Eric Lichtfouse · Jan Schwarzbauer
Didier Robert *Editors*

Environmental Chemistry for a Sustainable World

Volume 1: Nanotechnology and Health Risk

Springer

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Editors
Eric Lichtfouse
INRA, UMR Agroécologie
Dijon, France
eric.lichtfouse@dijon.inra.fr
www.researcherid.com/rid/F-4759-2011

Didier Robert
Lab. of de Chimie Industrielle
rue Victor Demange
Université de Metz
57500 Saint-Avold
France
didier.robert@iut.univ-metz.fr

Jan Schwarzbauer
RWTH Aachen
Inst. für Geologie, Geochemie u.
Lagerstätten d. Erdöls u. d. Kohle
Lochnerstr. 4-20, 52056 Aachen
Germany
schwarzbauer@lek.rwth-aachen.de

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Preface

I was at a conference where someone said something about the Holocene. I suddenly thought this was wrong. The world has changed too much. So I said: 'No, we are in the Anthropocene.' I just made up the word on the spur of the moment. Everyone was shocked. But it seems to have stuck.

Nobel Prize-winner Paul Crutzen

To find rapidly chapters of interest in this book please see list of topics in Table 1 page ix.

Fukushima, Chernobyl and Climate Change

Nuclear Plants on Earthquake Zones

Everybody has been recently shocked by the major accident of the nuclear power plant on March 31, 2011 at Fukushima, Japan. Such a failure was both unexpected and expected. Unexpected because most thought that the 1986 nuclear disaster at the power plant of Chernobyl, Ukraine, could never happen again, especially in wealthy, high technology countries such as Japan. Expected because geology tells us that Japan lies on the cusp of the Pacific-Philippine-Eurasian triple plate junction, where the complex interactions of three tectonic plates is unpredictable and loaded with potential activity. As a consequence, Japan experiences regular, high intensity earthquakes, tsunamis and volcanoes since centuries. Similarly to the Chernobyl global 'event', the release of radioactive pollutants from Fukushima nuclear plant in water, air, and soil will most probably severely affect human health, food security and economy worldwide for decades. Therefore, one might just ask why nuclear plants are built on such high-risk areas.

Human Errors Are Repeatable

The global warming event has similar features – though less rapid and catastrophic – as the Chernobyl and Fukushima events on several rationales. First, the global warming is a worldwide event due notably to worldwide CO_2 emissions (Lichtfouse 2009a), a fact that is nicely coined by the popular saying "pollutants have no borders". Second, the effects of global warming are now clearly proven by many scientific trends (Feehan et al. 2009; Jones et al. 2009; Lavalle et al. 2009). Third, despite all such scientific evidence humans still use cars and planes that emit CO_2; they practice intensive, industrial agriculture that decrease soil carbon, and in turn emits CO_2; they cut forest, which in turn emits CO_2, and so on. Recent essays reports on global issues of and solution for society (Lichtfouse 2009a, b, 2010). From the scientist view, one might say ironically that "human errors are repeatable".

Social Chemistry

From those global issues several conclusions and advices can be drawn to improve society and the life of further generations. First, overwhelming scientific evidence is not sufficient to convince humans, notably decision-makers. Such a failure is due in particular to the lack of communication between science and society. In other words, scientists should not only publish in scholarly journals and attend high-level scientific meetings, but also communicate with the "real world". Here, a "social impact factor" to measure the impact of science on society – based for instance on web, facebook and blog usage data – would be very appreciated.

A second advice is that classical natural sciences such as chemistry, physics, biology, geology and medicine should integrate social, human and political sciences. In other words, the real world should be involved in the process of scientific discovery to bridge the gap between science and people. The integration of social disciplines is already occurring in agrosciences (Fleming and Vanclay 2010; Karami and Keshavarz 2010; Lichtfouse 2010; Lichtfouse et al, 2009, 2010). Indeed agriculture has always been historically closer to citizens, e.g. farmers, than chemistry and physics. The need for analysis of citizen discourses is nicely shown by the following survey answer: 'What's sustainable? You've got to look at our world as we know it. We're not in a sustainable position at the moment. That's why I say what is sustainable – I don't know' (Fleming and Vanclay 2010).

The concept of discourse was introduced in the 1960s by the French philosopher Michel Foucault. Foucault (1972) maintained that the way language is used has consequences for a whole range of things that go beyond the level of individuals or disciplines, to the very structures of society that shape and limit how people are able to speak, think, and act, and to the social structures that are developed accordingly. Now, environmental chemistry should use techniques of social sciences such as discourse analysis to discover novel findings that will be both innovative and accepted by citizens.

The Success of Environmental Chemistry

Association of Chemistry and the Environment

We founded the Association of Chemistry and the Environment in 2000 with a group of environmental scientists (www.europeanace.com). A "chemistry flower" logo was designed to symbolise positive benefits of chemistry for Nature (Fig. 1). The association was launched by the organisation of the two first European Meeting on Environmental Chemistry by Eric Lichtfouse, Brigitte Elbisser and co-workers in 2000 in Nancy, France, and in 2001 in Dijon, France. Meetings were immediately a success, with more than 300 attendants, due to several factors such as hard work from the organising team, willingness to create a new science community in a highly conservative science system, and gathering in a friendly location scientists from various isolated disciplines such as soil science, toxicology and chemistry. The first presidents of the association were Eric Lichtfouse (2000–2004) and Jan Schwarzbauer (2005–2009). Noteworthy, well established associations, in particular the Division of Environmental Chemistry and the Division of Geochemistry of the American Chemical Society (ACS), supported us, in particular by organising joint symposia sponsored by the petroleum research fund. We therefore thank very much the American Chemical Society.

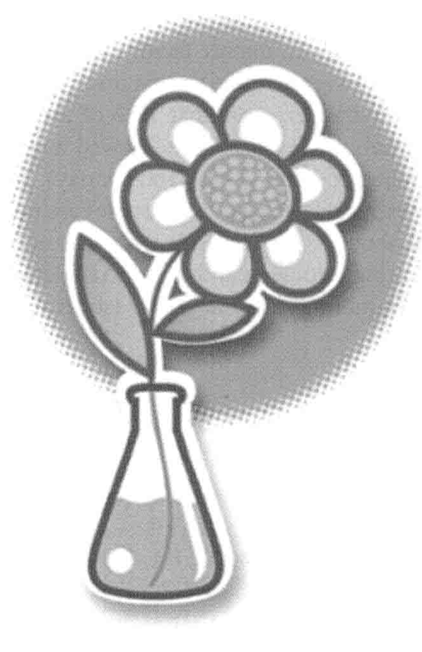

Fig. 1 The "chemistry flower" was designed by Eric Lichtfouse and Guillaume Decaux to symbolise positive benefits of chemistry for Nature. Guillaume Decaux is a professional drawer living in Strasbourg, France (http://www.alcide.fr/)

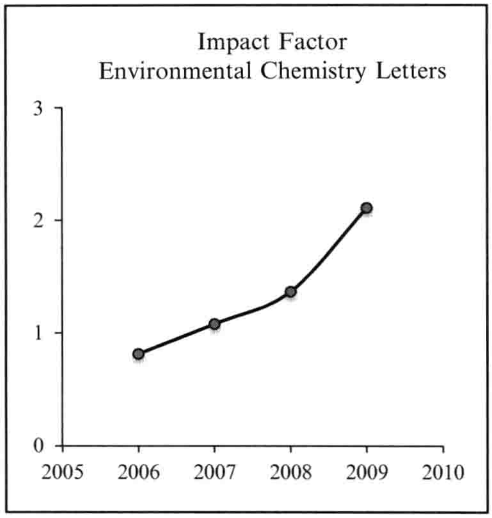

Fig. 2 The impact factor of the journal Environmental Chemistry Letters (*ECL*) increased from 0.814 in 2006 to 2.109 in 2009. Article pdf downloads reached 36,549 in 2009 (100 per day)

Environmental Chemistry Letters

We founded the journal Environmental Chemistry Letters in 2003 to fill the science gap between chemistry and environment (www.springer.com/10311). Despite a tough selection by the Thomson Reuters agency to enter the Science Citation Index, we got our first impact factor of 0.814 for 2006, only 3 years later. The impact factor increased steadily to reach 2.109 in 2009 (Fig. 2) (www.thomsonreuters.com). The increase of the impact factor can be explained by a higher quality of articles, as a result of higher rejection that reached 73% in 2009. Given the rapid increase of submitted articles, more that 70% of articles are now declined at pre-screening stage. Journal articles are highly viewed as proven by the number of pdf downloads that reached 36,549 in 2009 (100 per day). This finding is both unexpected and expected. Unexpected because most articles are not in open access. Expected because Springer has about 30 millions scientists who access articles. Here, contrarily to the common thinking, articles published in restricted access by a major publisher are probably much more visible than open access articles published by a minor publisher.

Environmental Chemistry

We published the book Environmental Chemistry in 2005 (Lichtfouse et al. 2005b). The book includes 69 chapters sorted in seven sections: Analytical Chemistry, Toxic Metals, Organic Pollutants, Polycyclic Aromatic Hydrocarbons, Pesticides, Green Chemistry, and Ecotoxicology. The book is a success with over 35,000 chapter downloads from 2007 to 2010. Book chapters are still highly downloaded with 639

Table 1 Chapters of environmental chemistry for a sustainable world (Lichtfouse et al. 2012a, b)

1st author	Keywords			DOI
Tan	Nanotubes	Energy	Water	10.1007/978-94-007-2442-6_1
Landy	Cyclodextrin	Sequestration	Water	10.1007/978-94-007-2442-6_2
Chauhan	Nanotubes	Energy	Sensors	10.1007/978-94-007-2442-6_3
Liu	Photocatalysis	Remediation	Water	10.1007/978-94-007-2442-6_4
Visinescu	Polysaccharides	Metal oxides	Green chemistry	10.1007/978-94-007-2442-6_5
Ricking	DDT isomers	Remediation	Pesticides	10.1007/978-94-007-2442-6_6
Heim	Geochronolgy	Pollution history	Sediments	10.1007/978-94-007-2442-6_7
Anupama	Endocrine disruptors	Toxicity	Pesticides	10.1007/978-94-007-2442-6_8
Stankovic	Heavy metal	Toxicity	Seafood	10.1007/978-94-007-2442-6_9
Sarkar	DDT, PCBs	Toxicity	Seafood	10.1007/978-94-007-2442-6_10
Ribeiro	Pharmaceuticals	Remediation	Water	10.1007/978-94-007-2439-6_1
Sanjurjo	Buildings	CO_2, SO_2, NO_x	Air	10.1007/978-94-007-2439-6_2
Rene	Bioreactors	Remediation	VOCs	10.1007/978-94-007-2439-6_3
Etxebarria	Extraction	Pollutants	Water	10.1007/978-94-007-2439-6_4
Sharma	ClO_2, R-Cl	Oxidation	Water	10.1007/978-94-007-2439-6_5
Mondal	Dyes	Biodegradation	Water	10.1007/978-94-007-2439-6_6
Shukla	Heavy metals	Lichens	Air	10.1007/978-94-007-2439-6_7
Brillas	Pharmaceuticals	Remediation	Water	10.1007/978-94-007-2439-6_8
López	Biogas	Cleaning	CO_2, H_2S, R-Cl	10.1007/978-94-007-2439-6_9
Mudhoo	Heavy metals	Toxicity	Biosorption	10.1007/978-94-007-2439-6_10
Gasparatos	Heavy metals	Sequestration	Nodules, soil	10.1007/978-94-007-2439-6_11
Dabrowska	Arsenic	Remediation	Biosorption	10.1007/978-94-007-2439-6_12
Mahmood	Photocatalysis	Microbes	Disinfection	10.1007/978-94-007-2439-6_13

Keywords and DOI for fast access. *DDT* 2,2,-bis(4-chlorophenyl)-1,1,1-trichlorethane, *PCBs* polychorinated biphenyls, *VOCs* volatile organic compounds downloads in January 2011 (20 per day). The highest recent downloads can be freely viewed at Springer Realtime (www.realtime.springer.com). Here the most popular topics are heavy metals, bioremediation and green chemistry.

Environmental Chemistry for a Sustainable World

This new book series presents 23 chapters published into 2 volumes: Nanotechnology and Health Risk (Lichtfouse et al. 2012a), and Remediation of Air and Water Pollution (Lichtfouse et al. 2012b). Table 1 allows fast access to chapters by topics. All chapters have been reviewed and the rejection rate was 15%. The Nanotechnology section highlights carbon nanotubes for energy and detection; cyclodextrins for pollutant trapping; magnetic nanophotocatalysts for pollutant degradation; and polysaccharides for metal oxide green synthesis. The Health Risk section describes new findings on the old DDT pesticide; geochronology of river pollutants; toxic effects of endocrine disruptors; and heavy metals in seafood. The Air and Water Pollution section presents the selective degradation of chiral pharmaceuticals; the alteration of housing walls by CO_2, SO_2 and NOx; cleaning industrial waste gas and dyes wastewater; methods to extract and detect pollutants; and harmful chlorinated pollutants. The Remediation section highlights the electrochemical degradation of pharmaceuticals; methods to treat biogas CO_2, CH_4, H_2S and NH_4; heavy metal sequestration on biomass and soil nodules; As phytoremediation; and photocatalytic inactivation of water microbial pathogens.

Eric Lichtfouse,
Jan Schwarzbauer,
Didier Robert

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Contributors

A. Alam Department of Marine Science, University of Calcutta, 35 Ballygunge Circular Road, Calcutta West Bengal 700 019, India

Lalit M. Bharadwaj Biomolecular Electronics and Nanotechnology, Central Scientific Instruments Organization (CSIR), Chandigarh, India

A. Bhattacharya Department of Marine Science, University of Calcutta, 35 Ballygunge Circular Road, Calcutta, West Bengal 700 019, India

B.D. Bhattacharya Department of Marine Science, University of Calcutta, 35 Ballygunge Circular Road, Calcutta, West Bengal 700 019, India

S.N. Biswas Department of Marine Science, University of Calcutta, 35 Ballygunge Circular Road, Calcutta 700 019, India

Oana Carp Coordination and Supramolecular Chemistry Laboratory, Institute of Physical Chemistry "Ilie Murgulescu", Romanian Academy, Splaiul Independentei 202, 060021 Bucharest, Romania, carp@acodarom.ro

M. Chatterjee Department of Marine Science, University of Calcutta, 35 Ballygunge Circular Road, Calcutta, West Bengal 700 019, India

Sippy K. Chauhan Traffic Planning and Environment Division, Central Road Research Institute (CSIR), New Delhi 110020, India, chauhansippy4@yahoo.co.in

Simpi Dutta Traffic Planning and Environment Division, Central Road Research Institute (CSIR), New Delhi 110020, India

Sophie Fourmentin Unité de Chimie Environnementale et Interactions sur le Vivant (EA 4492), Université du Littoral-Côte d'Opale, 145, Avenue Maurice Schumann, MREI 1, 59140, Dunkerque, France, sophie.fourmentin@univ-littoral.fr

S. Gangopadhyay Traffic Planning and Environment Division, Central Road Research Institute (CSIR), New Delhi 110020, India

Sabine Heim Laboratory for Organic-geochemical Analysis, Institute of Geology and Geochemistry of Petroleum and Coal, RWTH Aachen University, Lochnerstr. 4-20, 52056, Aachen, Germany, heim@lek.rwth-aachen.de

M.P. Jonathan Centro Interdisciplinario de Investigaciones y Estudios sobre Medio Ambiente y Desarrollo (CIIEMAD), Instituto Politécnico Nacional (IPN), Calle 30 de Junio de 1520, Barrio la Laguna Ticomán, Del. Gustavo A. Madero, C.P.07340 Mexico, D.F, Mexico, mpjonathan7@yahoo.com

Mihajlo Jovic Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11 000 Belgrade, Serbia, jovicmihajlo@yahoo.co.uk

Lynne Katsikas Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11 000 Belgrade, Serbia, lynne@tmf.bg.ac.rs

David Landy Unité de Chimie Environnementale et Interactions sur le Vivant (EA 4492), Université du Littoral-Côte d'Opale, 145, Avenue Maurice Schumann, MREI 1, 59140, Dunkerque, France

Eric Lichtfouse INRA, UMR Agroécologie, BP 86510 21065, Dijon Cedex, France, Eric.Lichtfouse@dijon.inra.fr

Shou-Qing Liu School of Chemistry and Bioengineering, Suzhou University of Science and Technology, Suzhou 215009, China, shouqing_liu@hotmail.com

Isabelle Mallard Unité de Chimie Environnementale et Interactions sur le Vivant (EA 4492), Université du Littoral-Côte d'Opale, 145, Avenue Maurice Schumann, MREI 1, 59140, Dunkerque, France

Abdul Rahman Mohamed School of Chemical Engineering, Engineering Campus, Universiti Sains Malaysia, Seri Ampangan, 14300 Nibong Tebal, S.P.S., Pulau Pinang, Malaysia

Eric Monflier Unité de Catalyse et de Chimie du solide (UMR 8181) Université d'Artois, Faculté Jean Perrin Rue Jean Souvraz - SP 18, 62307 Lens Cedex

P.R. Anupama Nair Department of Marine Biology, Microbiology and Biochemistry, Cochin University of Science and Technology, Cochin,Kerala 682 016, India, anupama.pr@gmail.com

Yit Thai Ong School of Chemical Engineering, Engineering Campus, Universiti Sains Malaysia, Seri Ampangan, 14300 Nibong Tebal, S.P.S., Pulau Pinang, Malaysia

Greta Patrinoiu Coordination and Supramolecular Chemistry Laboratory, Institute of Physical Chemistry "Ilie Murgulescu", Romanian Academy, Splaiul Independentei 202, 060021 Bucharest, Romania

Anne Ponchel Unité de Catalyse et de Chimie du solide (UMR 8181) Université d'Artois, Faculté Jean Perrin, Rue Jean Souvraz - SP 18, 62307 Lens Cedex

Mathias Ricking Department of Earth Sciences, Hydrogeology, Free University of Berlin, Malteserstr. 74-100, 122249 Berlin, Germany, ricking@zedat.fu-berlin.de

Didier Robert Equipe 'Photocatalyse et Nanostructures, LMSPC-CNRS-UMR 7515 et ELCLASS, European Laboratory for Catalysis and, Surface Sciences, Antenne de Saint-Avold UPV, Metz Rue Victor Demange, 57500, Saint-Avold, France, drobert@univ-metz.fr

K.K. Satpathy Environmental and Industrial Safety Section, Safety Group, Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam 603102, Tamil Nadu, India, satpathy@igcar.gov.in

Santosh Kumar Sarkar Department of Marine Science, University of Calcutta, 35 Ballygunge Circular Road, Calcutta, West Bengal 700 019, India, sarkar.santosh@gmail.com; sarkar22@yahoo.com

Jan Schwarzbauer Laboratory for Organic-geochemical Analysis, Institute of Geology and Geochemistry of Petroleum and Coal, RWTH Aachen University, Lochnerstr. 4-20, 52056 Aachen, Germany, schwarzbauer@lek.rwth-aachen.de

Anuradha Shukla Traffic Planning and Environment Division, Central Road Research Institute (CSIR), New Delhi 110020, India

Ana R. Stankovic Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11 000 Belgrade, Serbia, ana.r.stankovic@gmail.com

Slavka Stankovic Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11 000 Belgrade, Serbia, slavka@tmf.bg.ac.rs

C.H. Sujatha Department of Chemical Oceanography, Cochin University of Science and Technology, Cochin 682 016, Kerala, India, drchsujatha@yahoo.com

Soon Huat Tan School of Chemical Engineering, Engineering Campus, Universiti Sains Malaysia, Seri Ampangan, 14300 Nibong Tebal, S.P.S., Pulau Pinang, Malaysia, chshtan@eng.usm.my

Chin Wei Tan School of Chemical Engineering, Engineering Campus, Universiti Sains Malaysia, Seri Ampangan, 14300 Nibong Tebal, S.P.S., Pulau Pinang, Malaysia

Kok Hong Tan School of Chemical Engineering, Engineering Campus, Universiti Sains Malaysia, Seri Ampangan, 14300 Nibong Tebal, S.P.S., Pulau Pinang, Malaysia

Alina Tirsoaga Physical Chemistry Department, University of Bucharest, Bd. Elisabeta 4-12, 030018, Bucharest, Romania

Diana Visinescu Coordination and Supramolecular Chemistry Laboratory, Institute of Physical Chemistry "Ilie Murgulescu", Romanian Academy, Splaiul Independentei 202, 060021 Bucharest, Romania

Sharif Hussein Sharif Zein School of Chemical Engineering, Engineering Campus, Universiti Sains Malaysia, Seri Ampangan, 14300 Nibong Tebal, S.P.S., Pulau Pinang, Malaysia

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