic acid.

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Environmental concern related to silver revolves around its toxicity to microbes and aquatic organisms. Silver toxicity is mitigated by complexation, and by the formation of highly insoluble acanthite (Ag_2S) which removes Ag from the water column into the less accessible sediment phase. Under oxidizing conditions, however, low concentrations of silver may be released from sediments into overlying oxic waters. Silver complexation by dissolved thiolic functional groups may also enhance acanthite dissolution. We investigate the effect of model sulfides and humic acid on the dissolution of acanthite (1 mM KNO_3 , pH 6) under aerobic conditions. Results suggest that Ag may be mobilized from sediments since the sulfide in acanthite is readily oxidized with, concomitant reduction of Ag(I) to Ag(0) and release of Ag(I) into solution (150 micromolar). Sulfides in solution (e.g., 0.5 micromolar cysteine) however, strongly limit Ag solubility (<0.1 micromolar) and depress Ag reduction.

Keywords: acanthite, sulfide oxidation, silver, thiols.

ORAL SESSION 08. WATER POLLUTION - TOXIC METALS

Recycling of waste iron sulfate via synthesis of potassium ferrate.

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Iron sulfate is mainly generated by the industries of titanium dioxide production and surface treatment of steel. It is considered as a 'waste', and its waste disposal is an economic burden for these industrial sectors. This paper shows the possibility of recycling of iron sulfate via synthesis of potassium ferrate. Dry synthesis of potassium ferrate consists of the reaction between iron sulfate with chlorine in KOH medium. The process is achieved at about 20 °C and the overall reaction is exothermic. Effects of various parameters on the synthesis efficiency are investigated. In optimum conditions, more than 60 % of iron content is converted into hexavalent state. Potassium ferrate is used for different applications such as water and wastewater treatment, effluent decontamination, soil remediation, cyanide destruction, etc.

Keywords: waste iron sulfate, recycling, potassium ferrate synthesis.

ORAL SESSION 08. WATER POLLUTION - TOXIC METALS**Trace element signatures of suspended matter from six major rivers in southwest France.**

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Particulate fluxes mainly control the fluvial transport of trace elements and metallic pollutants. Therefore, monitoring pollutant fluxes and understanding transport mechanisms require reliable information on amounts and composition of suspended particulate matter (SPM). We present a fingerprint composition of particulate matter transported by the six main rivers at the continent/ocean interface in southwest France (Garonne, Dordogne, Isle, Charente, Adour and Gaves Rivers). Grain size distribution and concentrations of particulate organic carbon (POC), Fe, Mn and trace elements (e.g. Cd, Zn, Pb, Cu, As, Au, Hg and U) from the different basins are compared and the influence of the flow regime is discussed. At normal flow, ore deposits and mining in the upper reaches of the drainage basins significantly influence the trace element composition of fluvial SPM. At high flow, material from the whole basin may be eroded and mask the signal.

Keywords: pollutants, fluvial transport, suspended particulate matter, trace elements.

ORAL SESSION 09

ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE**Capillary electrophoresis - electrospray ionization / mass spectrometry of natural organic matter (NOM): a challenge in analytical chemistry.**

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Natural organic matter (NOM) is a highly complex, polydisperse mixture of naturally occurring polyelectrolytic organic compounds whose average residence time in the hydrosphere is substantially greater than that of ordinary biomolecules such as carbohydrates and proteins. NOM includes, but is not limited to, aquatic humic and fulvic acids, and much that is known about NOM is based on studies of those humic substances. The chemical and biological properties (rates and mechanisms of transformation, bioavailabilities, toxicities) of other natural and xenobiotic constituents of natural waters are often affected substantially by their interactions with NOM. Those interactions, in turn, are influenced by the physical-chemical properties of NOM. This presentation presents analytical (CZE, CZE-ESI/MS, ESI/MS) and preparative (FZE) electrophoretic methods currently developed and used in our group for the purpose of characterization of the charge, mass and charge states in NOM mixtures. Theoretical (based on structural models and separation simulations in free zone) and experimental approaches are presented.

Keywords: capillary electrophoresis coupled with electrospray mass spectrometry, natural organic matter, humic substances.

ORAL SESSION 09. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Metalloid speciation for environmental biomonitoring: analytical challenges and new approaches.

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Speciation analysis is indispensable for obtaining impact-related information about the state of our environment and has to be advanced for environmental biomonitoring. Corresponding analytical developments for metalloids are demanding because of the complex nature of the collected specimens, the low concentrations of the analytes, the species transformations within biological systems and the necessary high level of quality assurance. We have developed total analytical procedures for the speciation of antimony and arsenic. Investigated specimens include plant and animal tissues. The treatment of the original samples including their conservation will be discussed with a focus on different extraction approaches. Various modes of the on-line coupling of HPLC with HG-AAS and ICP-MS, respectively, will be evaluated also from the point of view of species transformations and quality assurance. Further demands and challenges for the speciation of both metalloids in biomonitoring samples will be discussed.

Keywords: speciation, trace analysis, metalloids, bioindicators.

ORAL SESSION 09. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Assessment of composts maturity by spectroscopic and thermal analyses.

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Waste recycling in agriculture is recognised as a promising alternative to solid waste management. Organic waste materials need to be properly processed previous to soil application in order to provide a mature, stabilised organic material closely resembling humic substances produced under natural soil conditions. The aim of the present work is to assess the maturity degree reached by a number of composted materials obtained from domestic solid wastes sampled at different composting times and in the final composts by means of spectroscopic techniques such as Excitation-Emission-Matrix (EEM) fluorescence spectroscopy and Fourier transform infrared spectroscopy (FT-IR), and thermal analysis in Differential Scanning Calorimetry (DSC). EEM spectra indicated the presence of two different fluorophores. The fluorescence intensities of these peaks showed trends related to the maturity of composts. FR-IR spectra exhibited changes in the relative intensity of peaks with composting time. DSC thermograms showed endothermic and exothermic peaks occurring at temperatures related to the chemical structure and thermal stability of samples.

Keywords: waste recycling, composted materials, humic substances.

ORAL SESSION 09. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Detecting endocrine disrupting compounds by fast impedance measurements.

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Xenoestrogens, a diverse group of environmental chemicals, mimic estrogenic actions and has adverse effects on human health. Here we describe a novel, class-selective detector that uses fast impedance measurements to monitor the binding of estrogen and xenoestrogens to a native estrogen receptor. We embedded the receptor in synthetic lipid bilayers attached to gold electrodes. Estrogen binding to the receptor-modified electrode is immediately followed by conformational changes in the lipid layer, which are detected by fast impedance measurements. The characterisation of changes in the bilayer structure allows quantification of the binding event. To assess the effectiveness of the method for detecting environmental estrogenic chemicals, we chose two classes of xenoestrogens: bisphenol-A, a synthetic xenoestrogen, and genistein, a phytoestrogen-ililiter solution This system is highly sensitive and amenable to use in the field, providing an efficient and economic tool for measuring minuscule amounts of endocrine disrupting chemicals in environmental samples.

Keywords: endocrine disrupting, xenoestrogens, impedance, environmental pollutants.

ORAL SESSION 09. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Environmental data management: case studies in USA and Europe.

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Site characterisation and assessment with the Data Management Software EQuIS (Environmental Quality Information System): case studies in USA and Europe. EQuIS is being adopted by regulatory agencies and a growing number of European corporations. Together with ArcView GIS, the system allows for the integration of a wide range of analytic tools for the environment. EQuIS allows you to report and graph your data and maintain high data quality and consistency. EQuIS promotes data sharing and interfaces to statistics, reports, graphs, advanced 3D visualization, boring logs, modeling, and many other systems for the display and analysis of soil and groundwater data. Data is processed more rapidly and effectively leading to more thorough analysis and greater certainty in decision making.

Keywords: data management, soil and groundwater, site assessment, monitoring, remediation, GIS.

ORAL SESSION 09. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

A novel technique for optical diagnostics of air pollutants by microwave breakdown spectroscopy.

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For accurate, quantitative, in-situ, and remote measurements of air pollutants, a new technique of pulsed microwave breakdown spectroscopy (MBS) has been developed. The basic idea is the remote optical diagnostics of the atomic/molecular spectra emitted from the microwave breakdown plasma of the atmosphere mixed with various kinds of air pollutants at relevant breakdown point in open space. For this objective a small test chamber composed of an evacuation system and a wavelength/duration-time resolved spectroscopy system was constructed. A magnetron of 9.4 GHz and 100 kW-maximum-rate is operated with pulse width of 5 micro-second and repetition rate of 10 Hz. The microwave pulse beam is focused on a center of the test chamber to generate the test gas plasma. This talk deals with the basic concept of MBS, the outline of the apparatus developed recently, and the preliminary results obtained from nitrogen/ CCl_2F_2 mixture measurements.

Keywords: air pollutants, optical diagnostics, microwave breakdown spectroscopy

ORAL SESSION 09. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Biodegradation of 2-substituted benzothiazoles by two strains of *Rhodococcus* : study by nuclear magnetic resonance (¹H-NMR).

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Benzothiazoles are a group of xenobiotics, heterocyclic chemicals, which are widely used in industrial processes, especially in the manufacture of rubber chemicals, but also for agricultural purposes as herbicide or fungicide. They enter the environment by routes associated with their manufacture and their use, and have been detected in many environmental compartments. We are studying the biodegradative pathways of several 2-substituted benzothiazoles by *Rhodococcus* strains (isolated from activated sludges of waste water treatment plant) using either classical analytical method (high performance liquid chromatography - HPLC) or also *in situ* ¹H NMR, performed directly on culture medium without any previous step of purification. Both methods are qualitative and quantitative. The metabolites formed during the biodegradation were identified using long-range ¹H-¹⁵N heteronuclear shift correlation (gHMBC) at natural abundance, as well as mass spectrometry. A common intermediate corresponding to a hydroxylation reaction in position 6 on the aromatic ring was evidenced (Besse et al., Appl. Environ. Microbiol., 2001, 67,1412).

Keywords: biodegradation, benzothiazole, NMR

ORAL SESSION 09. ANALYTICAL METHODS FOR ENVIRONMENTAL SCIENCE

Multi-component gas analysis with novel infrared detectors.

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A novel portable gas monitoring system allowing rapid multi-component analysis based on a fixed array of QWIPs (quantum well intersubband photodetectors) is being developed, in which the photodetectors are tailored to measure at specific infrared wavelengths. Applications for such a system would include multi-component gas analysis in the environment e.g. monitoring gases at landfill sites. The wavelengths measured in the array are chosen with variable selection using multivariate linear regression (VS-MLR) to determine combinations of wavelengths that give the lowest errors of prediction. In this case calibration models were built for CO, CO₂, N₂O, and CH₄. From these models, the variable set relating to measurements at 2.9μm, 3.25μm, 4.35μm and 4.73μm, was found to give good predictions. To simulate the expected response with an array of detectors measuring at these wavelengths, calibrations using filters at these wavelengths were performed. The next stage of the work will be the development of the QWIP detectors to measure at these wavelengths.

Keywords: gas analysis, variable selection, multivariate linear regression, QWIPs, infrared detectors.

ORAL SESSION 10

SOIL POLLUTION - ORGANIC POLLUTANTS**Micro-organic contaminant fluxes in simulated sediment-water columns.**

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Many micro-organic contaminants (MOCs) associate strongly with natural sediments and the impact and ultimate fate of MOCs entering a water body is therefore influenced by processes occurring at the sediment-water interface and within the sediment bed. Described here are laboratory investigations in which mesocosms are used to study the fluxes and fate of MOCs in simulated sediment-water columns, composed of a sediment bed with overlying freshwater. Selected compounds (the pesticides simazine, lindane and permethrin, and the endocrine-disrupter nonylphenol) were introduced into either the sediment or water phases and fluxes within the column were monitored over time. Results are presented from experiments to study the influence of diffusion, sorption/desorption and degradation on MOC fluxes and fate. Also presented are results of experiments to assess the additional influence of bioturbation by sediment-dwelling, pollution tolerant, oligochaete worms. The implications of these results for field situations are discussed and future work directions described.

Keywords: micro-organic contaminants, pesticides, sediments, sorption, bioturbation.

ORAL SESSION 10. SOIL POLLUTION - ORGANIC POLLUTANTS

Investigations of the use ethylene oxide-propylene oxide block copolymeric surfactants for the removal of coal tars from manufactured gas works' soils.

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Ethylene oxide-propylene oxide block copolymeric surfactants have been investigated as being of potential benefit for the removal of coal tars and associated polyaromatic hydrocarbons (PAHs) from soils and rocks. Successful soil remediation may be achieved either by solubilisation in surfactant micelles or by mobilisation of the coal tar through reduction of interfacial tensions and middle phase formation. Surfactant adsorption at the aqueous mineral interface reduces the efficiency of solubilisation but may aid removal of the coal tar through changes in mineral wettability. In our investigations we have examined: 1. solubilisation of exemplar PAHs as well as PAH removal from an authentic manufactured gas work's soil; 2. surfactant adsorption at aqueous, soil and model mineral interfaces; 3. interfacial tensions and wetting angles for coal tar- aqueous surfactant systems and 4. the impact of surfactants upon capillary pressure water saturation relationships for saturated porous media. Finally these issues have been investigated as a function of changing surfactant molecular structure thereby providing some indication of how the changing balance in hydrophobic and hydrophilic block lengths affect observed behaviour.

Keywords: soil, PAHs, surfactant, remediation.

ORAL SESSION 10. SOIL POLLUTION - ORGANIC POLLUTANTS

Solid state technology for the reductive elimination of polychlorobiphenyls (PCBs) from contaminated soils.

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In this work we present an experimental study on an innovative mechano-chemical treatment for PCBs abatement in contaminated soil. A sample of soil from a controlled landfill, has been mixed with solid hydrides as NaBH_4 or LiAlH_4 using two different ratios hydride/soil, 5% and 2.5% w/w. The reaction, carried out by high energetic milling, changes the chemical and physical characteristics of the soil only by impact and compression between milling bodies. The efficiency of the dehalogenation/hydrogenation reaction has been studied as a function of the milling time (3.5 up to 30 hours). After each run, the total PCBs content and the production of chloride ions were measured. Complete abatement (100%) has been obtained with a starting PCBs concentration of about 2600 mg/kg using NaBH_4 (98% with LiAlH_4). Biphenyl and chloride salts were obtained, no other toxic or hazardous by-products having been generated.

Keywords: polychlorobiphenyls (PCBs), mechanochemical, dechlorination, hydrogenation, high energy milling.

ORAL SESSION 10. SOIL POLLUTION - ORGANIC POLLUTANTS**Physico-chemical behaviour of anionic surfactants in coal tar contaminated soil systems.**

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The removal of organic pollutants from soils is an important aspect of contaminated land remediation. Kinetic experiments reported in the literature indicate that surfactants affect solute desorption in two ways: by providing a micellar medium which has a high fugacity capacity and which thus provides a fugacity gradient along which organic contaminants will travel and by affecting mass transfer from the complex matrices such as coal tars. Removal may be greatly facilitated by the use of aqueous surfactant solutions. Surfactant loss through adsorption at the soil water interface represents an unacceptable cost to the remediation process and should therefore be minimised. In order to maximise surfactant efficiency in remedial processes “loss” of surfactants due to mechanisms such as adsorption and precipitation ought to be quantified. The work currently undertaken investigates the physico-chemical behaviour of two anionic surfactants, SDS and AOT, in a range of soils, including sand and clay, both clean and coal tar contaminated. To assess these changes adsorption at the soil water interface for three phase systems was examined using the Du Noüy Ring Detachment method using a Torsion Balance. Results so far indicate that anionic surfactants actually desorb soil humic substances such as organic acids from the soil and incorporate them into the micellar phase, rather than adsorb onto the soil themselves. This results in lower interfacial tensions and critical micelle concentrations. Further investigations are necessary in order to gain a fuller understanding of these synergistic effects in contaminated soil/surfactant systems. Moreover these effects may in fact increase the engineering performance of surfactant facilitated desorption systems. Finally the study allows an assessment of surfactant efficiency and the results should be valuable for the construction of a model predicting clean-up efficiencies of surfactants in various soil systems.

Keywords: soil, surfactant, coal tar, organic pollutants.

ORAL SESSION 10. SOIL POLLUTION - ORGANIC POLLUTANTS

Biotransformation of nonylphenol surfactants in soils amended with contaminated sewage sludges.

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Nonylphenol ethoxylates are widely used nonionic surfactants which accumulate in sewage sludges. The aim of the present work is to investigate the biotransformation of NP in a soil amended with NP-containing sludges from two distinct origin. In the soil incubated in the presence of NP, almost 30% of initial pollutant amount were mineralized in a two-phase process: a rapid phase during a first 20-day period then followed by a slow increase until 100 days. When the soil was amended with the sludge from Bordeaux (33) , NP mineralization followed a similar pattern, but carbon dioxide production was enhanced to 52% at the end of the incubation. Finally, the amendment of soil with a sludge from Plaisir (78) resulted in a 10-day lag phase followed by a sigmoid-shaped carbon dioxide production to the final value of 48%. Seven filamentous fungal strains have been isolated and identified from the soil/sludge mixtures. All were able to transform NP in liquid cultures. In addition, the ligninolytic strain *Trametes versicolor* had also been studied for its ability to transform NP. It catalyzed both the conversion of NP into carbon dioxide and the polymerization of the phenol to produce macropolymers. Laccases are fungal oxidases involved in NP transformation.

Keywords: sewage sludge, soil, alkylphenols, fungi, enzymes, biotransformation.

ORAL SESSION 10. SOIL POLLUTION - ORGANIC POLLUTANTS

Use of Fenton's reagent to degrade polycyclic aromatic hydrocarbons in sludge samples

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Polycyclic aromatic hydrocarbons are ubiquitous pollutants. They are frequently found in the environment, especially in solid matrices such as soils, sediments, and air particulate matter. Despite their very low solubility, these compounds are also found in waters, especially in wastewaters. As a consequence, when waters are to be treated, PAHs accumulate into the sludge due to their hydrophobic character and resistance to biodegradation. As a consequence, the use of sewage sludge as a soil amendment remains uncertain in the future. In such a context, we investigated the feasibility of using the Fenton's reagent ($\text{Fe(II)}\text{-H}_2\text{O}_2$) to degrade PAHs in sludge samples. We studied three PAHs that are frequently analyzed in sludge samples : fluoranthene, benzo(b)fluoranthene and benzo(a)pyrene. PAHs were first desorbed into an aqueous solution, before being submitted to hydroxyl radical oxidation. Special care was required to enable PAHs desorption and to minimize their adsorption onto the walls of the recipients.

Keywords: remediation, Fenton, PAH, sludge.

ORAL SESSION 10. SOIL POLLUTION - ORGANIC POLLUTANTS

Degradation of phenylurea pesticides under oxidative conditions: influence of the structural factors.

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The contamination of natural waters by pesticides sometimes exceeds the concentration limits allowed for drinking water. The elimination of the pollutants can be achieved through reactions involving OH^\bullet radicals, ie by oxidation with ozone alone or associated with hydrogen peroxide, or by Fenton's reagent. In this communication, we present degradation studies performed on series of phenylurea herbicides of closely related structures. After solid-phase extraction for monitoring, by-products were characterized by mass spectrometry (MS and MS/MS) and quantified by liquid chromatography (HPLC-UV). Furthermore, ^{14}C radiolabelled experiments were undertaken for the evaluation of mass balances and CO_2 production. The degradation products were mainly originated from hydroxylation, dechlorination/hydroxylation and N-demethylation (through amide and/or carbinolamine intermediates) processes. Degradation schemes and kinetics appeared clearly dependent on the structures of the phenylureas. A tentative explanation of the observed effects will be given with regard to the reaction conditions.

Keywords: pesticide, analysis, degradation.

ORAL SESSION 10. SOIL POLLUTION - ORGANIC POLLUTANTS

Pesticide residue analysis of fruit and animal extracts using liquid chromatography-orthogonal acceleration time of flight mass spectrometry (LC-*oa*TOFMS).

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Pesticide residue screening of environmental samples can be extremely challenging, sometimes involving in excess of one hundred target compounds. Many pesticides are amenable to analysis by GC-MS. However, thermally labile or polar compounds present the residue analyst with a difficult problem particularly at the low ppb reporting levels demanded by regulatory authorities. With the advent of robust and sensitive atmospheric pressure ionisation sources, LC-MS has become the method of choice for the screening and confirmation of pesticides not amenable to GC-MS. In this paper we describe a novel screening method for 17 pesticides in fruit extracts and birds of prey using elevated resolution with exact mass measurement on an LC-*oa*TOFMS. We highlight the selectivity of exact mass chromatograms relative to nominal mass data and mass measurement accuracy obtained using a single lock mass infused into a dedicated ESI probe of a dual API ion source.

Keywords: pesticide, analysis, mass spectrometry.

POSTER SESSION 01

AIR POLLUTION - TOXIC METALS**Speciation of trace and major elements in coal ash of "Nikola Tesla" power plants (Obrenovac, Yugoslavia).**

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Composite samples of filter ash obtained by coal combustion in "Nikola Tesla" power plants were subjected to the sequential extraction procedure comprising of following extractants: 1) distilled water (to remove adsorbed fraction), 2) 1 M ammonium-acetate (to leach ion-exchangeable fraction), 3) 0.4 M oxalic acid and 0.4 M ammonium-oxalate (to dissolve oxides of iron and manganese), acidic solution of hydrogen peroxide (to dissolve organic substance) and 6 M HCl (to wash portion of residual fraction). It was found that largest portion of all of the elements examined was leached in the last, environmentally insignificant phase. The second largest fraction of all of the elements was leached in the third phase, with the exception of zinc, lead (organic phase is second most abundant), arsenic and silicon (ion-exchangeable phase is second most important). The significance of obtained results on predicting the pollution by examined elements due to coal ash dumping was discussed.

Keywords: coal ash, trace elements, major elements, speciation, pollution.

POSTER SESSION 01. AIR POLLUTION - TOXIC METALS

Influence of acidity of extractant on leaching of trace and major elements from coal ash "Kosovo A" power plant in Obilic (Yugoslavia).

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Composite samples of filter fly ash, filter bottom ash, as well as two samples of dump ash from Kosovo A located in Obilic near Pristina (Yugoslavia) were subjected to extraction by buffers solutions of different pH ranging from pH 3 to pH 7 in order to establish possible pollution by trace and major elements from ash obtained by coal combustion under different circumstances (naturally acidic rain, acid rain, different spills) that can be present in the nature. Although ash obtained in this power plant differs a lot from ash samples obtained in other plants in Yugoslavia, the effects of pH change on leaching of different trace and major elements was the same. The decrease of pH increased the amount of all of the elements examined. The obtained results were related to the possible changes of pH that can be present in the environment, and conclusions regarding potential pollution were drawn.

Keywords: coal ash, acid leaching, pollution, trace elements, major elements.

POSTER SESSION 01. AIR POLLUTION - TOXIC METALS

A clean and cost effective approach for electric arc furnaces dust treatment.

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Currently worldwide steel production through electric arc furnaces generates more than 3,700,000 t/y of dust. This dust, known as electric arc furnace dust (EAFD) is a hazardous waste due to the presence of leachable heavy metals such as Zn and Pb in appreciable amounts and Cd, Cr(VI) etc. in trace amounts. In this paper a closed loop zero emission cost effective treatment method for EAF dust is proposed wherein : (i) Conception of in-situ small treatment units which can be integrated to the EAF process avoiding the transportation and storage cost, (ii) leaching of EAFD in mild conditions dissolving only ZnO and other heavy metal components leaving all Fe in the residue which can be suitable for recycling to EAF, (iii) use of electrodialysis technique to generate necessary reagents [HCl and (Na,K)OH] from the alkali metal chlorides content of EAFD, (iv) production of market needed ZnO by decomposing zinc hydroxy carbonate precipitated from purified ZnCl₂ leach solution by (Na,K)CO₃ and (v) use of the generated CO₂ to carbonate (Na,K) OH. Consequently in the whole process no solid, liquid and gaseous wastes are produced.

Keywords: electric arc furnaces dust, electrodialysis, leaching, ZnO.

POSTER SESSION 01. AIR POLLUTION - TOXIC METALS

Tree rings microanalysis by energy dispersive X-ray spectroscopy: towards an historical reconstruction of pollution impact on chemical composition of wood.

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Tree ring widths and chemical mineral composition could provide a record of past and current impact of pollution in forest areas located in the vicinity of industrial sites. In this study, we tested this hypothesis in the Saint Avold forest (Moselle, France), an area previously submitted, during the 70s, to high deposition levels of acidifying compounds due to the activity of a charcoal power plant. Yearly variations of major mineral elements in tree rings of two trees from 5 polluted and 5 remote stands were analysed by X-ray microanalysis (EDS) We observed a significant decrease of calcium content in tree rings during the 70s near the industrial site, in comparison with remote areas. This difference disappeared during the 90s. Finally, EDS microanalysis of tree rings appears as a promising tool for environmental reconstruction of past pollution levels.

Keywords: pollution, mineral, rings, microanalysis X, historic.

POSTER SESSION 01. AIR POLLUTION - TOXIC METALS

Electrodialytic removal of heavy metals from municipal solid waste incineration (MSWI) fly ash.

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This work deals with the application of a method using a dc electric current as cleaning agent to extract heavy metals from municipal solid waste incineration fly ash - a method called electrodialytic remediation. In electrodialytic remediation experiments using a 1.25 % ammonia and 0.25 M ammonium citrate mixture as a desorption agent and a liquid-to-solid ratio of 7.5, 62 % Cd, 5.8 % Pb, 39 % Zn, 59 % Cu and 20 % Cr was removed from 75 g of MSWI fly ash after 2 weeks of electrodialytic remediation. The current density was 0.8 mA/cm. In a similar batch extraction experiment only 43 % Cd, 2.2 % Pb, 23 % Zn, 34 % Cu and 7.6 % Cr could be extracted. After 5 weeks of electrodialytic remediation 81 % Cd, 17 % Pb, 60 % Zn, 74 % Cu and 22 % Cr had been removed.

Keywords: heavy metal extraction, MSWI fly ash, electrochemical treatment.

POSTER SESSION 02

AIR POLLUTION - ORGANIC POLLUTANTS**Decontamination of fly ash via the dechlorination/degradation of dioxins in subcritical water.**

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Most of the dioxins (90%) emitted by municipal waste incinerators are released adsorbed on fly ash. The decontamination of fly ash is already applied at industrial scale in Japan and Germany to decrease the total dioxin release from all streams of municipal solid waste (MSW) incineration to the environment to below $5\mu\text{g}$ TEQ per ton MSW, as proposed in the "new guideline for controlling Dioxins" issued in Japan in 1997. This paper compares the degradation/dechlorination of dioxins in subcritical water (defined as hot water under sufficient pressure to maintain the liquid state) to the thermal degradation/dechlorination under N_2 atmosphere applied at industrial scale. The effect of temperature and pH on mechanisms and kinetics are investigated.

Keywords: dioxins, remediation, fly ash, subcritical water, degradation, dechlorination.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Seasonal variation of organic aerosol in urban Algiers and waste landfill of Algiers city area.

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Both in downtown Algiers and the waste landfill of Oued Smar, the concentrations of particulate organic compounds comprising *n*-alkanes, *n*-alkanoic acids, *n*-alkan-2-ones, polycyclic aromatic hydrocarbons (PAHs), oxygenated (OPAHs) and nitrated polycyclic aromatic hydrocarbons (NPAHs) in ambient air, were measured from May 1998 to February 1999. Motor vehicle were found to be the main source of airborne particles in downtown Algiers, while the combustion and pyrolysis processes and bacterial activity seemed to concur to the air pollution at the Oued Smar waste landfill. The in-situ generation of some OPAHs and NPAHs seemed to contribute to air pollution, especially during summertime. The seasonal variations in ambient NPAH and OPAH concentrations are due partly to fluctuations of precursors including NO_x, O₃ and OH radicals. In general, the wintertime concentrations of the organic pollutants in Algiers were similar to those measured in Europe and especially over the Mediterranean Basin.

Keywords: organic aerosols, PAHs, OPAHs, NPAHs, urban air pollution, waste landfill.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Photodegradation of pyrene on solid phase.

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This study deals with the photodegradation of pyrene on different model supports (SiO_2 , CaCO_3 and Montmorillonite), which are the main constituents of the soils and sediments. The pyrene was mixed mechanically at 1% weight ratio with the support and a thin layer of powder was irradiated by simulated solar irradiation (290 - 800 nm), using a xenon lamp (SUNTEST CPS+ appartus, incident irradiance 765 W/m²). The kinetic study shows that the half live of pyrene varies with the nature of the solid support. A dependence was found in relation with the absorption properties of the support, the amount of pyrene, the moisture and humic substances contain. Irradiation of pyrene gave rise to a great number of transformation products and five of them were identified using gas chromatography-mass spectrometry (GC/MS). Base on this byproduct identification, a possible degradation pathway is proposed, which involve two different mechanisms: the formation of a pyrene radical cation via the singlet state from excited pyrene, and the formation of singlet oxygen produced through the quenching of the triplet state of pyrene.

Keywords: PAHs, photodegradation.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Incorporation and destocking of dioxin in isolated adipocytes of pigs during the lipogenesis and of the lipolysis.

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Obesity was identified like a protective factor with respect to intoxication by dioxins, being liposoluble compounds which can be found integrated in the lipidic vacuole of the adipocytes. The aim of this work was to measure in isolated adipocytes from pigs maintained in suspension in a nutritional medium (Krebs Ringer albuminous) kinetics of incorporation and release of ^3H labelled palmitic acid tritium and ^{14}C labelled [2,3,7,8] TCDD. In conditions of lipogenesis, under effect of increasing quantities of insuline and in the presence of glucose, incorporation of TCDD is concomitant with that of palmitic acid. In the same way, in conditions of lipolysis, under adrenalin added in increasing quantities (from 10^{-7} to 10^{-5} M), the release of the two labelled molecules is also concomitant. These results confirm the risk induced by a too significant state of lipolysis at subjects previously exposed to an impregnation with dioxins.

Keywords: dioxin, adipocyte, lipogenesis, lipolysis.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Lipophilicity and hydrogen-bond basicity of nicotine.

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Skin penetration of organic compounds is important in environmental toxicology as well as in drug design. It is frequently modelled by octanol-water partition coefficients ($\log P_{ow}$) (Abraham, Chadha and Mitchell, J. Pharm. Pharmacol., 1995, 47, 8-16). To avoid synthesis, and analysis, of useless or dangerous compounds, the prediction of these coefficients can be made by physico-chemical parameters. We have shown (Berthelot, Graton, Ouvrard and Laurence, J. Phys. Org. Chem., submitted) that a simple bilinear equation can yield a satisfying estimation of $\log P_{ow}$. The two parameters used are a hydrophobic-cavity formation term, and a hydrogen-bond acceptor ability hydrophilic term. For polyfunctional compounds, this method takes into account the individual components of the apparent overall basicity. Nicotine is a typical example of polyfunctional solute. Indeed, in hydrophobic media, the two nitrogen atoms of the unprotonated nicotine are found to be efficient hydrogen-bond acceptors, and contribute both significantly to its lipophilicity.

Keywords: lipophilicity, nicotine, hydrogen-bond basicity.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS**Exposure to pesticides during amateur applications of home and garden products.**

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Studies to determine exposure of pesticide applicators tend to involve large scale commercial use. Recent studies have generated data which identify potential dermal and inhalation exposure during the application of amateur pesticides, specifically marketed for home and garden use in the UK. Volunteer “amateur” gardeners were observed, but not supervised, while they mixed, then applied a carbendazim pesticide, and decontaminated their equipment. Whole body dosimetry was used, including dosimeters on hands, feet and face. Personal air samplers collected airborne pesticide in the breathing zone. Analysis of the tank mixes prepared by volunteers indicated that the final concentration ranged from 55 to 212 % of the intended concentration. Areas of body most heavily contaminated during mixing were the hands and during application the arms, hands, front torso and feet were most contaminated. Typical contamination rates during application were 20 ml/hour of the diluted tank mix, with applications lasting 10 to 15 minutes.

Keywords: pesticide, air, human exposure.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Heavy polycyclic aromatic hydrocarbons (PAHs) in the environment of Czech Republic.

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Polycyclic aromatic hydrocarbons with molecular weight exceeding 278 u (HMW-PAHs) were followed in various environmental matrices at selected places within the Czech Republic. Laser Desorption/Ionisation - Time-of-Flight mass spectrometry was used as a quick method for the estimation of the HMW-PAHs distribution; high performance liquid chromatography-ion trap mass spectrometry with atmospheric pressure chemical ionisation was employed for their more detailed analysis as well as for their quantitative determination. Compounds with molecular mass up to 450 u were found in some industrial areas contaminated by coal tar conversion processes.

Keywords: high-molecular-weight PAHs, liquid chromatography-mass spectrometry, LDI-TOF

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Towards biological or physico-chemical screening for dioxins?

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Significant advances have been reported in the field of dioxins analysis not only concerning the sample preparation but also the measurement method itself. Advances benefit from the combined use of new extraction and clean-up techniques as well as last developments in the area of mass spectrometry and molecular biology. It is now possible to set up an efficient strategy based on a combination of bioassays and the latest physico-chemical methods. An evaluation of the various approaches to such an efficient large scale monitoring strategy are compared in terms of costs, delays, sample capacity.

Keywords: dioxins, fast methods, monitoring strategy.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Prevention of dioxins de novo formation on sintering process fly ash by using amines compounds.

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Two inhibitors, triethanolamine (TEA) and monoethanolamine (MEA), are tested relating to their ability to prevent the PCDD/Fs formation on sinter plant fly ash. Different parameters (amount of inhibitors, temperature and reaction time) as well as the homologue and full isomer distributions are examined. Both PCDDs and PCDFs concentrations decrease when inhibitors are added. Best results, up to 90 % reduction of the PCDD/Fs formation, are obtained with MEA. The results suggest that the two inhibitors, can reduce the PCDD/Fs formation on sinter plant fly ash under various conditions of temperature and reaction time, making them suitable for use in the real process. Tests performed at a real sinter plant are in good agreement with the laboratory experiments and show that this technique can be interesting for the prevention of PCDD/Fs emissions from sintering processes.

Keywords: polychlorodibenzo-p-dioxins (PCDDs), polychlorodibenzofurans (PCDFs), de novo synthesis, inhibition, fly ash, sinter plant.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Organic petrology in service of environment.

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Organic-petrological methods have proven suitable for revealing nature and provenance of organic materials. This includes organic contaminants found in soils and sediments. Recent studies have demonstrated that the characterisation of organic matter using white and UV-light microscopy within sediment or soil samples is a prerequisite to understand or predict sorption behaviour of organic pollutants (Kleineidam et al., 1999; Karapanagioti et al., 1999, 2000). Organic petrography, a valuable tool to characterise and quantify airborne contaminants (e. g. raw brown coal, hard coal, coke, char) of soils in highly industrialised areas (Kiem et al., in preparation), is going to be further developed. The selected studies show that organic petrology can uniquely contribute to the solution of problems in environmental sciences.

Keywords: organic petrology, sorption, airborne contaminants, coal, coke, char, soils, sediments

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Milk-arterial plasma transfer of dioxins (PCDDs) and furans (PCDFs) in the growing pig (A).

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The aim of this experiment was to study the transfer of PCDD/Fs from spiked milk to arterial plasma in pigs. Pigs, fitted with a permanent catheter in the brachiocephalic artery, have been fed with 900mL milk spiked with a mixture of 17 dioxins. The concentrations were between 50-500pg/g fat. The levels of PCDD/Fs in the serum extracts were determined using HRGC/HRMS prior to milk distribution and at 3h, 5h and 7h after milk ingestion. PCDD/Fs concentrations in arterial plasma increased from 3 to 5 hours after milk ingestion and then decreased. At time point 5h, concentrations were found between 500-10000pg/g fat. The transfer ratio "plasma fat/milk fat" was usually found between 0.7-3%. Moreover, all studied molecules presented a similar kinetic behaviour. Thus, PCDD/Fs milk-arterial blood transfer seems to be independent of physical and chemical properties of congeners.

Keywords: PAHs, dioxin, food, milk, animal, transfer.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

Behaviour of three ^{14}C -radiolabelled polycyclic aromatic compounds in the presence of an inoculum of mixed rumen bacteria.

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Whereas the biodegradation of PAHs was widely studied in aerobiosis, their modifications in anoxic ecosystems, like the digestive tract of ruminants, still remain unexplored. Three ^{14}C radio-labelled molecules (benzo(a)pyrene, phenanthrene, TCDD) were introduced in an anaerobic semi-synthetic medium in the presence of an inoculum of rumen bacteria (n=3). After a 6 hours incubation, the medium was fractionated into two compartments: the extracellular liquid phase and the bacteria, that were themselves parted in "bacteria walls" and "cell content". 20% of the benzo(a)pyrene were recovered in the cell content. Its capability to enter into bacteria probably give evidence of its ability to undergo an enzymatic attack. Phenanthrene entered twice less and TCDD intake was very low (2%). Concurrently, the more the HAP entered the cells, the higher its adsorption on the bacteria walls was (benzo(a)pyrene:50%, phenanthrene:30%, TCDD:20%), suggesting that the adsorption could be a prior step to their biodegradation and their absorption, by improving their contact area with bacteria enzymes. The number of benzenic cycles did not appear to limit the PAHs biodegradation in the rumen.

Keywords: PAH, rumen, bacteria, anaerobiosis.

POSTER SESSION 02. AIR POLLUTION - ORGANIC POLLUTANTS

In vitro study of organic micropollutants through intestinal barrier.

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Food seems to be one of the main ways of animal contamination with polyaromatic hydrocarbons (PAHs) and dioxins. Thus, intestinal absorption has been investigated in vivo and showed different behaviour, but the role of intestinal epithelium remains unknown. Our work aimed at studying in vitro transfer of PAHs and dioxins through intestinal barrier. Caco-2 intestinal epithelial cell line offers a useful model to evaluate intestinal uptake and transport processes of hydrophobic xenobiotics. We used Caco-2 cells cultured on permeable filters to measure transepithelial permeability of ^{14}C labelled phenanthrene, benzo[a]pyrene and 2,3,7,8-tetrachlorodibenzo-p-dioxin, which differed in their physicochemical properties. The results showed that the molecules were able to cross intestinal cell layers. Phenanthrene appeared faster and its level after a six hour-exposure was respectively twice and six fold higher than benzo[a]pyrene and 2,3,7,8-tetrachlorodibenzo-p-dioxin levels. These findings suggested that their intestinal transfer was dependent on molecules physicochemical properties.

Keywords: PAHs, food, dioxin, transfer.

POSTER SESSION 03

WATER POLLUTION - TOXIC METALS**Elimination of heavy metals in wastewater sludge by incineration in a fluidised bed reactor.**

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The wastewater treatment worn produces an enormous quantity of wastewater sludge containing of the trace elements poison and the pathogenic germs. The utilisation and the valorisation of these sludges must be preceded by a reduction and elimination of any risk for the ecosystem. The objective of our work is to study the possibility of processing and valorisation of sludge of the town of Marrakech - Morocco by incineration in a fluidised bed reactor. This technique makes it possible to reduce volume at 70 % and to decrease heavy metals (Cu, Cd, Pb and Zn). The results obtained show a weak rate in contents metal, and especially influenced by the temperature, as an example to 700 °C the rate of elimination exceeds 13 %, 14 %, 29 % and 30 % respectively for Cu, Zn, Cd and Pb. Ashes recovered after the combustion of sludge can be used out of concrete.

Keywords: sludge, incineration, fluidised bed, heavy metals.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

Removal of heavy metals in water by use of roasted coffee beans.

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Adsorption behaviour of heavy metals on the arabica and robusta roasted coffee beans treated in the 5 roasting degrees (light, medium, city, fullcity and french) was investigated. The coffee beans residue after extraction with hot water were suspended in the aqueous solution (pH=ca.6.6) containing the Cu(II) or Cd(II) and the suspension was stirred at room temperature for 180 min. The solid was separated by filtration and the amount of heavy metal remaining in the solution was determined on an atomic absorption spectrophotometer. Adsorption ratios Cu(II) were 6.05 and 79.6% for the light and French roasted coffee beans of Indonesia robusta employed as adsorbent, respectively. However, when the roasted coffee beans were washed with distilled water and then air-dried prior adsorption experiments, the ratios of Cu(II) were 92.1 and 92.6%, respectively and that of Cd(II) was ca. 93%.

Keywords: roasted coffee beans, heavy metals, water treatment.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

Copper fate and mobility in the water column and the surface sediment of a polymictic lake following copper sulfate treatment (Courtille Lake, France).

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Courtille Lake (France) was an eutrophic shallow polymictic lake, which was treated with copper sulfate since four years. Surface water analysis show that 1 year after the last Cu application, dissolved copper concentrations was greater in the water column than for the inlets, suggesting a net flux from the sediments to the overlying water column. Water column monitoring and laboratory experiments show that Cu was strongly complexed by natural organic ligands before and after copper addition. Sequential extraction and resuspension experiments suggest and confirm that a significant portion of the sediment-borne Cu is associated with organic fraction. Significant short-term release was not possible in the pH and oxygenated conditions of the Courtille Lake. But future organic matter mineralisation would release a part of copper sediment, which would explain the presence of copper in the water column one year after the last copper addition (long term release).

Keywords: copper fate, water column, oxic sediment, remobilization, organic matter.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

Heterogeneity and lability aspects of nickel interactions with natural organic matter.

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Nickel is an essential trace metal that is highly toxic at elevated concentrations (carcinogenicity has been verified in mammals). Ni complexes are predicted to be less stable than those for Cu (Irving-Williams series). The low rate constant for water exchange ($3 \times 10^4 \text{ s}^{-1}$, c.f. $7 \times 10^9 \text{ s}^{-1}$ for Pb) may restrict the lability of Ni complexes. The heterogeneity of metal-NOM complexes encompasses the distribution of both thermodynamic stabilities and kinetic dissociation rate constants, which is reflected experimentally in their apparent lability under given conditions. The few published data on Ni-NOM complexation suggest: (i) weak complexes are formed by isolated humic substances and biota-derived ligands (probably because of the high concentration ranges studied), yet (ii) very high K values have been reported for whole water samples. The high K values for whole waters can be rationalised by consideration of the detection window of the analytical methods used and slow Ni dissociation kinetics.

Keywords: metal, organic matter, speciation.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

A study on lead removal from battery manufacturing wastewater using modified cyclodextrins comparatively with barium carbonate.

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Lead is a toxic metal for organisms at relatively low concentrations and so stringent regulations are applied to wastewater effluents. Battery manufacturing wastewater consists mainly of H_2SO_4 solution at pH 1.2-2.5 in water which has a composition similar to tap water and contains soluble Pb in the concentration range of 5-15 mg/l. Per (3,6-anhydro-2-O-methyl)cyclodextrins act as specific chelating agents for lead (Baudin, Perly, and Gadelle, FP 1996 01073; Baudin, Perly, Gadelle, Debouzy and Fauvelle, FP 1997 07339). Unfortunately, such complexes are very soluble in water. To prevent the redissolution of lead modified cyclodextrins are grafted on polymers (cotton or polyester). Another alternative is the precipitation at pH 5, in the presence of barium carbonate, of barium sulfate and lead sulfate, after decanting and filtration, the water is recycled (Gadelle, FP 2000 03119).

Keywords: battery, lead, cyclodextrin, barium carbonate.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

Metal uptake from aqueous solution by olive pits wastes.

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Adsorptive removal of heavy metals in wastewater is usually achieved by using activated carbon, activated alumina, polymer resins, which are non regenerable or expensive materials. Thus, there exists the need of low price, effective and regenerable adsorbent materials capable of removing metal ions from wastewater. Vegetable residues, which are abundantly available, had been proved to adsorb heavy metals via physical adsorption and electrostatic attractions between adsorbent and adsorbant. On the other hand, toxicity associated to metal ions is not a problem when nonliving materials are used. In this study, olive pits wastes as a result of olive oil manufacture have been used for divalent metals uptake from aqueous solutions. The ability of this material to be used as a low cost adsorbent has been studied taking into account the influence of pH, salts content and initial metal concentration.

Keywords: vegetable wastes, metal adsorption.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

Covalent surface confinement of silver thiolato complexes. Pollutant metal uptake application.

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Heavy metals complexing properties may be used to eliminate them completely from waste waters. Supported molecular traps obtained by chemical modification of silica gel are able to uptake toxic metals as cadmium, mercury and lead ions (e.g. Menu and coll., J. Environ. Monitoring, 2000, 2, 240-247). Silver thiolato complexes, known to be stable, allowed silver uptake by reaction with mercaptopropyl modified silica gel. DRIFT and ^{13}C CP MAS NMR spectroscopic studies indicated silica surface as a covalent surface confinement of thiolato complexes on silica. Modélisation of the silica surface using the mercaptopropylsilatrane ligand, $\text{N}(\text{CH}_2\text{CH}_2\text{O})_3\text{Si}(\text{CH}_2)_3\text{SH}$, will be also reported and results compared.

Keywords: heavy metals uptake, thiolato complexes, silver, silatrane, DRIFT, CP MAS NMR.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

Environmental chemical study on the marsh of Fatimid cemetery at Aswan city, Egypt.

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Environmental chemical study were carried out on the Fatimid cemetery marsh at Aswan city, Egypt. Marsh contents (water, soil, sediment, metal & nonmetal-bearing salts, and emergent weed) were analysed to know the source of marsh water, speciation of the different elements between the marsh contents, and the toleration of emergent weed *Phragmites australis* for different metals and their bioaccumulation coefficients. Thus metals and nonmetals were determined in the samples. According to the chemical analysis, and applying the base exchange equation (water type) and calculate the hydrochemical parameters for marsh water samples, we can indicate that the marsh water is ground water with Na- SO_4 type and deep meteoric genesis. Topsoil of marsh dry land characterized by CaCl as dominant salt, while NaCl is a dominant salt in subsoil. The elevated pH values of marsh contents minimized the metal solubilities in different samples. *Phragmites australis* showed a strong ability to accumulate Mn & Fe in the aerial part in opposite to Co, Ni & Cd.

Keywords: metal, plant, marsh, water, soil, sediment, emergent weed, Egypt.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

Mercurial waste waters treatment using an immobilisation process.

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An artificial amorphous crandallite reduces the mercury content of a waste water stream ranging from 80 to 100 ppm to less than the level of 0.1 ppm. The crandallite was synthesized in our laboratory and studied for the separation and recovery of mercury from mine waste waters. Mercury was interchanged with calcium and strontium contained in crandallite because of its open structure. Crandallite crystallizes in the alunitecrystal lattice and mercury entering into the crystal network thus becomes immobilized. The equilibrium isotherms data were correlated by the Langmuir, Freundlinch and Prausnitz equations. The values of equilibrium constants confirm that isotherms are very favorable for crandallite.

Keywords: mercury, geochemical immobilization, ion exchange, crandallite, wastewaters.

POSTER SESSION 03. WATER POLLUTION - TOXIC METALS

Computer model (MAM-PEC) to predict environmental concentrations of antifoulants.

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New antifouling agents are expected to replace tributyltin(TBT)-based products in the near future. For the exposure assessment in marine environments there is a need for reliable chemical fate models. Existing models were tested and their performance and shortcomings evaluated; this experience was then used to develop a new user-friendly and generic chemical-fate computer model (MAM-PEC) specifically for antifouling agents. The study was commissioned by the Antifouling Working Group of the European Paint Makers Association (CEPE / CEFIC) and sponsored by the European Commission (DG XI). The model predicts concentrations of antifoulants in five generalised typical, marine environments: open sea, shipping lane, estuary, commercial harbour, yachting marina. The user can specify different emission scenarios, compound-related properties, e.g. partitioning biodegradation, and hydraulic and environmental properties: currents, tides, salinity, dissolved organic carbon (DOC), suspended matter, port dimensions. For TBT, Irgarol and Cu, model-predictions were compared with existing literature data to confirm the validity of the model.

Keywords: antifoulants, risk-assessment, chemical-fate modelling.

POSTER SESSION 04

WATER POLLUTION - ORGANIC POLLUTANTS**Depollution of olive mill wastewaters by catalytic hydrogenation. Kinetics of the degradation of a model molecule: tyrosol.**

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The extraction of olive oil results in the production of wastewaters, which constitute an important environmental problem due to their high organic content, which make them resistant to biological treatment. Olive mill waste waters (OMW) contains large amounts of phenolic and acidic compounds which are highly toxic. A three-step process including an adsorption-concentration, catalytic hydrogenation and regeneration on a fixed bed of adsorbant-catalyst has been previously developed for the destruction of chlorophenols. The extension of this process to other classes of phenolic compound and especially to polyfunctional phenols like those encountered in OMW is being investigated. Tyrosol (1-(4-hydroxyphenyl)-ethanol) was taken as a representative of the phenolic compound presents in those waste waters. The present work investigated the catalytic hydrogenation of tyrosol and resulted in the determination of its mechanism, kinetic law and rate constants necessary for the building of a pilot-scale reactor.

Keywords: olive oil wastewater, phenol degradation, catalytic hydrogenation, kinetic constant, tyrosol.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Trihalomethane formation in ozonated and chlorinated surface water.

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The relatively recent discovery of disinfecting by-products has driven the main regulatory organisms to set maximum contaminant levels for certain substances in drinking water. Trihalomethanes can be deemed as the most important group of by-products in chlorinated surface waters. The present work has focused on trihalomethanes formation in a full-scale water treatment plant and the influence that the main variables have on trihalomethanes levels in chlorinated finished water. Treatment scheme also includes an ozonation step. The effect that such a strong oxidising agent poses on trihalomethanes levels is also addressed.

Keywords: disinfecting by products, chlorine, ozone.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Decomposition of orange II dye by reduction and oxidation pathways with zero-valent iron.

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Treatment of organic dyes is an important area of environmental chemical research that has received a great attention in recent years. Zero-valent iron has been shown to be an effective material to reduce and degrade chlorinated organic compounds. In this studies zero-valent iron was found as very efficient material for orange II decomposition compared to other classical photodegradation catalysts. Results indicate that the decomposition of orange II in acidic solution is similar in anaerobic and aerobic conditions, and is not photosensitive. UV spectroscopy and infrared attenuated total reflection and external reflection spectroscopies were applied to study mechanisms of the decomposition. Reduction and oxidation pathways were documented for the decomposition of orange II in aerobic conditions.

Keywords: chorinated hydrocarbons, degradation, organic dyes.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Optimised management of granular activated carbon filtration step for atrazine and its by-products removal in a drinking water plant

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Filtration onto granular activated carbon (GAC) is a necessary step to remove atrazine and its by-products DEA, DIA and hydroxyatrazine. Its optimisation depends on the knowledge of the water source, of the ozonation step and of the filtration step itself. Atrazine is a good indicator for the presence of its by-products; the frequency and the level of these compounds follow the same pattern. Ozone efficiency depends on each compound: high for atrazine and hydroxyatrazine, low for DIA and for DEA which can also be generated. Ozonation increases biodegradable compounds and enhances adsorption performances of GAC towards triazines. However, DEA being less adsorbable than atrazine, a DEA/atrazine ratio higher than 1 in ozonated water is an unfavourable factor to GAC filter lifetime. A sequence of regeneration of GAC filters, taking into account their adsorption performances and pesticides to be treated (frequency and level) enhances their operating time with a higher level of safety.

Keywords: water treatment, pesticide

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Aerobic azo-dye degradation in dyehouse effluents with newly isolated *Bacillus* sp.

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A large concern within the textile industry is the substantial use of water during the dyeing process. Additionally the recalcitrant properties of the dyes, and the numerous additives used during dyeing entail a whole string of environmental problems. Since dyes, although at very low concentrations, are highly visible, effective decolourisation in standard wastewater treatment plants is mostly not efficient. In our work a newly thermoalkalophilic *Bacillus* sp. was isolated out of a wastewater drain of a textile finishing company. The most commonly used class of dyes is azo-dyes and the bacillus is successful in decolourising a wide range of these dyes up to 98%. The enzyme responsible for the decolourisation was identified as azoreductase. The *Bacillus* grows at 60°C and withstands pH values up to 10. Also very high amounts of NaCl and acetate are tolerated, which makes it very promising for prospective dyehouse effluent treatment plants.

Keywords: dyehouse effluent, aerobic dye degradation, newly isolated *Bacillus* sp.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Quantification of the polycyclic aromatic hydrocarbons (PAHs) bioavailable fraction in aquatic environments using semi-permeable membrane device (SPMD).

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The SPMD technique [J. N. Huckins and Co. Chemosphere, 20 (1990) 533-552] has been tested in laboratory to sample and to quantify the bioavailable dissolved fraction of three PAHs (fluoranthene, benzo(b)fluoranthene and benzo(a)pyrene) in aquatic matrices. We used 5 cm long devices. The devices were exposed to contaminated water at different PAHs concentrations and with exposure duration varying from 1 hour to 10 days, in order to study the kinetic of the accumulation and to establish the accumulation factor at equilibrium (K_{spmd}). Kinetic constants such as R_s (L/j, uptake rate) and k_u (L/j/g, normalised uptake rate) and the equilibrium constant K_{spmd} were found higher than those of the literature. This may be explained by the dimensions of our 5 cm long device, instead of the 1 m long standard device generally used, with a ratio Mass lipid/Mass membrane not equal to 0.2 as required if one wants to compare different size devices. Anyway, the sampling technique has been calibrated and validated: it permits, after 2 hours exposition, to sample PAHs in water with 50 ng/L quantification limits and good repeatability with 15 % relative standard deviation. Quantification limits can be easily reduced to the ng/L with longer expositions.

Keywords: SPMD, biodisponible fraction, PAHs, water.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Expert system of water treatment management.

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At present the majority of water reservoirs test strong antropogeneous influence and become dangerous for the environment. Result of anthropogeneous influence is deterioration the quality of water. The degree of treatment of water depends from the requirements showed to use of a reservoir: for drinking water supply, fishing, rest and agriculture. The fuzzy sets are used as a management model for construction of an integrated index, on which meaning it is possible to estimate the quality of water in reservoir and to offer technologies on its treatment. The higher is the quality of water, then it is offered less ways for water treatment and on the contrary. The meaning of an index is calculated in a range [0,1]. Fuzzy logic is a part of expert system pattern on personal computer.

Keywords: water treatment, expert system, management.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Photochemical degradations of biorecalcitrant etheroxides : ethyl tert-butyl ether (ETBE), methyl tert-butyl ether (MTBE) and tert-amyl methyl ether (TAME).

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ETBE, MTBE and TAME are three etheroxides used as octane enhancers in unleaded gasoline. These compounds present an important recalcitrance for chemical and/or biological degradation. We interested in the photochemical oxidation of these pollutants by using advanced oxidation processes (AOPs) such as the H_2O_2 /UV system and the photo-Fenton reaction. The effectiveness of these oxidation processes depends on some physico-chemical characteristics (initial oxidant dosage, pH) and on the conditions of irradiation (exposure time or irradiation dose). These parameters were studied on laboratory scale and pilot scale. The results show that 99% ETBE, 95% MTBE and 87% TAME are degraded after 30 minutes of irradiation in the optimal conditions.

Keywords: ETBE, MTBE, TAME, H_2O_2 , UV, photo-Fenton.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Natural organic matter from surface water (Algeria) extration-characterisation-coagulation.

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A fractionation of natural organic matter (NOM) from reservoir used for the production of drinking water was performed. Three fractions, humic, fulvic and hydrophilic acids were obtained using two ion exchange columns in series (XAD-8 and XAD-4). The combined XAD-8 and XAD-4 resins procedure was found to isolate 55 % of total organic carbon (TOC). 30 % was in the form of fulvic acids, and 10 % humic acids. Approximately 15 % of the hydrophilic solutes were adsorbed onto XAD-4 resin. The fractions were characterised using UV absorbance; elementary analysis; infrared analysis. Compared with data available in the literature, this sample is characterised by low value of the relative absorbance (254 nm) and of the carbon content (elementary analysis). Coagulation experiments are carried out at different pH on the raw water resulting in a removal of more than 60 % of UV absorbance.

Keywords: NOM, water, humic substances, extraction, caracterization, coagulation.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Use of organophilic pillared clays for the adsorption of diuron and its degradation products.

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A series of modified hydrophobic and organophilic pillared clays were prepared by exchanging some polymeric cations from Al, Fe and Ti into interlamellar space of an Algerian montmorillonite and then by co-adsorption of cetyltrimethylammonium bromide. These new adsorbent materials, characterised by X-ray diffraction (XRD), Brunauer-Emmett-Teller surface analysis (BET), differential thermal analysis (DTA) and fourier transformed infra-red spectroscopy (FTIR), were studied for the adsorption of some pesticides such as diuron and its degradation products: dichlorophenylmethyl urea (DCPMU), dichlorophenyl urea (DCPU) and dichloroanilin (DCA). According to adsorption isotherms under different conditions, the sorptive capacities of these new materials were considerably enhanced in comparison with natural occurring materials.

Keywords: pesticides, organic pollutant, pillared clays, adsorption.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Catalytic wet peroxide oxidation of phenol on iron based catalysts.

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The wastewater containing organic pollutants should be treated before to be released in the environment. Among the possible wastewater treatments, the catalytic wet oxidation by hydrogen peroxide (CWPO) seems to be one of the most efficient and cheapest processes. The phenol oxidation by hydrogen peroxide has been investigated on Al-Fe pillared clay and iron oxide supported on active carbon catalysts, under atmospheric pressure at various reaction temperature. On the pillared clay catalyst, a 100% phenol conversion with a TOC abatement of 80% was observed at 70°C, the selectivity towards hydrogen peroxide consumption being higher than 80%. The active centers have been identified by ESR to isolated iron species bonded to the support. The very low iron leaching observed on the Al-Fe pillared clay catalyst (less than 3% of the initial iron after more than 200 hrs of reaction) allows to use it in a continuous process.

Keywords: water treatment, catalytic oxidation, phenol elimination, hydrogen peroxide

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Evaluating surfactant modified pillared clays for organic pollutants control.

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This work focused on the potential application of hydrophobic mixed pillared bentonite for the adsorption of some organic compounds such as o-xylene, phenol bromophenol, pentachlorophenol and aniline from dilute liquid water streams. Adsorption tests have been conducted in batch wise manner. Obtained results show that the application of cationic surfactant modified Fe- pillared montmorillonite can be an effective adsorbents for the removal of organic pollutants from the aqueous streams. These products are characterized by their high affinity toward these class of priority hazardous pollutants higher in fact than other adsorbants used in the classical treatment.

Key words: organic pollutants , pillared clays, adsorption.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Competitive photodegradation of benzamide and parahydroxybenzoic acid mixture in TiO_2 aqueous solution.

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Photocatalytic reactions using semi-conductor powders (TiO_2 particularly) have been paid much interest because of their possible applications to solar energy storage and to the mineralization of organic pollutants in wastewater. The interactions between the solid photocatalysts and the organic molecules play a major role in the mechanisms of degradation. The photocatalytic degradation by TiO_2 of benzamide (Ba), parahydroxybenzoic acid (4-HBz) and the mixture of both has been studied. We have studied the influence of the chloride ions and the adsorption at the TiO_2 surface on the degradation kinetics. We have shown the selective degradation of the mixture of two organic compounds. The adsorbed molecule is degraded more quickly. The probable existence of at least two degradation ways has been underlined. One at the surface (in this case it is the direct action of the holes that degraded the pollutant) and the other at the liquid/solid interface of the photocatalyst (then, the intermediate -probably $^{\circ}\text{OH}^-$ is the intervening oxidant).

Keywords: photodegradation, water organic pollutant.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Compared growth of ethyl tert-butyl ether-degrading bacterial consortia in gas and liquid lab-scale fixed bed reactors.

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Ethyl tert-Butyl Ether (ETBE) is an unleaded gasoline additive used in France since 1990's. It causes ground- and surface-water contamination due to its high water solubility, its poor adsorption characteristics and its recalcitrance to natural attenuation. Several studies concerning ETBE biodegradation faced to low microbial growth. To stimulate this growth, we studied the ETBE biodegradation simultaneously in two aerobic fixed bed reactors, fed with ETBE in the gas flow and in the liquid phase. After five months of continuous culture, the bacterial growth achieved (10.1 ± 1.4) and (3.0 ± 0.9) g dry weight L^{-1} for the gas and liquid reactor respectively, so a bacterial growth 67% more important in the gas one. The two reactors degraded 96-98 % of 358 mg ETBE $L^{-1}d^{-1}$, at 1.4 and 4.4 mg ETBE (g dry weight) $^{-1} h^{-1}$ respectively. Then, the gas reactor can degrade ETBE at higher degradation rates with stimulating bacterial growth.

Keywords: ETBE, biodegradation, fixed bed reactor.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Study and comparison of two advanced oxidation processes in the treatment of polluted effluents.

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The main objective of this paper is the comparative study of two oxidation techniques in the treatment of industrial wastewater employing H_2O_2 as the oxidising agent. In one hand, the widely studied Fenton technique is revisited, and from the other microwave irradiation is employed, being the later one an innovative oxidation path never used before for the treatment of polluted effluents. Each technique have been applied to two types of effluents to fulfil the double objective of analysing the oxidation of effluents with different toxicity and load: In one hand to a synthetic solution of phenol in low load (100 ppm) and to a high loaded linear alkylbenzene sulfonate (LAS) surfactant effluent (20 g/L) from a soap processing plant. The comparative study of both systems has been carried out using a factorial design of the reactive conditions: pH, oxidant concentration and the catalyst concentration or the irradiation time in the case of the microwaves ; working out expressions that provide an accurate estimation of the removal of pollutant and the efficiency of oxidant consumption. Finally the influence of the variables on the oxidation rate is also analysed for the two pollutants.

Keywords: advanced oxidation processes, H_2O_2 /UV and H_2O_2 /MW comparison, phenol and surfactants degradation.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Influence of a co-solvent on the solubilization of organic pollutants (PAHs) included in stabilized/solidified materials.

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Some papers related the role of dissolved organic carbon (DOC) on organics mobility, so we devised new leaching tests to evaluate the impact of this phenomenon on stabilized/solidified materials including various amounts of PAH. DOC have been simulated by adding a co-solvent (methanol). Its influence on the availability of both organic and inorganic species have been studied. Results of tests on monolith materials show that cumulative release of organics in relation to time depends on the organic pollutant ratio in the material but is not really influenced by co-solvent percentage in the leachant.

Keywords: dissolved organic carbon, polycyclic aromatics hydrocarbons, stabilized/solidified materials, leaching tests.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Titanium dioxide photocatalytic degradation of petroleum in water.

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Titanium dioxide photodegradation of petroleum in water under on operation UV was investigated. For control of petroleum in samples was used laser-induced fluorescent spectroscopy with excitation by the fourth harmonic Nd:YAG laser (266 nm). Two bands - 330 nm (light fractions) and 420 nm (heavy fractions) charecterized the laser-induced fluorescence (LIF) spectra of petroleum in water. At introduction TiO_2 and exposure visible light in a spectrum does not find out differences from spectra water infusion of petroleum. At an exposure of UV radiation of samples (petroleum + TiO_2 , petroleum + TiO_2 + O_2) in their spectra the falling down of intensity of the first maxima to full vanishing and also falling of intensity of second maximum are observed during an exposure. In case of saturation of oxygen the process of intensity decreasing of LIF spectrum was expressed more strongly.

Keywords: Photodegradation, petroleum in water, laser-induced fluorescence.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Geochemistry of the Têt River in Southern France: natural controls and anthropogenic impacts.

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Our study presents a detailed investigation of the chemical and mineralogical composition of the river water of the Têt River, a small Mediterranean river draining the Pyrenees in the South of France. Its objective is to understand the major factors controlling the water composition with regard to the environmental characteristics of the river drainage basin and to quantify the riverine fluxes of dissolved and particulate matter to the Mediterranean Sea. Special emphasis is given on the impact of anthropogenic land use and water management on the natural fluxes. To do so, a weekly sampling of the river has been carried out during one year at seven stations starting from the headwater region down to the river mouth. Data analysis includes major dissolved elements, dissolved nutrients, total suspended solids and particulate organic carbon.

Keywords: river water quality, Mediterranean climate, land use.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

In situ partition of nonpolar pollutants in river systems.

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To estimate the influence of hydrological conditions on the partition of nonpolar pollutants in river systems, polycyclic aromatic hydrocarbons (PAHs) were monitored in water and suspended matter (SM) of the Rhône River (France) every fortnight and during floods from June 1994 to May 1995. More than 80% of particulate PAHs were unavailable for partition. Sorption coefficients (K_d and K_{oc}) varied by several orders of magnitude mainly in response to changes in SM with water discharge (WD). More than 90% of PAHs were transported in the particulate phase during floods, when K_d and K_{oc} steeply decreased. Both dilution of PAH carrier-particles with lithic organic-poor particles and changes in the composition of organic matter accounted for these variations. The occurrence of PAH-depleted organic carbon during floods could be traced back to a decrease in the soot fraction. These results are discussed in light of models obtained from laboratory simulations.

Keywords: nonpolar pollutants, sorption coefficients, river systems.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Degradation of azo dyes in aqueous media by Electro-Fenton process.

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Colour is one of the most obvious indicators of water pollution. The discharges of highly coloured dyes effluent can be damage the receiving water bodies. Synthetic dyes are used extensively by several industries including textile dyeing (60%), paper (10%) and plastic matter (10%). It is estimated that 10-15 % of the dyes are lost in the effluent during dying processes. Azo dyes represent the largest class of dyes used in industry and are refractory to microbial degradation and resistant to chemical processes. However, it is essential that these dyes be removed from industrial effluents. We used an advanced electrochemical oxidation process which is based on in situ and catalytic generation of hydroxyl radicals to eliminate the strong colour of aqueous azo dyes solutions and their toxicological characteristics. Final products of degradation are H₂O, CO₂ and inorganic ions. This technique could be extended to other organic pollutants.

Keywords: azo dyes, hydroxyl radicals, electro-Fenton process.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Effect of pH on the elimination of linear alkylbenzene sulphonates (LAS) in water by hydroxyl radicals produced by combination of UV irradiation plus hydrogen peroxide.

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Linear Alkylbenzene Sulphonates (LAS) are a group of anionic surfactants, they are water-soluble aromatic synthetic compounds used mostly in laundry detergent formulations. Predominant formulation of commercial LAS consists of alkyl chain lengths from 10 to 13 carbon atoms. LAS has been decomposed in aqueous solution by using hydrogen peroxide as the oxidising agent under UV radiation. This paper reports the complete photooxidation of LAS in aqueous solution in the presence of hydrogen peroxide. Initial solutions contained 200mg/l of surfactant LAS as acid were oxidised at pHs between 2 and 7, and modifying the initial hydrogen peroxide concentration. Both, LAS degradation and peroxide consumption, follow a pseudo-first order kinetics. These apparent kinetic constants are directly dependent on pH and oxidant-to-substrate mole ratio. The oxidation efficiency is deduced and correlated as a function of pH and oxidant dose, from pseudo-first order rate for LAS degradation, and oxidant consumption. The results showed that the oxidation efficiency was greatest at pH 3 value.

Keywords: alkylbenzene, LAS, water, degradation

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Trends and main temporal cycles of water temperature, salinity, oxygen concentration and pH in Polar and Atlantic water masses in North Atlantic.

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Global climate changes have significantly accelerated nowadays. In particular, this is evident from changing characteristics of the World Ocean. In North Atlantic we obtained statistically significant long-term trends and main temporal cycles of temperature, salinity, oxygen concentration and pH in recent three decades. Trends and main temporal cycles were calculated separately for Polar and Atlantic water masses, identified by means of automatic classification for productive ocean layer (100 - 200 m deep) in North Atlantic. A most interesting detail was a difference between temperature trends in Polar and Atlantic water masses in spring. While Polar mass temperature was increasing, Atlantic mass was becoming cooler. This could indicate a decrease in the latitudinal temperature gradient. Another interesting feature was a predominant 11-year salinity cycle. Changes in oxygen concentration usually had opposite signs as compared to trends in temperature.

Keywords: climate global change, long term trends, main temporal cycles , water temperature, salinity, oxygen concentration and pH.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Study of biodenitrification on cellulosic solid support in presence of 4-ethylphenol.

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The effect of varying concentrations of 4-ethylphenol on the denitrification is studied. Experimentations are conducted in flasks containing a solution of nitrate, phosphate, potassium hydrogenocarbonate, reed cellulose as reducing agent and inoculated with nitrate-reducing bacteria. Regularly, the flasks are sampled and samples analysed to determine nitrate, nitrite and during the last test 4-ethylphenol. In presence of reed chips, 4-ethylphenol at low concentrations (0,3 to 1 mg/L) do not affect the denitrification rate. Concentrations increase has an inhibitory effect on the reduction of nitrites. If phenol concentration is lower than 600 mg/L, bacteria are able, after an adaptation time, to ensure the complete denitrification. A concentration of 800 mg/L is lethal. When 4-ethylphenol is added without reed chips, inhibitor effect is drastic and the accumulation of nitrite ions can attain 30 mg/L. It seems that, in first step of experimentation, reed chips adsorb the phenolic compounds decreasing the toxicity.

Keywords: biodenitrification, nitrite accumulation, inhibition, 4-ethylphenol.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Photodecomposition of chloroorganic compounds in the aqueous solution in the presence of titania catalysts.

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Semiconductor heterogenous photocatalysis appears to be very productive method of water purification. The photocatalyst generally used in this kind of process is titanium dioxide. The aim of the presented work was to test activity of TiO_2 in the photodecomposition of chlorobenzene, o- and p- chlorophenol. The photocatalyst itself was the focus of attention. In the case of chlorobenzene, identification of intermediate products was carried out. On the basis of the obtained results and literature data the reaction mechanism was proposed. Influence of oxygen on the conversion of chloroorganics was also studied. In the latest research instead of popular TiO_2 titania aerogels were used. The effectiveness tests of them in photodegradation process were carried out and characteristics of their structure was determined.

Keywords: organic pollutant, water, photodegradation, Ti.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Activation of hydrogen peroxide for the bleaching of the azo dyes.

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Hydrogen peroxide is increasingly favoured as an environmentally acceptable azo dyes bleaching agent. However the degradation reactions are slow. A new generation of long-lived H_2O_2 activators was recently designed: Fe-TAML (iron complexes of TetraAmidoMacrocyclic Ligands) are green activators because they employ non-toxic elements and H_2O_2 , and destroy themselves after catalysing oxidations in water, releasing harmless by-products. In this work, Acid Orange 7 was selected to evaluate the effectiveness of this complex as a peroxide activator for the degradation of azo dyes. The bleaching time and rate dependence on pH, temperature, oxidant- and initial dye concentration was investigated.

Keywords: Fe-TAML, green oxidation, H_2O_2 , Acid Orange 7, dye bleaching.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Photodegradation of atrazine.

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Atrazine is an herbicide widely used in agriculture for the treatment of cultures. As a consequence of its use, atrazine is very often present in soil and in aquatic systems. In the environment, photodegradation is one of the pathway leading to the elimination of pesticide. In this work, we compared the photodegradation of atrazine in various conditions. First, we studied the photodegradation of aqueous atrazine, alone or in the presence of humic substances, when exposed to solar light. Then, atrazine was dispersed on solid supports (soils, sand) and exposed to the light. In all cases, photodegradation of atrazine was observed.

Keywords: photodegradation, atrazine, water, soil.

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Acetate in deep peat bog environments - Seasonal variation and implications for methanogenesis.

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This study reports the acetate concentration patterns along with those for methane and DOC in the pore water of the Etang de la Gruère (EGr) Bog in Northwest Switzerland's Jura Mountains. Acetate concentrations increase with depth from well below 5 μM at 0.5 m to up to about 180 μM at 5 m (June 2000 series). The presence of two concentration maxima at approximately 3.2 and 5 m depth is confirmed by most measurement series. Acetate is a product of fermentation and a key-metabolite for microbial methanogenic processes ("aceticlastic methanogenesis"). As the pore water temperatures are almost depth-invariant in the deeper bog, these maxima seem to reflect the zonal distribution of microbial acetate producing and consuming communities. Significant seasonal variations in the catotelm can be interpreted as the combined effect of a) increased acetate production in the acrotelm in spring followed by b) advective transport of chemical species in the bog pore water profile, and c) a 'seasonal delay' in aceticlastic methanogenesis in the deeper bog corresponding to slightly higher autumn and winter pore water temperatures in deeper bog parts.

Keywords: acetate, aceticlastic methanogenesis, greenhouse gases, peatlands, pore water

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Functional microbial agents for the treatment of malodor of piggery slurry waste.

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Functional microbial agents were developed for the treatment of malodor of livestock manures. *Bacillus* sp., *Chryseomonas* sp., *Rhodopseudomonas* sp., and *Thiobacillus* sp., were isolated for their ability to efficiently degrade malodor. The higher enzyme activities of the isolated bacteria such as amylase, protease, lipase and cellulase were detected. Effective formulation procedure was also developed by emulsification technique with nutrient additive, stabilizing agent and/or surfactant. Various stabilizing agents were tested to enhance the stability of microbial agents. The cell survival rate in a field test could be improved by emulsification of microbial agents. The malodor-degrading activity was also enhanced by the optimal formulation of protecting agents and nutrient sources such as skim milk, glycerol or mineral ion.

Keywords: microorganism, enzyme, malodor, formulation

POSTER SESSION 04. WATER POLLUTION - ORGANIC POLLUTANTS

Monooxygenase-catalyzed cometabolic biodegradation of trichloroethylene.

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Trichloroethylene (TCE) has become a widespread contaminant in air, soil, and underground water because of improper disposal. One of the efficient TCE treatment methods is biological degradation, in which monooxygenase transforms TCE to harmless end products via cometabolism. TCE, however, is not easily treated by simple cometabolic biodegradation. This is mainly due to the competitive inhibition between primary substrate and TCE, together with toxicity of TCE to microbial cell and monooxygenase. In this study, a kinetic analysis of cometabolic biodegradation of TCE and novel biodegradation methods will be presented including parallel trickling biofilter (TBF) and 2-stage CSTR/TBF system.

Keywords: trichloroethylene, biodegradation, monooxygenase, trickling biofilter

POSTER SESSION 05

SOIL POLLUTION - TOXIC METALS**Interactive influence of cadmium and humic acids on wheat: effect on metals acquisition and sequestration related to the production of metal ion ligands.**

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The natural ability of plants to absorb and concentrate elements can be used to clean up soils contaminated with metals. To implement this alternative technology called phytoremediation, it is crucial to better understand the various processes controlling metal mobilisation, uptake and sequestration by the plants. Metal chelation is recognised as an important factor, regulating to a large extent metals solubility and availability to plants. Natural ligands (soil humates, root exudates components) or anthropogenic chelators (i.e. EDTA) can be involved. We investigated the interactive effect of Cd and humates on metals acquisition and translocation in wheat plants. Metals contents, tissues metabolites and root exudates composition were determined. Cd treatment inhibited biomass production and greatly reduced root exudation, while an important increase of metals contents was noticed. Humic acids alleviated Cd effect on plant growth and some exudated components, enhancing accumulation of some metals in the roots.

Keywords: plant, metal, phytoremediation

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS**Study of cadmium adsorption on different granulometric fraction of soil.**

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The aim of our study is to isolate the fraction of an agricultural soil which best adsorb a toxic heavy metal like cadmium. We have tested eight granulometric fraction of the soil: the whole soil, sand, coarse silt, fine silt and clay, each one with and without organic matter. We have determined the adsorption isotherm (Langmuir model) at 30°C and 10°C. Generally the adsorption at 30°C is better than those at 10°C. Whatever the temperature we have found that the presence of organic matter have a positive effect on adsorption. For example the Langmuir model give a maximal adsorption of 0.21mg Cd/g soil for the fine silt and clay fraction without organic matter and 0.55 mg Cd/g soil for the same fraction with organic matter at 30°C. Moreover, the finest granulometric fraction (i.e. silt and clay) best adsorb more cadmium.

Keywords: metal, soil, extraction

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Influence of soil copper level, soil organic matter level and soil pH on copper concentration in maize.

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To evaluate transfer risks and toxicity of copper to maize under natural agricultural conditions, an acidic silty agricultural soil has been deliberately enriched, in 1992, with copper sulphate, with lime and organic matter. Soil and maize samples are collected in 1994, 1996 and 1998. Copper level in soil and in maize is determined, chemical speciation of copper is studied by sequential extraction isolating five fractions (exchangeable, bound to organic matter, bound to manganese and iron oxides and the residue). Regression models study shows that copper level in stalks at the female flowering stage is dependent on soil exchangeable copper, soil organic matter, soil pH and on precipitation. Copper concentration in grains is dependent on copper level bound to oxides, pH, temperature and on precipitation. For both organs, copper level in maize increases with copper level in soil. Leaves study doesn't give significant correlation results.

Keywords: metal, plant, food.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Role of soil components in immobilisation of Mn, Zn and Pb in gray forest soil under the broad-leaved forest.

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Role of soil components in the immobilisation of heavy metals in the background soils was studied using the method of selective extractions (Tessier A. et al., 1979) in samples from humus-eluvial horizon. The total content of manganese in soil is 1600 mg/kg, zinc - 65 mg/kg, lead - 19 mg/kg. The maximum quantity of manganese is in the Fe-Mn-hydroxides fraction (78.5 %, 1081.5 mg/kg). The concentration of zinc in gray forest soil is determined by its content in the structure of primary and clay minerals (69.8 %, 50 mg/kg in the residual fraction). The greatest quantity of lead is connected with Fe-Mn-hydroxides (48.3 %, 8.5 mg/kg), some less is contained in the structure of primary and clay minerals residual fraction (36.9 %, 6.5 mg/kg). The role of organic substance in metals immobilisation is measured from 5.1% (70 mg/kg) for manganese to 7.4% (1.3 mg/kg) for lead and 9.9% (7.1 mg/kg) for zinc.

Keywords: heavy metals, soil components, immobilisation.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Adsorption-desorption experiments to estimate the relative heavy-metal mobility in soils.

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The prediction of the impact of a heavy metal contamination in soils needs the determination of their concentrations and to estimate their mobility. This can be achieved through laboratory experiments, as adsorption and leaching tests. Here, we applied the adsorption approach to a set of soils with contrasting soil characteristics. For each soil, the adsorption isotherm of Cd, Cu, Pb and Zn was obtained in a medium that simulated the composition of each soil solution. The information derived from these experiments was compared with distribution coefficients obtained in solutions of similar ionic strength. After the adsorption step, the desorption yields with CaCl_2 1M were used to estimate the reversibility of the interaction. Cadmium was predicted to be the most mobile element, with the lowest K_d values and highest extractability, Pb seemed to be the most fixed, whereas Cu and Zn showed an intermediate pattern that depended mostly on the soils.

Keywords: heavy metals, soils, adsorption-desorption

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Dynamics of the interaction of trace elements in contaminated agricultural soils.

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Since the fate of trace elements in soils is a multifactor process, it is needed to apply complementary experimental approaches for long-term predictions for which the dynamics of the interaction plays a major role. Here, we have studied the dynamics of the interaction of Cd, Cu, Pb, Zn and As in agricultural soils, which had been contaminated by acid wastewaters and a pyritic sludge after an accidental spill in a mining exploitation. The dynamics was estimated by applying single extractions to field samples taken a few months after the toxic spill and nearly two years later. These results were compared with those from a laboratory approach in which the dynamics was simulated by drying-wetting cycles in the soil. Results showed that the dynamics depended not only on the trace element, but also on the source-term. Moreover, drying-wetting cycles seemed to be a promising tool when facing a soluble contamination.

Keywords: heavy metals, soils, dynamics

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Heavy metals in contaminated soils near a wire-drawing factory, Marseille, France.

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Heavy metals distributions and speciations have been studied in soils from gardens at the vicinity of a wire-drawing factory. Cadmium, with an atmospheric origin, is strongly enriched (to 250 ppm) in the cultivated upper horizon. Copper and Zinc are also enriched but these two metals have an other origin. The Lead content is high (200 to 400 ppm), but without variations with depth. Heavy metals speciations have been studied with a sequential extraction procedure. Most of the Cadmium (60 to 80%) is associated with the EDTA and NaOAc extractable forms. Copper is essentially distributed between the EDTA extractable form and the organic matter fraction. For these two metals, the contribution of the EDTA extractable form decreases when the grain-size increases. Zinc is associated with the EDTA extractable and reducible forms. The high Cd content in the cultivated vegetable can be explain by the high bioavailability of this metal in the soils.

Keywords: heavy metals, contamination of soils, bioavailability.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS**Forecast estimation of heavy metals values in a soils.**

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It is necessary to carry out a polyelement estimation of soil and to take into account variety of the factors at absence of the information a priori on probable distribution of heavy metals in soils. Such necessity dictated development of a method of a grouping soil given for a forecast estimation of the concentration of heavy metals in soils. As model object were used of soils of Predvolgie of Tatarstan Republic. The forecast estimation of the concentration of heavy metals in soils is carried out by application of a method of a grouping of soil date by concentration of heavy metals, on the basis of linguistic clusterisation, consecutive estimation procedure and fuzzy sets. The researchers have not enough the data of experimental and field researches necessary for construction of soil cards and an estimation of an ecological condition. The offered method allows solving above-mentioned problem.

Keywords: heavy metals, forecasting, linguistic clusterisation.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Use of sodium carboxylates for selective precipitation of metallic cations in industrial liquid wastes.

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Each year in France, the detoxification of liquid wastes from surface-finishing industry generates about 200,000 tons of metallic hydroxide sludge. Since April 1998, the regulations levels concerning their storage in specialised landfill have become much stricter and a new regulation concerning the storage of ultimate wastes has to come into effect from July 2002. At present time, the management of these liquid wastes has to be turn towards benefaction. Metals recycling need a selective recovery of each of them. From a technological and economic point of view, one of the best ways to investigate seems to be the selective precipitation of metallic cations using sodium carboxylates. The determination of metallic carboxylates solubilities allows the establishment of solubility diagrams which are used to predict the possibilities of selective recovery of metals in different mixtures. A laboratory-scale study has showed that the separation is effective in the case of binary or ternary mixtures like Fe/Zn, Ni/Zn or Fe/Cr/Ni.

Keywords: liquid waste, waste recycling, selective precipitation, carboxylates, metals.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

In-situ transformation of heavy metal phases in soils.

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Soils can be a large sink for anthropogenic and natural heavy metals. Important metal phases that are released e.g. by mining and smelting operations are sulfides and oxides. Their dissolution and phase transformation determines the initial fate of these heavy metals in the soil. These processes also influence the bioavailability and the transport of the metals into the groundwater. The present work will introduce a new method to analyze the long-term behavior of selected heavy metal phases in soils under in-situ conditions. This method uses polymer supports with heavy metal covered surfaces. These supports are used as a carrier for the selected phases and can be placed in soil systems without difficulties. After defined time segments the heavy metal phases will be recovered from the soil and analyzed for their phase transformation and dissolution.

Keywords: heavy metals, in-situ method, soil contamination.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Preliminary study of cadmium electrodialytic removal from soil.

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Some electrodialytic soil remediation experiments were conducted on 200 g of a soil previously polluted by 150 to 600 mg/kg of cadmium. A tension of 20 V is applied to the electrodialytic cell in order to keep a 0.3 A current intensity. The remediation kinetic is followed by atomic absorption analysis of the cadmium transferred from the soil to the catholyte. The remediation rate is evaluated by soil complete acidic mineralisation at the end of the experiment. Because of the cathodic electrolysis of water, the pH needs to be kept acidic in order to avoid cadmium complexation and precipitation. The results show that the higher the initial cadmium soil level is, the better the remediation rate is. Even if the experimental conditions were sweet (420 minutes, 20 V), the remediation rate reaches 16%.

Keywords: electrodialytic remediation, cadmium, soil.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Simulation of the migration of heavy metals through podzol soils by centrifugation.

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Sludge produced by water treatment plants have been spread on agricultural soils for a long time as they provide high amounts of organic matter and nutrients (esp. P). However they can contain high amounts of toxic heavy metals and little is known about their long-term behavior in soils. Their migration down to the water table and therefore to potential drinking water resources could be hazardous to Man. Using the centrifuge of the CEA-CESTA, we were able to accelerate the percolation processes occurring in sandy soil columns (monoliths) collected in podzol soils in the Landes forest, France. Investigations of the percolating water, of migrating colloidal particles and of the soil itself demonstrated that heavy metals are transferred downwards, this transport being linked to the migration of clays and organic matter. The migration depends on the pollutant and on the size of the particles involved.

Keywords: heavy metals, contamination of groundwater and soils, sewage sludge, risk assessment.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Heavy metal speciation in composting process.

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Composting is an efficient and environment friendly methods of solid waste disposal compared to landfill which the UK and Ireland are currently heavily dependent upon. Compost is a very complicated biological system, which involves intensive microbe activities, yet the detailed mechanisms have not been fully understood. Metal speciation information would be important for better understanding of the metal-microbial interaction, evaluating the quality of composts and exploiting new applications of composts in remediation of heavy metal contaminated land. In this paper, the BCR (bureau of common references) three step sequential extraction method has been applied to monitor the change in metal speciation in four different green waste composting process. The results show that the metals do behave quite differently between different elements and different types of compost. In many cases, composting tends to redistribute the metals from more labile forms to more fixed forms. The feasibility of using ultrasonic extraction for speciation has also been evaluated.

Keywords: composting, heavy metals, chemical speciation, ultrasonic extraction.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Green fluorescent protein expression in a cadmium resistant *Streptomyces* R25 sp. strain.

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Streptomyces are Gram-positive soil bacteria with great potential in bioremediation process. Cadmium is a very toxic metal and has been found in the human environment at increased concentrations. One of the main problems is following the viability of microorganisms in the culture medium and also in different cadmium contaminated areas, so one of the newest possibility is by fluorescence. The aim of this work was to insert the green fluorescent protein gene (EGFP) by transformation in *Streptomyces* R25. The modified version of EGFP construction was used for transformation assays. The specific cadmium consumption increased 100% at 1.0 mM, indicating the capacity of this strain to uptake cadmium from the liquid medium. The pellet fluorescence images was detected in *Streptomyces* R25 transformants. These results will prove a new methodology for following the survival of this microorganism, with uptake capacity of heavy metals, in natural areas contaminated with heavy metals.

Keywords: *Streptomyces*, cadmium, fluorescence, transformation.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Phytoremediation of thallium contaminated soils: effect of binding forms on thallium uptake of Brassicaceae.

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In order to assess the efficacy of phytoremediation, the thallium (Tl)- hyperaccumulators kale and candytuft (Brassicaceae) were grown in different Tl contaminated soils. The soils selected for the pot experiment differ in degree of contamination (total concentration from 1.4 to 49.1 mg Tl kg⁻¹ soil) as well as in origin of pollution (anthropogenic and geogenic) and the composition of Tl binding forms, which were characterized by sequential extraction. In general, in soils with a Tl contamination of geogenic origin the percentage of binding forms, which are characterized as "plant- available", is relatively low and only small parts of these plant available fractions can be depleted by hyperaccumulator plants. In contrast, in soils of an anthropogenic Tl pollution, a much higher part of the total Tl content is "plant-available" and even the so called "non-plant available" binding forms are depleted, if the degree of contamination is not too high (as in the used soil contaminated by deposits from a cement plant). In such soils, phytoremediation seems to be possible in limited time. If the degree of contamination of anthropogenic contaminated soils is very high (for example as a result of mining) the hyperaccumulators kale and candytuft show toxicity symptoms and the growth rate is reduced or even completely inhibited. In these highly contaminated soils phytoremediation with the the used hyperaccumulator plants is not possible.

Keywords: metal, binding form, candytuft, hyperaccumulators, kale, phytoremediation, thallium

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Mercury recovery from soils by phytoextraction.

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Since its low environmental impact, phytoremediation techniques have become an attractive method for the removal of heavy metals from contaminated soils. This communication shows the preliminary results about the recovery of mercury from contaminated soils by means of phytoextraction. The proposed process involves the removal of mercury by plants from the soil and subsequent biomass combustion for the recovery of the extracted mercury. Three agricultural crop plants (barley, wheat and lupine) were tested in a field experiment. Soil samples were taken and characterized both before and after of the culture period. Preliminary results put forward that the three crops tested were effective in the Hg extraction from the soil, although the mercury uptake values were low. Methylmercury concentration was very low both in soil and plants. Co-operation of Minas de Almaden y Arrayanes S.A. and CIEMAT is gratefully acknowledged.

Keywords: metal, remediation, contamination of soils, mercury, phytoextraction.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Chromium behaviour in an aquifer under an industrial site.

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An industrial plant located within the city of Bordeaux, France was investigated: the underlying aquifer is contaminated due to the manufacture of bouillie bordelaise (copper sulfate). The contamination is probably due to the processes of the chemical treatment of copper and to the use of pyritic minerals involved in the production of sulfuric acid. The geochemical behaviour of chromium was studied using several approaches: (a) analysis of water samples collected throughout the site (with pH values ranging from 2 to 11), (b) analysis of core samples and (c) sorption of chromium in presence of non polluted aquifer solids as a function of pH. The solubility and therefore the mobility of chromium is highly dependent on pH.

Keywords: chromium, soil pollution, mobility, risk assessment.

POSTER SESSION 05. SOIL POLLUTION - TOXIC METALS

Heavy metal mobilisation in soil after slurry spreading.

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The supply of slurry to soil leads to accumulation of copper and zinc in soil. Most of the element remain in the first horizon of soil but a little part can be redistributed in the profile or migrate towards the hydrographic network. Many factors can influence the mobility of Cu and Zn in soil (water content, nature of soil constituents, activity of microflora). Here we focused on the mobility during the days following slurry spreading, because intense microflora activity occurs and modify the physico-chemical conditions (pH, Eh, dissolved organic carbon). During 1 month, trace element concentrations, dissolved organic carbon, pH were measured on non buffered saline extract of incubated soil receiving slurry, or equivalent N supply as mineral form, or nothing. We compare the kinetics of mobilisation of Cu, Zn between the treatments. A mobilisation of these elements were observed only on slurry treatment, during the first 10 days.

Keywords: metal, soil

POSTER SESSION 06

SOIL POLLUTION - ORGANIC POLLUTANTS**Net nitrogen mineralisation and nitrification in Alpine soils in the Northern Caucasus.**

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In high-mountain ecosystems the majority of organically bound plant nutrients are incorporated in the soil pool. Much work remains to be done to estimate N transformation in these ecosystems. The sampling sites are located in the Teberda reserve, N-W Caucasus, between 2650 and 2750 m a.s.l. Nitrogen mineralisation and nitrification were studied in the one-year field incubation experiment by the combination of sequential soil coring and ion exchange resins. Net N mineralisation increased along a hydrological gradient of toposequence from 12.4 mg kg⁻¹ up to 28.7 mg kg⁻¹. Net nitrification in the majority of soils was insignificant (1-2 mg kg⁻¹). Only in the soil of slope Geranium gymnocaulon meadow nitrification was 9.0 mg kg⁻¹. The intensity of N mineralisation and nitrification in mountain-meadow alpine soils is supervised by a complex combination of favourable (low soil acidity, low C to N ratio, long vegetation period, absence of hydromorphy) and unfavourable factors.

Keywords: Caucasus, alpine soils, net nitrogen mineralisation, nitrification

POSTER SESSION 06. SOIL POLLUTION - ORGANIC POLLUTANTS

Mobility of C-14-alachlor in unsaturated-soils during horizontal infiltration

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We examined the mobility of alachlor in unsaturated soil columns subjected to horizontal infiltration. An input pulse of C-14-alachlor solution was introduced to the column and the advance of the volume infiltrated was monitored. When the wetting front reached 25 cm each column was dismantled and soil moisture and alachlor concentrations in 1-cm sections quantified. Alachlor concentrations versus depth were retarded behind the wetting front and did not show sharp fronts. Alachlor peaks were of moderately shaped fronts reaching some 10 cm from the (input) source and were followed by a gradual decrease in concentrations with depth. Attempts were made to describe alachlor movement using solute transport equation for transient flow in water-unsaturated soils. Results were compared to equilibrium type models of the linear and nonlinear type under steady as well as transient flow.

Keywords: pesticide, soil, water

POSTER SESSION 06. SOIL POLLUTION - ORGANIC POLLUTANTS

Contaminated soil bioremediation: comparison study of biodegradation rates in stirred and fixed-bed reactors.

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Bioremediation methods seem a promising way of dealing with soil and subsoil contamination by organic substances. This biodegradation process is supported by microorganisms which use the organic carbon from the pollutants as energy source and cells building blocks. The scope of our work is to study the main parameters of the process and its physical limiting steps. Several ground samples from an actual petroleum hydrocarbon contaminated site have been laboratory tested. Four fixed bed column reactors and one stirred tank reactor are used, enabling the study of the different operating variables influence on the biodegradation kinetics. The stoichiometric equation for bacteria growth and pollutant degradation has been established, allowing the determination of mass balances. Biodegradation monitoring is achieved by continuously measuring the emissions of carbon dioxide production and intermittently by analysing residual hydrocarbons. Biodegradation rates and pollution load decrease in the two kinds of bioreactors are compared.

Keywords: bioremediation, petroleum hydrocarbon, contaminated soils.

POSTER SESSION 06. SOIL POLLUTION - ORGANIC POLLUTANTS

Petroleum biodegradation: mass and chemical composition changes.

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The oil mass decreases and chemical composition changes in the model laboratory biodegradation experiments were investigated. The total petroleum composition (grouped into three classes: saturates, aromatics, "resins+asphaltenes") and n-paraffins, iso-paraffins, light aromatic hydrocarbons, PAH profile changes were identified and quantified by gravimetry, column chromatography and GC/MS techniques. It is shown that biodegradation of oil system is accompanied by a simultaneous change in all petroleum constituents saturates, aromatics and high-molecular (~ resins and asphaltenes). The changes both in PAH and monoaromatics isomeric composition observed under biodegradation are strongly interdependent. The mechanism of the above interdependent change could be similar to and explained by the mechanism of PAC photodegradation processes described (e.g. Matsuzawa, S. (2000) Polycyclic Aromatic Compounds, 21, 331-339).

Keywords: petroleum, biodegradation, organic pollutants, soils contamination and remediation.

POSTER SESSION 06. SOIL POLLUTION - ORGANIC POLLUTANTS

Identification of entrapped and covalently bound residues of atrazine using physical and chemical fractionation.

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Four soils were treated with atrazine (1 mg.kg⁻¹) and incubated for 55 days in laboratory conditions. They were then physically and chemically fractionated using alkaline extraction, HF treatment and acid hydrolysis with HCl 2M in reflux conditions. Solid phase extraction, dialysis and HPLC analysis were conducted for the fractions which were made soluble by these treatments. For the four soils, between 26 and 45 % of the bound residues associated with the fraction < 20 μ m (which contained between 60 and 80 % of the total bound residues of atrazine) corresponded to atrazine and its degradative products which were entrapped. Between 25 and 40 % were chemically bound to soil organic matter. Some of the covalently bound residues were identified as hydroxy-atrazine which was bound via the carbon 6 of the triazinic ring.

Keywords: bound residues, atrazine.

POSTER SESSION 06. SOIL POLLUTION - ORGANIC POLLUTANTS

Dialysis and sorption studies on the binding of phenolic xenobiotics to dissolved organic matter.

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The association of nonylphenol (NP), bisphenol A (BPA), and the herbicide metabolite hydroxydesethyl terbutylazine (HDT) with dissolved organic matter (DOM) has been investigated. In dialysis experiments at neutral pH, NP was markedly stronger adsorbed to peat humic acid than BPA and HDT. Under alkaline conditions, no formation of adducts with DOM was observed, whereas acidification typically enhanced the binding interactions. No associates of the investigated chemicals with the more hydrophilic fulvic acids were found at neutral pH. Normalised adsorption coefficients (KOC) obtained in soil sorption studies with NP, BPA, and HDT amounted to 9100, 900, and 90 L/kg, respectively. Addition of DOM to the sorption solutions did not affect the ad- or desorption coefficients of the compounds. Dissolved organic carbon measurements indicated that strong soil-DOM interactions precluded processes such as co-sorption or competitive displacement of the xenobiotics by the DOM.

Keywords: phenolic compounds, dissolved organic matter, soil, dialysis, sorption.

POSTER SESSION 06. SOIL POLLUTION - ORGANIC POLLUTANTS

Abiotic degradation of the herbicide Rimsulfuron on adsorbed phase.

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The study of photodegradation processes of pesticides on the soil shows many difficulties because of the heterogeneity of this substrate. Nevertheless, it is necessary to simplify the investigation by using models which results can be transferred to the natural environment. Considering the opportune limitations, different solid supports can be used to simulate soil and soil component influences on pesticide fate. The aim of our work is to show results of on the photochemical degradation of the sulfonylurea herbicide, Rimsulfuron on adsorbed phase. The photochemical reactions have been performed on different solid support: silica material, clay mineral and soil. Reaction kinetics were determined and reaction order was chosen by using a best fit statistic programme. A solar simulator (Heraeus) equipped with a Xenon lamp has been used. The physico-chemical properties of selected solid phases have differently influenced the reaction kinetics. The increasing the adsorption capacity of support the half time of pesticides decreased. More investigations are necessary to understand the interaction mechanisms between the solid phases and the xenobiotic molecules, and to improve the knowledge on the behaviour of pesticides in the environment.

Key words: pesticide, photodegradation, rimsulfuron, adsorbed phase, solar simulator.

POSTER SESSION 07

SEDIMENT POLLUTION**Can riverine cadmium fluxes be predicted from water discharge?**

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Prediction of heavy metals fluxes from rivers to oceans is a great concern when scientific, economic, environmental and human stakes are gathering. Here, nine-year routine measurements of Lot and Garonne river discharge and total suspended sediment content (TSS) were combined together with high frequency analyses of dissolved and particulate cadmium (Cd) concentration to calculate daily dissolved cadmium fluxes. That allowed us to propose a predictive model of Cd fluxes for the polluted Lot-Garonne fluvial system (France). Daily cadmium fluxes are related to floods and low waters distribution along the year. Thus, dissolved cadmium fluxes variability is a function of climate variability within the basin scale. The predictive model proposed here allows, without performing metal analysis, to roughly estimate daily dissolved and particulate Cd fluxes with uncertainty good enough for helping get a better management of this Cd pollution along time.

Keywords: anthropogenic pollution, cadmium fluxes, predictive model

POSTER SESSION 07. SEDIMENT POLLUTION

Role of the Lot River sediments as a sink or a source of coastal pollution.

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The Lot-Garonne fluvial system can be considered as a natural model for cadmium pollution (e.g. Blanc et al., *Hydrobiologia*, 1999, 410: 331-341). Other trace elements such as Zn, Pb, Cu, Cr, Co, Ni, As, Hg and U are less documented. We present routine measurements of river discharge and total suspended sediment concentration (TSS), which are combined with regular analyses for the particulate and dissolved trace metals listed above. The trace metal contribution of the major anthropogenic source is now well constrained. These data sets allow us to propose a box model involving trace metals mass balance for the Lot-Garonne man-influenced river system. This model allows quantifying the contribution from the sediment of the hydroelectric dams acting as sources or sinks for metal pollution in function of the river discharge.

Keywords: pollution, trace metals, source, sink, mass balance.

POSTER SESSION 07. SEDIMENT POLLUTION

A preliminary study of the geochemical distribution within the Medway estuary, UK.

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A study was undertaken of sediment chemistry in the Medway estuary, NE Kent, UK, in order to assess the spatial distribution of heavy metals and to determine if geochemical means can be used to infer transport directions within the estuary. Forty-six sediment samples were collected from subtidal and inter tidal zones. Sediments were prepared for examination using an Aqua Regia digest and subsequently analysed for Ba, Co, Cu, Ni, Pb and Zn using ICP-OES. Several major elements and rare earth elements were also analysed. The results indicate that geochemical tracing is possible only in localised areas within the estuary, as larger scale transport can be lost within the noise created by alternative inputs, and changing sediment dynamics.

Keywords: metal, sediment.

POSTER SESSION 07. SEDIMENT POLLUTION

Determination of optimal experimental conditions for the study of the kinetics of the EDTA-trace metals extractions from contaminated sediments.

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In the last decades, industrial development and urbanisation have led to a dramatic increase in the amount of trace metals discharged into natural environment. To assess the distribution of metal cations in sediments, sequential extraction procedures have been proposed (Tessier, A., Analytical Chemistry, 1979, 51(7), 844-851) but several authors (Li, Z., and Shuman, L.M., Soil Science, 1996, 161 (4), 226-232; Lin, J.G. and Chen, S.Y., Toxicological and Environmental Chemistry, 1998, 67, 511-529) consider that a more correct approach could be obtained from studies dealing with the kinetics of the extraction with EDTA. Experimental conditions have been optimised using 4 sediments samples. The results show that the ratio m/V (mass of sediment / Volume of EDTA) have no influence on quantities of Cu^{2+} , Cd^{2+} and Pb^{2+} extracted and the optimal pH extraction has been determined.

Keywords: trace metals, sediment, kinetics extraction.

POSTER SESSION 07. SEDIMENT POLLUTION

Desorption of dioxin and the organic-carbon normalised partition coefficient, K_{oc} .

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An attempt to measure K_{oc} by desorption from Lake Ontario sediment (470 pg dioxin/g dry wt., 2.37% organic carbon), exploiting the solids' concentration effect, is described. Suspensions of various solids' concentration were prepared in 2- or 4-L cylinders. After 4-14 days, the solids and water were separated by sedimentation. The measured aqueous quantities were solids' concentration, 0.06-60 g/L; organic carbon, C_{oc} , w, 0.23-65 mg/L; and dioxin, 2-1000 pg/L. Measured coefficients follow $\log K_{oc} = \text{constant} - \log C$, where C is the quantity of sorbent in the aqueous phase. The level of dioxin in water depends on organic carbon when $C_{oc}, w > 0.25$ mg/L, providing evidence for a critical micelle concentration for natural organic carbon. The apparatus was spiked with ^{13}C -labelled dioxin and ratios of native-to-all dioxin in water, sediment and dioxin associated with the apparatus indicate the approach to equilibrium. It is concluded that $\log K_{oc} > 7.1$.

Keywords: laboratory experiments, dioxins, sediments, dissolved organic matter, stable isotopes, speciation.

POSTER SESSION 07. SEDIMENT POLLUTION

Occurrence and fate of organic pollutants incorporated into macromolecular organic matter of riverine sediments

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Anthropogenic activities cause significant alterations of the macromolecular organic matter (MOM) in riverine systems mainly by emission of pollutants and their subsequent incorporation into geopolymers (bound residues). We have characterised highly polluted OMM of riverine sediments (Spree river, Germany) in order to investigate the occurrence, alteration, fate and distribution of several organic xenobiotics *in situ*. Therefore this study intended a comprehensive characterisation of riverine MOM combining different analytical techniques (various pyrolytic analyses and chemical degradation techniques), in order to provide information concerning the incorporation mechanism and the mode of binding of a variety of organic pollutants with different chemical properties. As main results of our study, the combined interpretation of the analytical data concerning the different degradation methods, the fractionation of the extracts and the pyrolytic data allowed to attribute several identified anthropogenic pollutants (pesticides, halogenated compounds, plasticizers) to various modes of incorporation into riverine macromolecular organic matter.

Keywords: contaminated riverine sediments, organic macromolecular matter, organic pollutants.

POSTER SESSION 07. SEDIMENT POLLUTION

Enhanced removal of trichloroethylene from soil and groundwater by substituted cyclodextrins.

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Trichloroethylene (TCE), an important industrial chemical, contaminates soil and groundwater at many sites throughout the world. The usual remediation technology includes flushing the contaminated area with water containing surfactants or other solubilizing agents, and treating the dissolved trichloroethylene using in- or ex-situ processes. In the present study, hydroxypropyl-, sulfated-, methyl- and carboxymethyl-beta-cyclodextrins (CDs) have been used in an alternative approach for enhancing trichloroethylene solubility. It was found that a 5% aqueous concentration of the substituted cyclodextrins is able to increase the solubility of trichloroethylene up to 5.5 times. Trichloroethylene is also known to be retained in soil through its association with organic matter, particularly humic material, which is present in many soils. We have shown that cyclodextrins are able to extract trichloroethylene from soil organic matter to different degrees depending on conditions. The influence of cyclodextrins on the rate of reductive dechlorination by zero valent iron is also examined.

Keywords: water, trichloroethylene, cyclodextrin, soil remediation.

POSTER SESSION 08

STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

This special session on applications and developments in stable isotope mass spectrometry in the field of environmental science is being held in memoriam to Dr Gareth Rieley (1969 - 1998). Gareth's tragically short but immensely successful career was aimed at understanding the factors which control the isotopic fractionations at the molecular level in organic components of biological and environmental significance. We celebrate his dedication to research in this field through this stable isotopes session and also through an award being launched at this year's meeting. We are proud to announce the European Young Researcher of the Year Award, which will recognise the achievements of young researchers who have made an outstanding contribution to our scientific understanding of Environmental processes. Nominations are invited through the ACE website (www.u-bourgogne.fr/ACE). The first award will be presented in Geneva in 2002.

Downstream geochemical changes in a Tufa depositing Karstic river (Krka, Croatia).

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Environmental pollution and intensive tourism endanger the picturesque scenery of the National Park Krka (Croatia). Geochemical studies of tufa deposition were performed in order to estimate the conditions of recent tufa precipitation and/or erosion. The Krka River water was supersaturated with respect to calcite and aragonite during the period observed. Theoretically, precipitation of calcite could be possible only at falls and cascades due to the outgassing of CO₂, and in microenvironments affected by plants. Isotope composition of dissolved inorganic carbon and carbonate indicates the decomposition of organic matter as a primary source of carbon to carbonate precipitates. Depletion of tufa carbonate in ¹⁸O with respect to the water indicates non-equilibrium conditions of tufa precipitation. At the present, the tufa formation is limited only to the warmest period of the year, thus resulting in net erosion of the barriers over the year.

Keywords: tufa precipitation, stable isotopes, water.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Environmental impact of aquaculture: a stable isotope study.

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An European Union project (BIOFAQs) started in December 2000, aiming to demonstrate the effectiveness of reducing the environmental impacts of organic inputs from intensive mariculture by using biofilter deployments over a pan-European scale. Hard substrates were deployed in the vicinity of four fish farms in different marine environments in Scotland, Slovenia, Greece and Israel. Stable isotopes of C and N were used as natural tracers to follow the nutrient flow in the impacted ecosystems. Isotopic composition of C and N in the sediment, particulate organic matter, fouling organisms and fish are regularly analysed at the fish cages, as well as at reference locations not affected by mariculture. It was demonstrated that the organic rain from the fish cages affects the sediment, as well as the food web in the ecosystem. The effectiveness of the biofilters can be assessed from isotopical balance of the ecosystems.

Keywords: stable isotopes, biofiltering, tracers, water.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Determination of climatic changes by speleothem analysis.

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Cave calcites known as speleothems formed in limestone caves have been found to be an excellent repository of paleoclimatic data for terrestrial environments. Combined radiometric and stable isotope methods have been used on calcite obtained from speleothems to reconstruct the paleoclimate. The isotopic composition of carbon and oxygen in the calcium carbonate of cave concretions may vary under different climatic conditions, according to the isotopic variations of water and CO₂ participating in the CaCO₃ solution-deposition chemical reactions. Such variations are determined by the isotopic composition of CO₂ in rainwater, which changed under glacial and interglacial conditions. Furthermore, the isotopic composition of the deposited carbonate depends on the deposition temperature, which equals, in general, the yearly averaged temperature of the region. These various factors stimulate interest in the idea of looking for continuous isotopic record of climatic variations in the cave concretions.

Keywords: speleothems, stable isotopes, paleoclimate.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Deuterium-depleted water. Romanian achievements and perspectives.

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Deuterium-depleted water (DDW) represents water with an isotopic deuterium content smaller than 145 ppm. The researches realised were materialised by many patents. The investigations lead to the conclusion that DDW caused a tendency towards the increase of the basal tone, accompanied by the intensification of the vasoconstrictor effects. Animals treated with DDW showed an increase of the resistance both to sub lethal and to lethal gamma radiation doses. DDW stimulates immune defence reactions. Investigations regarding artificial reproduction of fish with DDW fecundated solutions confirmed favourable influence in embryo growth stage and resistance in next growth stages. One can remark the favourable influence of DDW on biological process at plants in various ontogenetic stages.

Keywords: stable isotopes, deuterium-depleted water, production, biological effects.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

The relationship between kerogens, bitumens and oils revealed by carbon isotope composition in some wells in Pannonian Basin, Croatia.

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Stable carbon isotope are natural traces in organic matter, and are widely used parameter in organic geochemistry. Geochemical parameters from nine wells in the Pannonian Basin, have been evaluated regarding to their carbon isotopic composition. Carbon isotope profiles of kerogens, bitumens and oils of Bjelovar, Sava and Drava Depressions show variation between - 23.1 to - 27.0 delta ^{13}C PDB. Carbon isotope ranges between kerogens, bitumens and oils for each Depression are less than 1,85 per mil, which indicate a positive correlation between them. Marine originated amorphous, algal-bacterial kerogens were determined by optical methods in four wells from Bjelovar Depression. The differences in their carbon isotope values (-23.03 to - 25.26) are caused not only by differences in their composition but also by heterogeneity of the kerogen matter. All related bitumens are indigenous to those kerogens and show depletion in delta ^{13}C isotope ranged from 0.36 to 1.38 per mil.

Keywords: stable isotope, kerogen, bitumen, oil, genetic relationship

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Fertiliser characterisation: chemical and isotopic (S, N, O, and Sr) constraints.

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In the last years there is an increasing concern about the impact of the agricultural activities on surface and ground waters. In most areas, fertilisers are widely used, leading to significant inputs of nitrate, sulphate and heavy metals in waters. The extent of such pollution can be constrained by means of coupled chemical and isotopic analyses (e.g. Wassenaar, Appl. Geochem., 1995, 10, 391-405; Robinson and Bottrell, Appl. Geochem., 1997, 12, 305-319; Soler et al., Water, Air and Soil Pollution, accepted). In order to provide new tools for quantifying fertilisers contribution to water contamination, detailed chemical and isotopic analyses of 27 fertilisers were performed. Chemical characterisation includes major and minor ions and trace metals. Sulphur and oxygen isotope composition of dissolved sulphate, nitrogen and oxygen isotope composition of nitrate and $^{87}\text{Sr}/^{86}\text{Sr}$ were determined for each fertiliser. A case study is presented.

Keywords: fertilisers, stable isotopes, tracers.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Production and export of dissolved organic carbon (DOC) from an ombrotrophic peat bog.

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Enhanced export and remineralization of DOC from peatlands is currently being considered as an important positive feedback with respect to global warming (e.g. Freeman et al. 2001, Nature 409, 785). We study the production and export of DOC from a thick (> 6 m) ombrotrophic peat bog (Etang de la Gruyère, Switzerland). Long-term measurements of DOC distribution within the peat profile show DOC concentrations ranging from < 20 mg/L to 140 mg/L with a prominent maximum at a depth of 3-4 m. This demonstrates ongoing DOC production in the deep layers. However, as these layers are more decomposed and therefore less permeable, the rate of production of DOC is not necessarily higher than in the overlying peat, where DOC is more effectively flushed. Stable isotopes ($\delta^{13}\text{C}$ values of DOC and the peat matrix) are used to track in-situ DOC production in deeper layers.

Key-words: DOC, peatlands, global carbon cycle, stable isotopes.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

The stable isotopic composition of daily and monthly precipitation in Slovenia.

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Monitoring of stable isotopic composition of oxygen and hydrogen in precipitation represents an important tool in studies related to understanding of climatic and meteorological conditions that influence the formation of precipitation and circulation of atmospheric masses. To assess the variability of mean isotopic values of precipitation in the Slovenian Mediterranean and central region the monitoring programme of daily and monthly precipitation is performed since October 2000 at three sampling stations. The isotopic composition of precipitation varies considerably at all stations. The highest values of $\delta^{18}\text{O}$ and $\delta^2\text{H}$ are observed at the coastal station at Portorož Airport and the lowest, due to the continental effect, at Ljubljana. Higher values are significant for the start of precipitation event. The correlation with temperature is very poor and demonstrates that individual weather patterns, storm tracks and air mass mixing are far too chaotic to develop a clear relationship at event-scale (daily samples).

Keywords: stable isotopes, precipitation, monitoring.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

A reconstruction of the history of early environmental stress in the Basque country from the geochemical and pollinic signals recorded in a peat bog.

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An interdisciplinary research combining palynology and lead isotopic geochemistry was performed in a peat bog of the Basque Country, in an area recognized as being an old metallurgical centre. These various analyses make possible to reconstitute the history of mining and metallurgical activities and to appreciate their impact on forest during the last five millennia. Several phases of activities are attested between late Neolithic and modern times (Late Neolithic, Middle Bronze age, Late Bronze age, Antiquity and finally modern time). Most of these phases are clearly related to forest clearance. However the major impact of the metallurgy on wood peaks at the beginning of 15th-16th centuries.

Keywords: metalurgy, metals, geochemistry, palynology, environmental history, Pays Basque.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Oxygen 18, deuterium and hydrochemical data as a tool to identify some geological structures as hydrogeological barriers or conduits.

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The Valley of Leon, Guanajuato, lies in a graven of the Trans Mexican Neovolcanic Belt, at the Central Plateau physiographic province. A wide variety of rocks are distributed within the study area including: Cretaceous, Tertiary and Quaternary rocks and sediments. The Guanajuato Range is the highest and most important recharge area and is composed of igneous rocks and an associated volcano-sedimentary complex. The presence of great structures, such as the fault systems, act as hydrologic boundaries (system N-S and NW-SE), and in some cases as a permeable zones (NE-SW). These conditions result in hydraulic connection between aquifers. In others cases, substantial drawdown is generated by groundwater pumping. Other evidence of the geological influence on the hydrodynamics of the aquifer system include the response of the piezometric surface in the Rio Turbio Valley and the isotopic behavior in the surrounding areas. The distribution of the isotopic and hydrogeochemical data show a close relationship with the main structures in the area. The presence of thermal wells (La Muralla, Comanjilla, Palenque, and The Charcas) also can be related to the structural conditions and the genetic source of the igneous rocks.

Keywords: isotopes, geology.

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

Alterations in chemical composition of thermal and mineral waters as aftermath of an earthquake in Turkey.

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As part of an IAEA co-ordinated research project, samples of groundwater (mineral and thermal) within the zone of influence of the North Anatolian Fault Zone (NAFZ) were collected in July 1999. After the catastrophic earthquake of August 17th, further sampling campaigns were undertaken in order to observe possible effects of this earthquake on the isotopic and chemical compositions of thermal and mineral waters within the surrounding areas. Variations were observed in the chemical and isotopic compositions of the waters as well as changes in the intensities of the synchronous scans of fluorescence spectroscopy. The alterations observed were most noticeable in the thermal and mineral waters of the most affected areas of Kuzuluk, Bursa, and Yalova/Gemlik along the North Anatolian Fault Zone. These changes are most probably related to the active tectonics of the area which influence the groundwater circulation.

Keywords: fluorescence spectrometry, isotopes, tectonic activity (earthquake).

POSTER SESSION 08. STABLE ISOTOPES FOR ENVIRONMENTAL SCIENCE

 ^2H and ^{18}O isotopic use as tracers in groundwater of a wide basin under semi-arid climate: case of Souss-Massa, Morocco.

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This paper summarise of the application of isotope hydrological studies in different part of the Souss-Massa region. The isotopic data obtained in ^{18}O show a variation between -7 permil in the upstream and -4 permil in down stream with the intermediate values in the medium part of the plain. The upstream basin, place of condensation and beginning of the atlas mountain, shows impoverished values which can be explained by the altitude and continental effect. The values enriched towards the ocean in the west, show an evaporation effect, proximity of the source of condensation or the irrigation return especially in the irrigated perimeters. The values of rain indicate a majority supplying by the atlasic mountain, whereas the contribution of the local rains is negligible towards down stream. Relation ^2H - ^{18}O , shows lines with variable slopes while going from upstream towards down stream. The slopes lower than 8 in certain sectors, represent an evaporation during the infiltration (runoff or return from the irrigation). The values different of slope correspond on the other hand to the variables observed on a regional level in the basin.

Keywords: isotopes, tracers, groundwater.

POSTER SESSION 09

GREEN CHEMISTRY**Catalytic thiolation of polyols.**

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Industrially polythiols are produced by reaction between the halogenocompounds and alkali hydrosulfides. This non-catalytic reaction utilises toxic reactant and is not selective enough due to the formation of thioethers. The aim of this work was to develop a new catalytic route for the synthesis of polythiols employing non-hazardous reactants. The thiolation of 1-8 octanediol by H_2S was used as model reaction. This transformation was performed in a batch reactor and the catalytic properties of various oxides were determined. Among them, zirconia was one of the most effective system leading to selectivity towards 1-8 octanedithiol close to 55% at total conversion. Olefins, secondary thiols and polyethers or polythioethers were the main by-products arising from surface acidity of the catalyst. The control of the surface acidity of zirconia by doping its surface with magnesium oxide increases the selectivity up to 85% without modifying the overall activity.

Keywords: thiolation, catalysis, thiochemistry.

POSTER SESSION 09. GREEN CHEMISTRY

Regioselective rhodium-catalysed hydroformylation of olefins in supercritical carbon dioxide.

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Hydroformylation is one of the most industrially important and most extensively investigated homogeneously catalysed reactions. Since its discovery by Roelen in 1938, this homogeneous catalysis has developed into an extremely important industrial process with over 6 million tons per year of oxo products obtained via this method worldwide in 1993. Hydroformylation allows the functionalization of C=C bonds, and consequently it can be seen as an efficient synthetic route for the preparation of fine chemicals. Traditionally, organic solvents have been used for this reaction. However, these solvents are frequently expensive, environmentally undesirable, and difficult to remove from the reaction products. Supercritical carbon dioxide, the alternative solvent for the reaction, is often promoted as a solvent for green chemistry because it is non-toxic, non-flammable, readily available and inexpensive. We now wish to report the results of highly regioselective novel rhodium-catalysed hydroformylation of olefins in supercritical carbon dioxide. The detail results for this research will be discussed.

Keywords: green chemistry, supercritical carbon dioxide, hydroformylation.

POSTER SESSION 09. GREEN CHEMISTRY

Novel $\text{Sn}_x\text{Cu}_y\text{S}$ semiconductor photocatalysts for photogeneration of hydrogen.

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The semiconductor mediated conversion of solar energy into electric or chemical energy has attracted considerable research efforts in recent years. Efficient semiconductor materials for this purpose must possess certain characteristics such as suitable band gap energies, stability toward photo corrosion, and suitable physical characteristics. We now wish to report a new mixed metal sulfide semiconductor photocatalyst ($\text{Sn}_x\text{Cu}_y\text{S}$) shows significant activity for photochemical hydrogen production from water under illumination with either UV or visible light. A $\text{Sn}_{0.95}\text{Cu}_{0.05}\text{S}$ photocatalyst produced 420 micro mol/h of hydrogen under visible light irradiation. Raising the copper amount in the catalyst ($\text{Sn}_{0.5}\text{Cu}_{0.5}\text{S}$) reduced hydrogen production (270 micro mol/h). Hydrogen production dramatically increased with UV light illumination (8200 micro mol/h). And the detail results for this research will be discussed.

Keywords: solar energy conversion, photocatalyst, hydrogen.

POSTER SESSION 09. GREEN CHEMISTRY

Anaerobic biodegradation of phenols.

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Ferulic or veratric acid are shown to be an adequate substrate for *Thauera aromatica* K172 in liquid culture under anaerobic conditions, with nitrate as electron acceptor. The protein pattern of cell extract of *T. aromatica* grown on these substrates show the presence of a new band that is very likely to be part of a methyltransferase enzyme. This fact suggests that the biodegradation of the methoxylated substrates requires as a first step the conversion of the OCH_3 into OH groups, followed by the dehydroxylation. This hypothesis well matches the features of the protein pattern. In cultures with ferulate as substrate it is observed that the exponential growth of bacteria corresponds to the increase of the concentration of nitrite ion in solution. The nitrite accumulation induced a reduction of the cell-growing rate. Eventually, nitrite was reduced to dinitrogen and the rate of growth increased again.

Keywords: anaerobical degradation, ferulic acid, veratric acid, *T. aromatica* K172, biodegradation.

POSTER SESSION 09. GREEN CHEMISTRY

Carbon dioxide as a C₁-synthon and solvent: an alternative for green chemistry.

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Carbon dioxide, one of the major man-made greenhouse gas, is a renewable resource of carbon which can be viewed as a C₁ synthon to build valuable organic chemicals. The industrial syntheses of urea, cyclic carbonates, salicylic acid, and methanol already involve carbon dioxide as a reactant. Nowadays, the development of new applications is of major interest from the point of view of carbon dioxide sequestration and within the scope of green chemistry. Comparing carbon dioxide to carbon monoxide and phosgene as C₁-building blocks, the former has the obvious advantages to be non toxic, easy to handle, to transport and to store. Catalysis offers interesting options for dialkyl carbonate production from carbon dioxide, therefore avoiding the phosgene route which is still under operation. We will discuss our approach based on the chemistry and the reactor design for such reactions under supercritical conditions.

Keywords: CO₂, greenhous gases, supercritical, green chemistry

POSTER SESSION 09. GREEN CHEMISTRY

Solvent-free microwave irradiation of ϵ -caprolactone; an interesting route to synthesize polymers via green chemistry procedure.

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Poly(ϵ -caprolactone) is one of the most important biocompatible/biodegradable polymers. Due to their multiple biomedical applications, the synthesis of such materials has been attracting an increasing attention in the past few decades. Microwave heating is a modern technique which presents many advantages compared to the classical, thermal activation: shorter reaction times, controlled structure of the polymers. In this work, the polymers were synthesized by bulk polymerization, using different lanthanide halides as initiators. The lanthanides are known as non-toxic, very active catalysts in the ring-opening polymerization of the cyclic esters. Reaction times were between 5 and 45 minutes and the molecular weights of the obtained polymers were between 3000 and 12000. A comparison between hydrolytic and thermal degradation of the materials, with and without the lanthanide incorporated in the polymer matrix, has been done.

Keywords: green chemistry, polymer, biomedical, catalyst.

POSTER SESSION 09. GREEN CHEMISTRY

Physical and chemical behavior of cements obtained from rice hull ash.

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Brazil produces large amounts of rice hull. Rice hull contains about 20 % of silica in its structure. Usually this material is burned at the fields, causing environmental and healthy problems. In this work silica is obtained through the heating of rice hull at 600 C. After that, silica is mixed with CaO and BaCl₂, in several proportions and water is added. The resulting dispersion is sonicated (25 kHz, 60 minutes), dried and heated at several temperatures, rendering, in some cases, the Ca₂SiO₄, a component of commercial cements. On the other hand, commercial Portland cement is produced at about 1500 C. Also, considering that cement industry is responsible by about 6% of total CO₂ emissions processes based on lower energy consumption is desired. The process of cement hydration was studied using ATR/FTIR spectroscopy, at different experimental conditions. This work will present kinetics and thermodynamic results of hydration.

Keywords: biomass, cement, hydration

POSTER SESSION 10

ECOTOXICOLOGY**Organic material and biogenics elements circulation simulation model in Belarus mires.**

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The problem of the functioning of mire geoecosystems is a very complicated, extensive and many-sided. Its various aspect have been studied uneven, first of all because of the complexity of the object, it's polysystem, polystructure and polyfunctions ability and also due to the territorial differentiation and biogeocenotical diversity. The programme complex "MIRE" created within the framework of the REIA has allowed getting a quantitative estimation of circles organic material and biogenics elements in mires of Belarus. The model consists of two subsystems and describes a unity of phytocenosis and ecotop. Structure of phytocenosis is characterised by the system of layers from 1 to 4 (wood, shrubbery, herbaceous and moss vegetation). Ecotop is made up by a matrix of condition, which main blocks are a mire litter, dead, partly humoused organic matter and chemical elements, containing in mire water. Circulation model presents a system of difference balance equations. Turned out results will be informative for the substantiation of project of land-reclamation construction and agricultural use of mire.

Keywords: biogeocenotical diversity, mire geoecosystem, simulation model.

POSTER SESSION 10. ECOTOXICOLOGY

The effects of short time exposure of several plant species to ethylene

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In order to study the effects of incidents of elevated ethylene concentrations in the air on widely used garden plants, green peppers, salad, spruce trees and Impatiens - plants were exposed to the following ethylene concentrations: ambient concentration, 1 ppm, 10 ppm and 100 ppm. The following methods were used as bioindicators for plant vigour: Stomatalconductivity (CO_2 uptake of the leaves), Carboxylation Efficiency undersaturated light Photosynthetic Capacity and the amount of green Chlorophyll. A five-minute exposure to concentrations of 10 and 100 ppm ethylene led to a reduction of the carboxylation efficiency of two of the investigated plant species that might lead to a decrease in carbon gain of the plants.

Keywords: plant, toxicity, organic pollutant, hydrocarbon.

POSTER SESSION 10. ECOTOXICOLOGY

Optimisation of the uridine uptake inhibition assay for the screening of cytotoxicity.

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The uridine uptake inhibition assay is an in-vitro sensitive microassay for measuring cytotoxicity. A modified protocol, which suppresses chromatography, a time consuming step of the original method is described. After the uridine incorporation step, transfer of tritiated uridine contained in each well of the microplate is carried out on a 96-well filtration microplate instead of on a 3 MM whatman paper avoiding the paper chromatography. At the end of the protocol, the plate is directly counted with a microplate reader. So, this method enables high throughput screening capabilities to determine the cytotoxicity of numerous toxic compounds. In order to evaluate the new protocol, we determined and compared the IC₅₀ values of 9 compounds. The study shows a good correlation between the two methods ($r = 0.99$). In this way, the uridine uptake inhibition assay applied with the automated protocol is very convenient, suitable, rapid and enables daily high throughput screening.

Keywords: toxicology, in-vitro assay, cytotoxicity, HepG2 cell line.

POSTER SESSION 10. ECOTOXICOLOGY

Toxicity monitoring of field waters in Berlin using the multi-channel continuous toxicity monitoring system.

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The previously developed multi-channel continuous toxicity monitoring system for easy and long-term detection of water toxicity was applied and tested successfully in three different field waters in Berlin. The field waters tested were effluents of Ruhleben wastewater treatment plant, a river flow at the Teltow canal and a river stream in Fisherieamt of Berlin. In the multi-channel system, four different recombinant bioluminescent bacteria (DPD2794, DPD2540, TV1061, or GC2), which are responsive to DNA-, cell membrane-, protein-damage or cellular toxicity damage, respectively, were continuously grown in the first stage and freshly fed in the second stage of the each channel, where a specific bioluminescent cell is mixed with water samples. Due to the characteristics of the recombinant bioluminescent bacteria, DPD2794, DPD2540 and TV1061 containing inducible promoters such as *recA*, *fabA*, or *grpE* are expected to increase its bioluminescence while GC2 containing *lac* promoter is expected to decrease bioluminescence after mixing with samples containing toxic chemicals. Data obtained from the three different field sites have shown very consistent results for a week or two weeks operations. At all sites, DPD2540 and TV1061 channels showed the significant bioluminescence increase while in GC2 channel the bioluminescence decrease. This result suggests that there are some notable substances, which are causing cell membrane-, protein-damages, and metabolic inhibition.

Keywords: water, toxicity, DNA, bioassay.

POSTER SESSION 10. ECOTOXICOLOGY

Effects of deuterium-depleted water on reproduction of rainbow trout.

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The paper refers to an isotopic composition used to prepare fecundating solutions for artificial reproduction of fish. The solution it is constituted as a mixture (whose isotopic concentration is of 85-90 PPM D/(D+H)) of deuterium depleted water and natural water in we can add activating and energising substances. This fecundating solution ensure an improved fecundating level of fish roe, increase life index in the next growth up stages and increase fish resistance at special medium conditions.

Keywords: stable isotopes, deuterium-depleted water, artificial reproduction of fish.

POSTER SESSION 10. ECOTOXICOLOGY

Deuterium depletion in natural water.

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In the last years was proved that deuterium-depleted water (DDW) has a favourable influence on living organisms. In order to assure a total compatibility between this product and living organism, DDW must be mineralised. On can obtain spring water depleted in deuterium, depletion in deuterium of water used in balneology, river water depleted in deuterium, seawater depleted in deuterium. These can be used for the prevention and the treatment of various diseases and as living medium for aquatic organisms.

Keywords: stable isotopes, deuterium-depleted water, biological effects.

POSTER SESSION 10. ECOTOXICOLOGY

Deuterium-depleted water effects on plants behaviour.

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The studies regarding the effects of deuterium-depleted water on plants were initiated by the presumption that deuterium depletion may influence cellular activity and plant growth. It was observed that deuterium-depleted water has a favourable influence on biological process at plants in various ontogenetic stages. In vitro corn mature - embryo growth relieve that the growth of root in deuterium-depleted water medium was promoted for homozygote forms.

Keywords: stable isotopes in agriculture, deuterium-depleted water.

POSTER SESSION 10. ECOTOXICOLOGY

Development of environmental toxicity biosensors using genetically-engineered bioluminescent bacteria

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Bioluminescence is being used as a prevailing reporter of gene expression in microorganisms and mammalian cells. Bacterial bioluminescence draws special attention from environmental biotechnologists since it has many advantageous characteristics, such as no requirement of extra substrates, highly sensitive, and on-line measurability. Using bacterial bioluminescence as a reporter of toxicity has replaced the classical toxicity monitoring technology of using fish or daphnia with a cutting-edge technology. Fusion of bacterial stress promoters, which control the transcription of stress genes corresponding to heat-shock, DNA-, or oxidative-damaging stress, to the bacterial *lux* operon has resulted in the development of novel environmental toxicity biosensors with a short measurement time, enhanced sensitivity, and ease and convenient usage. These recombinant bioluminescent bacteria have been successfully used to develop environmental toxicity biosensors with high specificities to specific damages in continuous, portable, or *in situ* measurement forms for air, water, and soil environments. All the data obtained from these environmental toxicity biosensors were found to be repeatable and reproducible, and the minimum detection level of toxicity was found to be ppb (part per billion) levels for specific chemicals.

Keywords: bacterial bioluminescence; environmental toxicity; air, soil, water biosensors.

POSTER SESSION 10. ECOTOXICOLOGY

Bioelectrochemical sensor for the detection of the hepatotoxin microcystin LR.

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The blue green algae (cyanobacteria) accumulate on the surfaces of fresh water. Microcystins are secreted by some cyanobacteria and are acutely toxic to mammals, fish and invertebrates and promote highly severe liver cancer. We have developed a disposable one-step electrochemical biosensor for the detection of low levels of microcystin-LR in water. The detection is based on the specific inhibition of the target hepatic enzymes phosphatase, PP1 and PP2A, by microcystin-LR. Recombinant PP1 or bovine liver PP2A were immobilised via polyethyleneimime and glutaraldehyde onto the screen printed working electrode. The immobilised enzyme hydrolyses the substrate p-amino phenylphosphate (PAPP) to the electrochemically active product p-amino phenol (PAP). PAP is measured amperometrically by its oxidation on the electrode to p-iminoquinon. The sensor is of low cost, easy to operate and was shown to meet the sensitivity requirements of the World Health Organization with detection limit of 0.1 ng/ml of microcystins.

Keywords: microcystins, liver phosphatases, inhibition.

POSTER SESSION 10. ECOTOXICOLOGY

Relational database of information on potential endocrine disrupters (REDIPED).

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Environmental and toxicological information on potential endocrine disrupting chemicals has been assembled and organised in the form of a relational database, using Microsoft Access. 78 chemicals were selected and extensive literature searches conducted to obtain data on physicochemical properties, production volumes and uses, environmental exposure, degradation, accumulation and fate, and relevant biological effects. The biological entries include quantitative data from in vitro and in vivo assays (e.g. hormone receptor binding, cell proliferation and reporter gene assays, uterotrophic assays) and observations that could be ascribed to endocrine disruption from more general toxicological studies. All entries are fully supported by references, with extensive notes on the cited references. Chemicals selected include natural and synthetic hormones, phytoestrogens, pesticides, phthalates, alkyl phenols, PCBs and dioxins. The database will be a valuable source of information for researchers, environmentalists and regulators and has great potential as a tool for prioritisation of chemicals for further research or control.

Keywords: endocrine disruption, toxicology.

POSTER SESSION 10. ECOTOXICOLOGY

Effects of two cyanotoxins, microcystin-LR and cylindrospermopsin, on *Euglena gracilis*.

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We use the alga *Euglena* in a multiparametric test to detect polluted waters. Freshwater eutrophication causes blooms of cyanobacteria, among which some species produce toxins harmful for man or animals. We present here a study of the effect on *Euglena* of two hepatotoxins : microcystin-LR (MC, heptapeptide PM = 995,2) and cylindrospermopsin (CYN, alkaloid, PM = 415). MC (0,01-10 μ g/mL) and CYN (0,13-12,5 μ g/mL) showed no toxic effect on growth but increased cell productivity significantly. O₂ consumption was significantly stimulated half an hour after the toxin was added for MC and 48h after for CYN for all the concentrations tested. What is more, a drastic inhibition of greening and photosynthesis as well as an 80% increase of reduced glutathione were observed with the highest concentration of CYN. Bidimensional electrophoresis after methionine 35S labelling showed that with CYN a 23kDa protein was induced in the first 2 hours, while a 28,6 kDa protein was overexpressed with MC and CYN.

Keywords: bioassay, microcystin, cylindrospermopsin, *Euglena gracilis*.

POSTER SESSION 10. ECOTOXICOLOGY

Use of a unicellular organism, *Euglena*, as a water pollution marker.

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Physico-chemical analysis of waters may reveal traces of pollutants and allow their identification and quantification. However, it is not easy to get a reliable evaluation of the impact of pollutants on fauna and flora from such data. *Euglena*, a unicellular Eucaryote, presents numerous analogies with the hepatic cell such as the lactate and ethanol metabolic pathways. Some of its proteins are recognised by mammalia's antibodies. We have tested the effects of 11 micropollutants of freshwaters (concentrations determined from water research center - WRC) on six physiological and biochemical parameters of *Euglena*. These multiparametric approaches allow a better diagnostic and avoid false negatives. We have controlled the validity of *Euglena* as a biomarker of water pollution (on rivers, industrial effluents and city effluents) but it remains difficult to test river sediments.

Keywords: bioassays, toxicology, cellular model.

POSTER SESSION 10. ECOTOXICOLOGY

Assessment of metal toxicity on a human cell line and luminescent bacteria.

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Dramatic expansion of industrial and urban areas in recent years has caused increased environmental and health burdens. There is also an increasing dependence on toxicity assays to provide information concerning potential impact of chemical and complex mixtures of contaminants on aquatic ecosystems. One of this the tests that has received considerable attention is the Microtox bioassay, which uses the luminescent bacteria *Vibrio fischeri* as the test organism. The Microtox toxicity bioassay has been used extensively for the quick and reliable assessment of aquatic toxicity of organic and inorganic chemical and complex effluents containing potential contaminants. On the other hand, a cell cultured method using HT29 human cell line was used. After the exposure of these heavy metals on cell cultures, the cell growth diminution was determined as a parameter of cellular damage. EC50 and thresholds were determined with both biological models. Results are presented and compared.

Keywords: metal toxicity, HT29 cell line, *Vibrio fischeri*.

POSTER SESSION 10. ECOTOXICOLOGY

Biological assessment of pollutants in water samples from rural and urban origin using the Lux-Fluoro Test.

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During the 20th century, population growth and urbanization, together with changes in production and consumption, have placed unprecedented demands on water quality. The ongoing extraordinary economic growth, industrialization, and urbanization of many developing countries results in widespread water pollution from agricultural, industrial, and domestic sources. In consequence, people consume contaminated drinking water, thereby increasing the risk of exposure not only to infectious and parasitic disease but also to a growing volume of genotoxic and cytotoxic chemicals. In light of these trends, new quick and low-cost approaches are urgently needed to assess the quality of water supplies. Thus, the Lux-Fluoro test which measures in parallel the genotoxic (SOS-Lux test: DNA damage induced light production) and cytotoxic (Lac-Fluoro test: reduction in constitutive GFPuv fluorescence) potency of agents, was used to identify polluted water from samples of rural and urban sources, collected from different locations in the Punjab river basin.

Keywords: Lux-Fluoro Test, bioassay, toxicology, contamination of water.

POSTER SESSION 10. ECOTOXICOLOGY

Impact of a sulfonylurea herbicide on growth of photosynthetic protozoa.

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Effect of a sulfonylurea-based herbicide, known to block plant amino acid synthesis, on growth of photosynthetic protozoa and zoochlorella was examined. Methyl=3-(4-methoxy-6-methyl-1,3,5-triazin-2-ylcarbamoysulfamoyl)-2-thenoate, known as thifensulfuron methyl, was added to the culture of photosynthetic protozoa (euglena, green paramecia and green euplotes) and symbiotic algae isolated from green paramecia, at various concentrations ranging from 0.01 to 1000 mg/L. Viability of the protozoa or algae was examined under microscopy, 1 week after addition of thifensulfuron methyl. High concentrations (100-300 mg/L) of thifensulfuron methyl were shown to be inhibitory to the growth of symbiotic algae and free living chlorella. The same range of thifensulfuron methyl concentrations was shown to be lethal to green paramecia and green euplotes. Growth of euglena was not drastically affected by thifensulfuron methyl. However, thifensulfuron methyl-treatment induced some changes in size and shape of the euglena cells. Thus, sulfonylurea herbicides may not be harmless to aqueous protozoa.

Keywords: algae, herbicide, protozoa, sulfonylurea.

POSTER SESSION 10. ECOTOXICOLOGY

Oxidative burst induced by metal cation stress in tobacco BY-2 cells and mitigation by zinc and manganese ions.

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Our recent studies have shown that tobacco cells exposed to the environment rich in various metal salts, immediately produce superoxide via activation of NADPH oxidase by ions of alkali metals, alkali earth metals, lanthanides or aluminum. In this study, we show the effect of extracellular supplementation of Zn^{2+} and Mn^{2+} on the cation-induced oxidative burst in tobacco cells, measured with superoxide-specific chemiluminescence of a Cypridina luciferin analogue. Supplementation of Zn^{2+} and Mn^{2+} inhibited the metal salt induced superoxide generation. Mn^{2+} simply inhibited total production of superoxide. In contrast, Zn^{2+} inhibited only the early phase of superoxide production. Here we propose the roles for Mn^{2+} and Zn^{2+} in protection of plant cells, as an effective superoxide scavenger and an effective inhibitor of superoxide generating enzymes, respectively.

Keywords: metal, plant, bioassay.

POSTER SESSION 10. ECOTOXICOLOGY

A new bioassay system of chemical substances in environment using green paramecia, *Paramecium bursaria*.

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We investigated to establish the new bioassay system using green paramecia, *Paramecium bursaria*, as a new testing material. *P. bursaria* is a unicellular organism which widely exists in river and pond. Since *P. bursaria* can use metabolites of their endosymbiotic green algae as a nutritive source, culturing them is much easier than that of cultured cells. In a present study, we selected 32 chemical substances as environmental indicator substances such as bisphenol A and nonylphenol which were considered to be toxic by the test using cultured cells. At various concentrations, those substances were added to the culture solution of paramecia. The values of 50% inhibition concentration (IC₅₀) of growth rate were compared with the data obtained using mammalian cultured cells. We conclude that *P. bursaria* is very useful for using as an environmental indicator material against water pollution by chemical substances.

Keywords: environmental indicator substance, water pollution, endosymbiotic algae.

POSTER SESSION 10. ECOTOXICOLOGY

Erika crude petroleum genotoxic impact on fish (*Sola sola*) and relationship with cytochrome P450 1A1 expression.

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On december the 12th of 1999, the load of the tanker Erika (10 000 ton crude oil) flowed into the sea near the French coast (Finistère). Crude oil is a mixture of hydrocarbons polycyclic aromatic (HAP) known to have genotoxic properties and to induce carcinogenic lesions on fish liver (Vincent et al, 1998; French et al, 1996) . In this study, the Erika oil genotoxic impact is evaluated in time and in space on fish liver. In three locations and at four periods of the following year, ten fishes (adged 1 and 2 years) have been caught. DNA adducts (reflecting genotoxic effect) in liver fish (*Sola sola*), has been detected by DNA 32 P-postlabelling method (Randerath et al, 1981), and used as biomarker of early pollution. The modulation of the expression of the cytochrome P450 1A1, enzyme involved in the biotransformation and the genotoxicity of the HAP, has been analysed.

Keywords: crude petroleum, HAP, genotoxic impact, DNA adduct, fish, cyp1A1.

POSTER SESSION 10. ECOTOXICOLOGY

DNA adducts as a biomarker of seasonal contamination by hydrocarbon polycyclic aromatic in mussel digestive gland (*Mytilus galloprovincialis*) in Mediterranean sea.

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DNA Adducts are early biomarkers reflecting genotoxicity of some compounds. They are usually used in biomonitoring of the aquatic system (Kurelec et al, 1989; Lyons et al, 1997). DNA Adducts have been analysed in gills mussels, from two sites of the French Mediterranean coast exposed to a marine diffuse contamination by hydrocarbons polycyclic aromatic (HAP) having two different origins. One of the them is located near a petrochemical factory (8 ppm/dry weight mussel) while the other is submitted to urban dejectas (4 ppm/dry weight mussel). In each site, pool of 30 gills mussels have been sampled monthly along the years 1999 and 2000. For both locations, we observed a seasonal variation of the presence of DNA adduct. This difference is more pronounced in 1999 than in 2000. Moreover, the DNA adduct pattern is more or less specific of the location. This study shows the interest to use DNA Adducts detection as a biomarker of pollution from genotoxic mixture of unknown composition.

Keywords: HAP, DNA adduct, mussel, biomonitoring

POSTER SESSION 10. ECOTOXICOLOGY

Dutch survey of chlorinated persistent, bioaccumulative and toxic compounds (PBTs) in industrial effluents and other emission sources.

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The first results will be presented from a national survey (OVOC) on the presence of chlorinated PBTs (persistent, bioaccumulative and toxic compounds) in effluents from industrial and municipal waste water treatment plants. A bioassay-directed approach was used, with sensitive in-vitro screening methods (DR-Calux, Carp-hepatocyte) for compounds with dioxin-like or estrogenic mode of action, in-vivo testing (zebrafish-ELS, microtox), C-18 fractionation, and chemical screening: gas chromatography-electron capture detector - mass spectrometry detector (GC-ECD/MSD). The project is executed together with different national partners (IRAS-UU, RIZA, TNO-STB and CML-UL) and sponsored by the Dutch government (VROM, VW), chemical industry (VNCI) and national NGOs. DR-Calux, EROD in Carp-hepatocyte and the semi-chronic were responsive in various samples. Halogenated compounds were detected in fractions with different hydrophobicity (Log Kow ranges <4, 4-6 and >6). Bioanalysis-based dioxin equivalent concentrations were higher than data from chemical monitoring studies. A selection of samples will be subject to further biodegradation and TIE studies (toxicity identity evaluation) to identify responsive compounds.

Keywords: bioassay-based screening, TIE, wastewater, PBTs.

POSTER SESSION 10. ECOTOXICOLOGY

Impedance based biomonitoring of the environmental toxicants

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Trinitrotoluene (TNT), trinitrobenzene (TNB) and 2-amino-4,6-dinitrotoluene (ADNT) have been detected as defence related environmental contaminants of surface water, ground water and soil. An emerging sensor technology referred to as electric cell-substrate impedance sensing (ECIS) has been extended for quantitates the nitroaromatics upon monitoring the behavior of insect cells including attachment, motility, and mortality. Based on cell-matrix recognition approach, experimental data revealed that insect cells interacted differently with various proteins used to pre-coat the gold electrode, with concanavalin A as the best promoter to accelerate the rate of cell attachment. Upon the attachment and spreading of cells on the gold electrode, the impedance increased because the cells acted as insulating particles to restrict the current flow. Then adsorbed cells can behave sensitive to external chemicals. The quantitative data obtained in this study are taken in real time and in a continuous fashion to depict cell motility and mortality.

Keywords: TNT, Biosensor, ECIS.

POSTER SESSION 10. ECOTOXICOLOGY

Fate of imidacloprid in fields and toxicity for honeybees.

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The insecticide imidacloprid (Bayer) is suspected of harmful effects on honeybees. Researches were developed by AFSSA, CNRS and INRA with the support of EC. Vital functions of bees are affected by sub-lethal doses of imidacloprid, from 1 to 20 ppb ($\mu\text{g/kg}$) and from 0.1 to 2 ng/bee. HPLC/MS-MS was developed to detect such small amounts in soils, plants and pollens. LOD and LOQ are 0.1 ppb and 1 ppb, respectively. Imidacloprid diffuses in sunflowers during the growth. At the flowering, concentrations reach average values of 8 ppb in flowers and 3 ppb in pollens. Also, the concentration of imidacloprid in soils is still at 6 ppb (averaged) one year after sowing. Thus, imidacloprid was forbidden on sunflower in France, first in 1999, again in 2001. A preliminary study shown that imidacloprid was found at (mean values) 11 ppb in the maize flowers and 2 ppb in its pollen.

Keywords: insecticide, imidacloprid, analysis, sub-lethal effects, bees.

POSTER SESSION 11

ANALYTICAL METHODS - ORGANIC POLLUTANTS**Determination of ethylenediaminetetraacetic acid (EDTA) in surface water by capillary electrophoresis via large volume sample stacking (LVSS) injection.**

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The widespreadly using of ethylenediaminetetraacetic acid (EDTA) has requested an urgent monitoring program in surface and groundwater. Analyzing EDTA at low ug/L concentration in the environment is not easy by the conventional GC/MS or HPLC methods. In this study, a novel sample injection technique large volume sample stacking was developed and applied for the first time in the detection of EDTA in surface water by capillary electrophoresis (CE). Compared with classical CE method, 2000-fold concentration factor could be achieved smoothly on LVSS method. Thus, the detection limit of current technique for EDTA analysis is as low as 0.01ug/L. To the best of our knowledge, this represents the best sensitivity for EDTA analysis via CE. Several reservoir water samples have been tested by this developed method.

Keywords: water, ethylenediaminetetraacetic acid, large volume sample stacking, capillary electrophoresis.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

The comminution of large quantities of wet sediment for chemical analysis.

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When preparing field samples for chemical analysis, it is invariably necessary to split the sample into representative subsamples. If the mass of the original sample is of the order of 1000 kg (dried), then subsamples that are about 100,000-10,000,000 times smaller are required for chemical analysis. With such large size reductions, the representability of the subsample is a concern. A systematic method for preparing representative subsamples from large quantities of wet sediment is described. The sediment is passed through a commercially available slurry splitter that provides 1/20th splits. Further splits are obtained with a custom-built churn splitter. The procedure was applied to sediments collected from Lake Ontario (LO), USA, and from the Fox River and Green Bay (FRGB), Wisconsin, USA. Its efficacy was evaluated by dioxin and TOC analysis for the LO sediments and by analysis of the pore-water ammonia of the FRGB sediments.

Keywords: trace analysis, dioxins, organic pollutants, sediments.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Pollut-Eval: an innovative analytical tool for direct hydrocarbon assessment in contaminated soils.

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The Pollut-Eval is a novel analytical tool able to perform quantitative and qualitative hydrocarbon characterisation of contaminated soils. The laboratory equipment provide a complete organic carbon mass balance of the soil sample. Various pollutant profiles (pyrograms) will be presented and compared to results obtained by conventional techniques such as gas chromatography and infra-red spectrometry. A field analyser has also been designed to perform real time on-site diagnosis. The main environmental benefit of this equipment, associated to a new real time sampling strategy, is a faster global characterisation, quantification and localisation of the pollution extension. Furthermore, the few samples needed for further certified analyses leads to a cost reduction of the diagnosis operations. Data from two different sites will be presented: a jet fuel contaminated site and a former cocking plant polluted by coal tar.

Keywords: petroleum, contaminated soils.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Determination of the sewage indicator compound, aminoacetone, its environmental lifetime, and its correlation with faecal bacterial indicators in sewage effluent.

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The potential of aminoacetone (AA) as a sewage indicator compound has already been reported, and the current work comprised of the following: 1) the development of an improved analytical method to detect AA in aqueous solution 2) a pilot study to determine both its environmental lifetime and its correlation with faecal indicator bacteria in a series of sewage effluent incubations. AA was determined in aqueous samples as its hydrazone through reaction with 2,4-dinitrophenylhydrazine (DHPH), using a gas-stripping chamber connected on-line to a cartridge containing DNPH. The cartridge was eluted with acetonitrile and the derivative was determined by HPLC with UV detection. Recoveries were > 90% at the 10 μM level and the detection limit was determined to be 18 nM. APR was detected in urine and sewage effluent using this method. A subsequent pilot study was undertaken to determine the environmental lifetime of AA and its correlation with bacterial indicators in incubations of primary treated sewage effluent. A strong relationship between bacterial numbers and AA concentrations was observed in the samples. Regression analysis of AA with the bacterial species indicated a variance coefficient R^2 was 87.5%, 81.0.8% and 80.0% for total coliforms, faecal coliforms and faecal streptococci respectively, overtime the lifetime of the incubations. From these results, the threshold AA concentration indicating the presence of faecal coliforms was 1.25mM, which was well above the detection limits of the method. The measured AA concentration subsequent to bacterial die-off was approximately 1.2 μM , and the compound was detected in all samples after 10 days. These results further indicate the potential application of this compound to the measurement of faecal contamination in surface waters.

Keywords: sewage sludge, aminoacetone, bacteria.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Microwave breakdown spectroscopy (MBS) applied to the detection of halides in air: dual-beam intersection method

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Dual-beam intersection method for MBS technique has been newly developed in order to improve the beam controllability of the single-beam method to focus on the arbitrary breakdown point in the open-space. The dual beams were generated by a 9.4 GHz pulse magnetron (pulse width: 5 microsecond, pulse repetition frequency: 10 Hz) using a power divider. The pulse power and the phase difference of dual beams could be varied in the range of 10-100 kW and 0-360 degree, respectively. These beams were superposed on a center of test chamber through each dielectronic lens. The preliminary experiments clarified that the threshold value of breakdown power was strongly depend on the phase difference, and almost all the emission spectra observed by this experiment was more intensive than that of single-beam method. The chlorine atom spectrum (837.6 nm) in nitrogen/oxygen/2vol% CCl_2F_2 mixture (10 Torr) was precisely examined.

Keywords: microwave breakdown spectroscopy, dual-beam intersection, halides.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Differentiation of mobile and immobile pesticide on anionic clays by high resolution magic angle spinning nuclear magnetic resonance (^1H -HR-MAS-NMR).

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The adsorption-desorption mechanisms at the interface between organic and inorganic soil colloids influence movement of pesticides, and thus their bioavailability. Direct analyses of dry parts of soils have been reported in the literature using solid-state cross polarisation (CP)-MAS NMR spectroscopy but this technique cannot allow quantification of the bioavailability of the pollutant. This communication demonstrates the potential of the ^1H HR MAS technique to study in situ interactions at the solid-aqueous interface of a solid matrix. By using a well-characterized model of soil it was possible to distinguish unambiguously the mobile and immobile pesticide. We have shown that adsorbed versus intercalated MCPA (4-chloro-2-methylphenoxyacetic acid) in highly hydrated clays (HDLs) could be clearly distinguished by ^1H HR MAS NMR; adsorbed herbicide gave sharp signals indicating high mobility while intercalated herbicide gave very wide unresolved spectra due to its strong interaction with the solid matrix (Combourieu et al., Chem. Com. , 2001 in press).

Keywords: bioavailability, pesticides, clay, ^1H HR-MAS NMR

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Spectroscopic tools for the remote sensing of some greenhouse gases: CH₄, CF₄, SF₆...

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Highly symmetrical molecules like CH₄, CF₄ or SF₆ are known as atmospheric pollutants and greenhouse gases. High resolution spectroscopy in the infrared is particularly suitable for the monitoring of gas concentration and radiative transfers in the Earth's atmosphere. This technique requires prior extensive theoretical studies for the modeling of the spectra of such molecules (positions, intensities and shapes of absorption lines). Since many years, we have developed in our group, powerful tools for the analysis and the simulation of absorption spectra of highly symmetrical molecules. These tools have been implemented in the STDS and HTDS softwares available at <http://www.u-bourgogne.fr/LPUB/shTDS.html>. They include a compilation of modeled data obtained during the last 20 years. An overview of our latest results in this domain will be presented.

Keywords: greenhouse gases, atmosphere, analysis.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Infrared detection of chlorinated hydrocarbons in water at part per billion concentrations.

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Infrared sensor, based on attenuated total reflection (ATR) phenomenon, for the detection of chlorinated hydrocarbons represents a big advantage compared to chromatographic and mass spectroscopic techniques since it is one step detector. Pre-concentration and separation take place in polymer film covering ATR element and pollutants are identified immediately. The analysis is rapid, sample does not require any initial preparation, and can be easily performed in a field. It is documented that response dynamics of the optical sensor and its sensitivity depend strongly on the diffusion of pollutants through a boundary layer formed between polymer film and the monitored solution, and in the polymer film. The optimization of these parameters (thickness of polymer film and flow rate) result in tremendous improvement of the response dynamics and sensitivity as low as a few ppb. The sensor was tested for mixture of six hydrocarbons: monochlorobenzene, dichlorobenzene, trichlorobenzene, chloroform, trichloroethylene, and perchloroethylene.

Keywords: chlorinated hydrocarbons, analysis.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

¹H NMR study of the biodegradation of 2-substituted benzothiazoles by Rhodococcus strains.

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Benzothiazoles are a group of xenobiotics, heterocyclic chemicals, which are widely used in industrial processes, especially in the manufacture of rubber chemicals, but also for agricultural purposes as herbicide or fungicide. They enter the environment by routes associated with their manufacture and their use, and have been detected in many environmental compartments. We are studying the biodegradative pathways of several 2-substituted benzothiazoles by Rhodococcus strains (isolated from activated sludges of waste water treatment plant) using either classical analytical method (HPLC) or also in situ ¹H NMR, performed directly on culture medium without any previous step of purification. Both methods are qualitative and quantitative. The metabolites formed during the biodegradation were identified using long-range ¹H-¹⁵N heteronuclear shift correlation (gHMBC) at natural abundance, as well as mass spectrometry. A common intermediate corresponding to a hydroxylation reaction in position 6 on the aromatic ring was evidenced (Besse et al., Appl. Environ. Microbiol., 2001, 67, 1412).

Keywords: biodegradation, benzothiazole, NMR.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Adjustment of parameters involved in the detection and the identification of biomarker proteins of pathogenic bacteria by matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry.

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Different procedures have been developed in recent years that utilise mass spectrometry for the identification of bacteria. The accuracy and speed with which data can be obtained by Matrix-assisted Laser Desorption/Ionization Time-of-flight Mass Spectrometry (MALDI-TOF MS) make this an interesting tool for environmental monitoring. However, minor variations in the sample/matrix preparation procedures and in the experimental conditions used for bacterial protein extraction can result in a significant change in the observed mass spectra. This study define optimum experimental parameters to allow the rapid identification, by MALDI-TOF MS, of whole bacterial cells isolated from environmental matrices.

Keywords: analysis, bacteria, protein.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Analytical potentialities of sensitized room temperature phosphorescence for determination of polycyclic aromatic hydrocarbons.

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Polycyclic aromatic hydrocarbons (PAH) belong to priority environmental pollutants because of their carcinogenic and mutagenic character. For determining of PAH is widely used room temperature phosphorescence (RTP) in micellar solutions. For enhanced of RTP analysis selectivity we used triplet-triplet (T-T) excitation energy transfer and sensitized RTP. Triphaflavine, acridine yellow and acridine orange as a triplet energy donors, thallium (I) nitrate as a heavy atom, and sodium sulphite as a scavenger of oxygen were used. A comparative study of selectivity factors for pyrene, benz[a]anthracene and anthracene determination by room temperature phosphorescence (RTP) and sensitized RTP has been made.

Keywords: pollutants, PAHs, analysis.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Internal and external heavy atom effect on solid-state room-temperature phosphorescence of polycyclic aromatic hydrocarbons.

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Polycyclic aromatic hydrocarbons (PAHs) represent one of the most ubiquitous groups of organic pollutants in the environment. Solid-surface room-temperature phosphorimetry (SS-RTP) provide one of methods for PAHs detection. This method has a lot of advantages that is simplicity and rapidness of the experimental procedures, selectivity, sensitivity and small sample requirements. Intensity of phosphorescence emission can be improved by the presence heavy atom. Effect of internal and external heavy atom on SS-RTP of PAHs was studied. The phosphorescence lifetimes of PAHs adsorbed on treaded and non-treated support was evaluated. Mechanism of SS-PTR signal arising was discussed in terms analyte-support matrix and analyte-heavy metal interactions. The experimental parameters that affect to the PAHs detection were optimized in terms of matrix and heavy atom nature, solvent, temperature and time of dry and etc.

Keywords: polycyclic aromatic hydrocarbons, phosphorimetry, heavy atom.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Multi-channel detection of toxic compounds by microbial sensors.

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The analytic device for the detection of toxic compounds has been developed and tested for assay of 2,4-dinitrophenol (2,4-DNP), picric acid and nitrite ions in model conditions. The device consists of four amperometric type biosensors (three membrane-type ones and a column-type one). The measurements are realized in the flow-through mode. The receptor elements of sensors utilize the specially chosen microbial strains belonging to *Rhodococcus* and *Nitrobacter* genera and possessing high oxidizing activity towards nitrophenols and nitrite ions, respectively. The range of detection of 2,4-dinitrophenol is 10-250 microMoles and of nitrite ions is 0.02-10 mMoles. The measuring time for the analysis of a single sample is not more than 10-15 min. This device could be applied for express analysis of wide spectrum of xenobiotics including nitrophenol compounds and nitrite ions in waste waters of chemical plants.

Keywords: microbial biosensors, multi-channel detection, nitroaromatic compounds, nitrite ions, integral BOD.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Interaction of beta-naphthol with humic acid.

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Isoperibolic calorimetry was used to determine the thermodynamic parameters for humic acid interactions with water and beta-naphthol solutions. The enthalpy of interaction of humic acid with water, measured as a function of the cumulate mass of humic acid mixed with water, is exothermic and strongly vary between 0.3 and 0.8g of humic acid. The enthalpy of interaction of humic acid and beta-naphthol as a fonction of beta-naphthol was calculated from the difference between the heats of mixing of humic acid with beta-naphthol solutions and with water. The association seems to be unfavourable below a beta-naphthol concentration of 0.6 g /L and favourable beyond this limit.

Keywords: calorimetry, humic acid, beta-naphthol, interaction.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Determination of nicosulfuron and atrazine evolution in mesocosms.

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The ecotoxicological risk implied by pesticides may be assessed in mesocosms to imitate a whole ecosystem. In the present study, the induced effects of atrazine (one of the main water pollutants) have been compared to those of nicosulfuron, a sulfonylurea herbicide. Pesticides were monitored at two different levels of concentration for correlation with biological effects (biomass amount, phytoplankton photosynthetic efficiency, community diversity). In the case of nicosulfuron, a new analysis procedure has been designed considering the characteristics of this compound. This procedure is based on the use of alternatively anionic or molecular state of the pesticide (pK_a 4.6), and takes care of its sensitiveness to hydrolysis. The method includes solid-phase extraction on a styrene-divinylbenzene polymeric support and HPLC with UV-diode array detection. Stability, recovery and reproducibility have been checked in different matrixes. Investigations on the possible extension of the method to other sulfonylureas are in progress.

Keywords: pesticide, analysis.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Trace analysis of fluorescent substances in groundwater by combined high-performance liquid chromatography (HPLC) luminescence technique.

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In hydrogeological applications, analyses of fluorescent dye tracers are routinely determined by fluorescence spectrometry. Performing tracer tests in fractured rocks and porous aquifers normally yield low recovery resulting in concentrations near the detection limits of the method. At these very low levels, natural or unnatural fluorescent contaminants can mask the fluorescence intensities and therefore yield erroneous results. In practice this often results in an increase in the fluorescence signal of the method leading to inaccurate results, mostly false positives. In this experimental study, the advantages of a separation technique prior to detection was demonstrated. We examined and compared the results obtained by conventional spectrofluorimetry with those of HPLC coupled to a fluorescence detector. We were able to show that the combined technique provides a highly sensitive substance specific analytical method with detection levels of the tracers within the range of the conventional fluorescence spectrometric method.

Keywords: water, analysis, hydrogeology, tracer dyes, fluorescence spectrophotometry, HPLC.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Analysis of coal tar contamination in soils and water using solid phase microextraction and gas chromatography-mass spectrometry (GC-MS).

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Solid Phase Microextraction (SPME) is a sampling technique that works on the principle that organic molecules will partition between the polar aqueous phase and the non-polar solid phase of the SPME fibre. It has the advantages of being able to combine the extraction and preconcentration steps which more traditional methods require, and is a solvent free process. Coal tar is a by-product of the manufactured gas industry and a major pollutant throughout the world. Its major constituents are polycyclic aromatic hydrocarbons (PAHs) which have been reported as known or suspected carcinogens. A method has been developed for the analysis of selected PAHs in soils and soil waters using SPME as the sampling technique and GC-MS for the analysis. It has been validated using standard solutions and a standard reference soil, both showing good repeatability and good limits of detection. The method was applied to the analysis of an authentic coal tar contaminated soil and the water run off from column experiments using this soil and the results are reported.

Keywords: analysis, PAHs, coal tar, soil.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Rapid extraction of halogenated aromatic compounds by accelerated solvent extraction (ASE) in multi-polluted incinerator furnace bricks.

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Before the incineration in a cement works of the polluted mineral waste (incinerator furnace brick) from a aluminium producer, we must have a certificate of the different level of the pollutants. It's why we have to identify and quantify these pollutants like halogenated compounds. In order to reduce time and cost of analysis, the extractor (ASE 200-Dionex), has been tried out for the extraction of halogenated polycyclic aromatic hydrocarbons (HPAHs : PCBs, PCDD/Fs) from these incinerator furnace bricks. This method, which uses a conventional liquid solvent at elevated temperature and pressure (under control), has been developed and compared to traditional extraction like Soxhlet, Soxtet. For the analysis, we use different methods like HRGC-HRMS (high resolution gas chromatography couples to high resolution mass spectrometer). The consumption of extraction solvent has been reduced to about a fifth and the time to about a quarter, compared traditional extraction. ASE is the most sophisticated method and turned out to be as efficient as Soxhlet. Soxhlet extraction however, showed the smallest variations in the results.

Keywords: dioxin, furnace pollution, extraction, accelerated solvent extraction.

POSTER SESSION 11. ANALYTICAL METHODS - ORGANIC POLLUTANTS

Quantification of glycoalkaloids from different genetically modified potatoes by capillary electrophoresis coupled with electrospray ionization ion trap mass spectrometry (CE-ESI/ion trap MS)

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Genetically modified foods are becoming an increasing part of the common food supply. Rigorous specifications are necessary to ensure the safety of these products for human health and for the environment. Steroidal glycoalkaloids (SGAs) are naturally occurring nitrogen-containing toxins found in the Solanaceae family. Owing to their toxicological character, it is very important to have a sensitive and selective method in order to determine the SGAs in crops. The SGAs cannot be analyzed by classical CE using water-based buffers owing to the extremely low solubility of these substances in water and water-alcohol solutions. Detection is a problem with SGAs as they lack a strong UV or visible chromophore. We report here the quantification of SGAs extracted from genetically modified potatoes. Capillary electrophoretic separations were coupled on-line to ion-trap mass spectrometry with a self developed electrospray ionization interface, allowing significant sensitivity enhancement and reproducibility.

Keywords: genetically modified food, glycoalkaloids, capillary electrophoresis, mass spectrometry.

POSTER SESSION 12

ANALYTICAL METHODS - TOXIC METALS**Use of diffusion gradient in thin films (DGT) and ultrafiltration methods for copper speciation in river water.**

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Accurate determination of metal speciation is important for understanding metals biogeochemistry in natural waters. The Diffusion Gradient in Thin Films (DGT) is capable to measure free metal ion plus labile complexes, by diffusion through a hydrogel to a resin. To determinate copper speciation in filtrated river water, we employed 10 kDa ultrafiltration (UF), DGT measurements in filtrate and UF permeate and equilibrium model (Winhumic V, Gustafsson, 1999). As underlined by Zhang and Davison (Anal. Chem., 2000), labile metal concentration is a better input to the model than total concentration. About 20 % of copper was retained by UF membrane, presumably adsorbed on colloids. Of the permeate, 75 % was found to be labile metal (equivalent to 60% of total concentration, as measured in the initial filtrate). The model simulated 0.04 % of labile copper as free ion. Simultaneous use of these technics, in spite of limitations, can improve speciation knowledge.

Keywords: pollutants, speciation, new analytical approaches

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Comparison of three mild extraction procedures used to assess the heavy metal availability in soils.

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The extraction of heavy metals from soils by unbuffered salt solutions is a fast and simple method used to evaluate their availability to plants. Three of these procedures, which are standardised or undergoing standardisation in Europe have been compared. The procedures tested were CaCl_2 0.01 M (The Netherlands), NaNO_3 0.1 M (Switzerland) and NH_4NO_3 1 M (Germany). Eleven contaminated soils with different composition were extracted using each procedure, and the results were compared using Principal Component Analysis. In general, the results show that the three extractants give equivalent information when used to predict metal mobility ($\text{Cd} > \text{Zn} = \text{Cu} \gg \text{Pb}$), although the extracted amounts are different ($\text{NH}_4\text{NO}_3 \geq \text{CaCl}_2 > \text{NaNO}_3$). However, for Cu the relative mobility prediction obtained in the studied samples when using NH_4NO_3 is slightly different to that obtained when using the other extractants.

Keywords: heavy metals, soils

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Determination of chromium and copper using cathodic stripping voltammetry with mixed ligands.

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Most adsorptive stripping procedures have been focused on the one ligand / one analyte approach. In order to reduce analysis time and volume of sample used, the possibility of simultaneously determining several metals by cathodic stripping voltammetry using a mixture of ligands was explored (e.g. C. Colombo, C. M. G. van den Berg, Anal. Chim. Acta, 337 (1997) 29-40). A new procedure for quantifying chromium and copper using 2,2'-bipyridine and 8-hydroxyquinoline (oxine) is described. Various operational parameters (pH, concentration of both ligands, potential and time collection) affecting the response are assessed and optimized. Possible interferences by trace metals and organic matter are investigated. Applicability in fresh water is illustrated.

Keywords: chromium, copper, mixed ligands, adsorptive stripping voltammetry.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Speciation analysis for organometallic compounds in the environment by gas chromatography with microwave assisted plasma atomic emission spectrometry (MIP AES) and inductively coupled plasma mass spectrometry (ICP MS).

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The environmental toxicity of a number of heavy metals in the environment is critically dependent on the chemical form (speciation) in which they occur. The contribution discusses the recent advances in analytical methodology for the species-specific analysis of butyl and phenyltin (antifouling agents and pesticides), methylmercury (toxic product of natural mercury biomethylation), and alkyllead (antiknock additives to gasoline) residues in aquatic and terrestrial environment. Focus is given to microwave assisted sample preparation for solid samples, capillary purge and trap sample handling and recent developments in gas chromatography with element specific detection by microwave assisted plasma atomic emission spectrometry (MIP AES) and inductively coupled plasma mass spectrometry (ICP MS). Examples of the monitoring of the aquatic environment will be presented.

Keywords: heavy metals, speciation, pesticide.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Detection and identification of heavy metal complexes in plants exposed to heavy metal stress.

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Plants have developed a number of internal mechanisms to cope with the stress induced by toxic elements. The most frequent case is the biosynthesis of a ligand, such as a phenolic compound, organic acid or oligo- and polypeptide, that would be able to complex the excess of the toxic element into a compound innocuous to the organism. The molecular description of the complexes formed is a major challenge in analytical chemistry of heavy elements in plant biochemistry. Indeed, very few data are available on the actual complexes formed by these ligands with heavy metals. This contribution presents an analytical strategy based on high performance liquid chromatography (HPLC) and capillary zone electrophoresis (CZE) with the parallel ICP MS and electrospray tandem mass spectrometry detection for the characterisation (detection, identification and quantification) of Cd-complexes with phytochelatins in plants (Silene, maize, soybeans).

Keywords: heavy metals, speciation, plant.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Direct elemental analysis of aerosols collected on silicone wafer carriers by total-reflection X-ray fluorescence spectrometry.

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In order to develop a simple and sensitive analytical technique for aerosols, a direct impact sampling on silicon wafer carriers for subsequent elemental analysis by total-reflection X-ray fluorescence spectrometry (TXRF) was studied. The detection limits and sensitivity factors to selenium as an internal standard were determined for Cr, Mn, Fe, Cu, Zn, Pb, Br and Sr. The detection limits went down to lower level than those reported by using glassy carbon and quartz carriers, due to the reduction of the background noise caused by the scattering of incident X-ray. In the analysis of aerosol samples, the concentrations of the elements in picogram level were successfully determined by the present technique. Compared with the conventional technique that involves filtrated particle collection and acid digestion, this direct impact sampling technique can reduce the possibility of contamination from ambient air because no sample preparation is needed.

Keywords: heavy metals, X-ray analysis, atmosphere, aerosol samples, particles.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Combining Raman imaging and electron microprobe microanalysis to characterise dusts emitted by a lead and zinc smelter.

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Confocal Raman imaging and Wavelength Dispersive Spectrometry Electron Probe MicroAnalysis (WDS-EPMA) have been used to characterise atmospheric emissions of lead and zinc which originate from a lead-zinc producing factory. Industrial dusts originate from smokestack filters. Atmospheric particles were size segregated collected at 1 km from the smelter on pure silica strips at 1 m³/h with a PM13 sampling head coupled to an Andersen cascade impactor. When combined, Raman imaging and WDS-EPMA provide detailed spatial, elemental, and molecular information for particulate matter. Since both techniques are non-destructive, particles of interest from the different samples were relocated from the Raman microspectrometer to the electron probe microanalyser so that the same areas were mapped. Moreover, original data treatments were made to interpret experimental results obtained: the SIMPLISMA approach for Raman imaging and XMAS coupled with MATROX (modal analysis), image processing softwares for EPMA.

Keywords: lead, zinc, smelter, WDS, electron and Raman microanalysis, elemental and molecular imaging.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Detection of toxic pollution by respirometry in wastewater treatment plants.

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The characterization of the composition of water is usually based on Carbon Oxygen Demand (COD), Biological Oxygen Demand over five days (BOD₅), etc. Most of these measurements are time-consuming and are not adequate for a continuous monitoring of the wastewater, especially to detect critical situations, that can have a detrimental effect on the operation of the wastewater treatment plant. More global but faster measurements are available : A test based on the analysis of the exogenous oxygen uptake rate (OUR_{ex}) has been developed for the rapid detection of incoming inhibitory substances. Tests have been conducted on a full-scale plant for the detection of heavy metals (Cr, Hg), detergents, solvents (white spirit), and dyes. A Principal Component Analysis procedure is used for the OUR_{ex} data treatment, critical situations are detected with respect to a reference trajectory.

Keywords: water, metal, respirometry, detection, toxics, principal components analysis.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

The application of LI-TOF-MS LAMAS.10M for analyzing of geo-sample.

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The recently designed LI-TOFMS (time of flight mass spectrometry) LAMAS 10M is portable device for wide class of problems including geochemistry and environmental chemistry. The using of laser ionization gives possibility to analyze geological samples without any complicate methods. The preliminary tests of ores (sulphide copper.nickel and sulphide-bearing ores) show limit of detection for trace element is equal 1-10 ppb at time of test 7-15 min. The low weight of LAMAS 10M allows to use one in field.

Keywords: analysis, masss spectrometry.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Detection of transition metals in water samples using a sensitised tetracyanoquinodimethane chemiluminescence reaction and flow injection analysis.

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A chemiluminescence reaction with flow injection is described for the determination of transition metals. The catalysed reaction is based on the oxidation of 7,7,8,8-tetracyanoquinodimethane by dissolved oxygen in alkaline solution. The system is enhanced by the presence of Eosin Y as a sensitiser and bilayer vesicles formed by didodecyldimethylammonium. The chemiluminescence reaction is based on the energy transfer between molecules with production of singlet oxygen. The analysis has shown that Mn^{2+} , Fe^{2+} , and V^{4+} , work catalytically on the oxidation of tetracyanoquinodimethane with limits of detection of 1.4, 3.3 and 20 micrograms per liter, respectively. The applicability of the method is suitable for on-line environmental analysis of water samples. The catalytic effect of the metal ions studied is found to be limited by the precipitation of oxidation products during the course of the analysis.

Keywords: chemiluminescence, FIA, transition metals.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Engineering new metal specificity in the EF-hand motif of calmodulin.

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Heavy metals represent a source of important environment pollution in the industrialised society. Particular toxic metals may be also released in the environment in the case of accidents occurring in nuclear plants. In order to chelate such ions, we have designed a cyclic peptide comprising the EF-hand motif of calmodulin site I (33 residues in length) which was able to bind Cd(II), Tb(III), UO₂(II) with sub-micromolar affinity. By combining ab initio and molecular dynamic calculations, we designed new derivatives with charge and size modification in the chelating loop, and presenting increased selectivity for uranyl and cadmium ions. Our studies demonstrate the potential of the structure-based approach in the engineering of metal binding structures and suggest new avenues for obtaining specific metal-binding proteins to be used in biosensor systems or in bioremediation strategies.

Keywords: heavy metals, biosensor, bioremediation, calmodulin.

POSTER SESSION 12. ANALYTICAL METHODS - TOXIC METALS

Comparison of three sequential extraction procedures to study the partitioning of trace metals in an acid sandy soil.

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The total concentration of trace metals in soil is an inadequate indicator of their biological effects because their chemical forms determine their behavior in the environment. A number of sequential extraction procedures have been therefore proposed to determine the geochemical partitioning of trace metals in soils. Results obtained by different sequential extraction procedures may vary considerably with the physicochemical characteristics of the soil and/or the type of elements and the used reagents. To specify the effect of the main reagents in the case of a slightly acidic contaminated soil, three sequential extraction procedures were compared. This work showed that the efficiency of a given sequential extraction procedure is determined by the use or not of sodium acetate, the reagent used in the oxidation stage, and the position of the oxidation stage in the sequence.

Keywords: metal, soil, extraction.
