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Publisher *Taylor & Francis*

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International Journal of Environmental Analytical Chemistry

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713640455>

Book reviews

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To cite this Article Albaigés, J.(1993) 'Book reviews', International Journal of Environmental Analytical Chemistry, 53: 1, 79 – 85

To link to this Article: DOI: 10.1080/03067319308045984

URL: <http://dx.doi.org/10.1080/03067319308045984>

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BOOK REVIEWS

THE HANDBOOK OF ENVIRONMENTAL CHEMISTRY, edited by O. Hutzinger (University of Bayreuth, Germany).

Vol. 3, PART G. ANTHROPOGENIC COMPOUNDS (237 pages). Springer-Verlag, Berlin (1991). ISBN 3-540-53198-X. 168 DM.

The last part published of Volume 3 devoted to Anthropogenic compounds includes reviews on:

Isocyanates (F. Brochhagen).

Nitro Derivatives of Polycyclic Aromatic Hydrocarbons (NO₂-PAH) (H. Fiedler).

Chlorinated Ethanes: General Sources, Biological Effects, and Environmental Fate (J. Konietzko).

Explosives and Related Compounds (D. Rosenblatt).

Toxicological, ecological, analytical and occupational health aspects of these chemicals are evaluated. Particularly detailed is the chapter on isocyanates, with 95 pages and more than 600 references, consistently with the long history and large use of these polymer precursors. More recent is the appearance of nitroaromatic compounds in the environment predominantly produced in combustion processes. The chemistry, sources and fate of these pollutants, as well as the analytical work up of environmental samples are reviewed. A large variety of organic nitro compounds are also of environmental concern, as they constitute the basis for the production of explosives and propellants. The last chapter focus on physico-chemical properties, environmental fate (e.g. photolysis and biodegradation) and toxicity to human beings and wildlife of the more important substances of this type.

Vol. 5, PART A. WATER POLLUTION (264 pages). Springer-Verlag, Berlin (1991). ISBN 3-540-51599-2. 198 DM.

This well known book series has reasonably presented along its more than 10 years existence a view of various aspects of the chemistry of the environment and chemical reactions occurring in it. The three volumes initially planned, 1) The natural environment and the biogeochemical cycles, 2) Reactions and processes and 3) Anthropogenic compounds, were complemented with two others, more specifically related with pollution compartments, namely Air (Volume 4) and Water (Volume 5).

This is the first part of Volume 5, that contains four independent contributions:

Epidemiologic Studies of Organic Micropollutants in Drinking Water (G.F. Braun).
Water Quality Genesis and Disturbances of Natural Freshwaters (B. Allard).
Eutrophication of Lakes, Rivers and Coastal Seas (H.L. Golterman).
Mathematical Models for Describing Transport in the Unsaturated Zone of Soils (W.T. Piver)

The public concern about health problems of using chlorinated drinking water is assessed from the epidemiologic viewpoint. The studies reviewed in the Craun's contribution indicate that although much research has been conducted on the occurrence of organic byproducts produced in water supplies by the use of chlorine as disinfectant and repeatedly suggested to increase the risk of cancer in populations using chlorinated drinking water, it is not yet possible to determine whether there is a causal association between these factors.

The second chapter addresses the chemical characteristics of natural water from a dynamic perspective, combining water's movement through the surface and subsurface landscape with chemical reactions taking place along the pathways. A discussion of field monitoring, data analysis and modeling, stresses that a number of factors contribute in making a predictive description of water quality disturbances quite difficult. The chapter closes with a discussion of past, present and future policies of water pollution control.

The possible approaches to study the relationship between primary production and phosphate loading in aquatic systems, mainly freshwater, are discussed in the third chapter. Particular emphasis is given to the problems of identifying indicators of eutrophication, to the development of conceptual and statistical models and to lake restoration programs on a lake management basis. The role of sediments in the P cycle and the role of rivers as sources of nutrients for coastal areas are reviewed in some detail.

Finally, half of the book is devoted to numerical methods for solving the equations describing transport in the unsaturated zone of soil-water systems. After a general introduction on the hydrological cycle, conceptual and mathematical models, which require a certain knowledge of the field, are extensively described. The chapter contains also an assessment of the performance of these methods and examines the error sources in calculating concentration profiles.

As the general orientation of the series, these two volumes reflect more the state-of-the-art of well established domains than the last minute developments of advanced topics.

Therefore, they are of special interest for graduate students and practising scientists and, particularly, for developing specialised courses on Environmental Chemistry.

ENVIRONMENTAL CHEMISTRY (5th edition) by S.E. Manahan (University of Missouri-Columbia, Missouri 65211, USA), 583 pages, Lewis Publishers Inc., Chelsea, MI, USA (1991). ISBN 0-87371-425-3, US \$72

The author indicates in the preface that the book has been written for providing a basic understanding of environmental chemistry and its applications to anyone entering the chemical profession but also to those actively engaged in it. In fact, his attempt has been successful. The book has been written at a level such that, with a little extra study of organic and analytical chemistry, an individual with a primary background in chemistry can understand the material presented. The variety of topics covered provides a timely introduction to this

multidisciplinary science, so that the non-specialist may find in it satisfactory explanations for the major environmental problems we are facing today.

This new edition, substantially improved, of the book begins with an introduction to environmental chemistry in Chapter 1. Included in this chapter is a brief review of several aspects of solutions and chemical equilibria as well as organic chemistry, useful in mastering the next several chapters that follow. Chapters 2-8 deal with aquatic chemistry, first addressing the basic principles of this topic and finishing with a coverage of water pollution (Chapter 7) and water treatment (Chapter 8). Included also is a discussion of the essential role played by microorganisms in aquatic chemical phenomena (Chapter 6 "Aquatic Microbial Biochemistry"). Chapters 9-14 cover atmospheric chemistry, concluding with a discussion of major threats to the global atmosphere, particularly from greenhouse gases and ozone-depleting chemicals (Chapter 14, "The Endangered Global Atmosphere"). Chapters 15-19 deal with the geosphere and hazardous substances, which often end up as discarded materials in the geosphere. Chapter 15 covers the fundamental aspects of the geosphere and Chapter 16 emphasizes soil chemistry. The nature and sources of hazardous wastes are discussed in Chapter 17, their environmental chemistry in Chapter 18, and their treatment, minimization, and recycling in Chapter 19. Chapter 20 covers the effects of pollutants and hazardous substances on living organisms as presented from the toxicological chemistry view. Resources and energy are reviewed in Chapter 21.

Each chapter contains an extensive list of supplementary references, usually books or reviews, largely from 1986 to 1990, for a better knowledge of the topic. Moreover, a section of questions and problems will assist teachers and students in assessing the understanding of each chapter. Therefore, I strongly recommend the book for general as well as for specialized courses on environmental chemistry.

INSTRUMENTATION FOR TRACE ORGANIC MONITORING, edited by R.E. Clement, K.W.M. Sin and H.H. Hill, Jr., 319 pages, Lewis Publishers Inc., Chelsea, MI (USA), 1992. ISBN 0-87371-213-7. US \$96

The search for trace organic substances in complex matrices, namely environmental or biological is one of the most challenging tasks facing analytical chemists today. To meet this challenge a number of instrumental analytical techniques have been developed and refined over the past 20 years.

In this volume the advanced techniques of gas and liquid chromatography, low- and high-resolution mass spectrometry, supercritical fluid extraction and chromatography. Fourier transform infrared spectroscopy and others are described as they are used to tackle some applications of trace organic analysis.

The first five chapters are devoted to the analysis of organic vapors of environmental or forensic relevance by Ion Mobility Spectrometry (IMS). IMS is a technique based on ionizing the sample under atmospheric pressure conditions and recording the positive and negative ion mobility spectra of the product ions. Then, IMS can be used as a chromatographic detector and constitute an easily transportable device intended for field use and detection of specific target compounds.

Three chapters cover extensively different MS techniques for PCDDs and PCDFs analysis. The coupling of HPLC-MS is assessed for organometallic speciation in marine

materials. Multidimensional GC-MS, GC-FTIR-MS and SFE-GC applications are described in other chapters.

The book, based on a symposium to honor Prof. F.W. Karasek, will be particularly useful for post-graduates or young scientists interested or engaged in environmental analytical chemistry.

HANDBOOK OF ENVIRONMENTAL DEGRADATION RATES, edited by P.H. Howard (Syracuse Research Corporation, USA), 725 pages, Lewis Publishers Inc., Chelsea, MI, USA (1991). ISBN 0-87371-358-3, US \$83

This book is the result of a work completed for EPA, entailing the compilation of rate constants for biotic and abiotic degradation processes affecting anthropogenic chemicals as they pertain to different environmental compartments. Part I of the book outlines the approach employed for determining environmental degradation rate constants. Part II contains a test set of seven chemicals which exemplifies the approach used for the rest of compounds reported in Part III.

Estimates are given for 331 chemicals in which rate data could not be located in the available literature. A range of half-lives is established for both individual degradation processes and specific environmental media. For each compound biodegradation is separated into categories of aerobic, anaerobic and removal from wastewater treatment. The abiotic degradation processes of hydrolysis, photolysis, and oxidation/reduction are also examined individually.

Compartments include air, soil, surface water and groundwater. Half-lives are based upon the high and low degradation rates. Despite the fact that these data do not account for the transport of a chemical between compartments, so that overall ranges are not necessarily representative of a chemical's actual persistence in the environment, the book contains more than 450 references, updated until 1989, which may greatly assist in their interpretation.

A chemical name directory, including the CAS Registry Number is also provided. In summary, the book contains a wealth of data of great use in environmental risk assessment and modelling, which should be present in specialized libraries.

HANDBOOK OF ENVIRONMENTAL FATE AND EXPOSURE DATA FOR ORGANIC CHEMICALS, edited by P.H. Howard (Syracuse Research Corporation, USA), Lewis Publishers Inc., Chelsea MI, USA. Vol. I, 874 pages (1989) ISBN 0-87371-151-3 US \$102. Vol. II, 546 pages, (1989) ISBN 0-87371-204-8 US \$102. Vol. III, 684 pages, (1990) ISBN 0-87371-328-1 US \$96

This unique 7 volume series provides relevant facts on how individual chemicals are released, transported and degraded in the environment, and how they are exposed to humans and environmental organisms during their production, use, transport and disposal.

The three volumes that have already been published deal with large production and priority pollutants (Vol. I), solvents (Vol. II) and pesticides (Vol. III). They are devoted to the review and evaluation of the available data on physical/chemical properties, commercial use and possible natural and/or artificial sources of environmental contamination, environmental data, and monitoring data of individual chemicals.

Among the physical and chemical properties, the boiling and melting points, pKa, log Kow, water solubility, vapor pressure, and Henry's law constant are reported. Biotic and abiotic degradation, transport processes, such as bioconcentration, soil adsorption/mobility and volatilization, as well as monitoring data (concentrations in water, effluents, sediment/soil, atmospheric, biota and food) are used to synthesize how each chemical is likely to behave if released to the terrestrial, aquatic and atmospheric compartments.

Each review of a chemical provides most of the data necessary for either qualitative or quantitative exposure assessment. However, probable routes of human exposure, average intake and finally human body burdens are also discussed for each chemical.

There are thousands of data in every volume, with each referenced to its original source. Almost 100 references appear at the end of each compound review. Cumulative indices are provided to allow the reader to find a given chemical by chemical name synonym, CAS number or chemical formula. This book series, together with the Handbook of Environmental Degradation Rates, also reviewed in this section, above, constitute an essential for environmental managers and administrators as well as for a better assessment of field studies.

ORGANIC SUBSTANCES AND SEDIMENTS IN WATER, edited by R.A. Baker (U.S. Geological Survey, USA). Lewis Publishers Inc., Chelsea, MI, USA (1991). Vol. 1, 392 pages, ISBN 0-87371-342-7 US \$84. Vol. 2, 547 pages, ISBN 0-87371-528-4 US \$78. Vol. 3, 332 pages, ISBN 0-87371-529-2 US \$78

This three-volume book covers the many complex factors and processes that influence the occurrence, transport and fate of organic substances in water, with special reference to the role of particulates and sediments in the contaminants behaviour and the processes in their interfaces with water.

The book derives from an American Chemical Society Symposium, held in Boston in 1990 and extends well over the interdisciplinary aspects of the subject with a good balance between theoretical and experimental approaches. The different subtopics are illustrated with many field studies.

The first volume deals on the roles of humic substances and soils-sediments in the sorption and mobility of contaminants. Both regimes are introduced by comprehensive review papers, and both reviews are followed by papers that treat specific topics in depth.

The second volume combines papers that summarize various processes involved in contaminants fate and transport as well as analytical developments. The processes section has been divided into aquatic particle-organic chemical interactions; fate and transport; and interfacial and organic-inorganic processes. The processes and analytical sections present theoretical as well as case study developments.

The third volume is devoted to biological processes. It begins with a state-of-the-science summary which incorporates references to the other papers deriving from the symposium. The papers are divided under subheadings; integrating chemistry and toxicology of sediment-water interactions; uptake and accumulation (bioavailability and bioaccumulation); biodegradation (aerobic dechlorinations and co-metabolism).

The book provides the best up-dated information available on the topic and it should prove valuable for environmental chemists, engineers, biologists and modelers. It will also stimulate experienced scientists to find new or better approaches for future research in this

area. A very comprehensive and useful subject index facilitates the going through the extensive information of the book.

SEDIMENT TOXICITY ASSESSMENT, edited by G. Allen Burton Jr. (Wright State University, Dayton, OH, USA), 457 pages, Lewis Publishers Inc., Chelsea, MI, USA (1992). ISBN 0-87371-450-4. US \$84.

Sediments have been recognized as important sinks for hydrophobic organic pollutants and metals present in aquatic systems (e.g. streams, lakes, estuaries and coastal environments). Contaminated sediments may cause, then, a detrimental impact to local ecosystems, raising the need for the development of methods for assessing the significance of this contamination.

The book examines various approaches to assess sediment toxicity and how they can be used as tools for sediment management. Most of them are based on the concept that sediments reflect the conditions of the overlying waters and the recognition that toxic chemicals could be characterized by their affinity for particulates.

The book focuses on toxicity assessment of sediments, emphasizing biological components and their interaction with physical and chemical factors. After a general introduction to the field (chapter 1), two chapters outline the basic factors regulating sediment variability (chapter 2) and reflecting realism in sample collection and handling (chapter 3), which are extremely critical components of any ecosystem evaluation.

Sediment quality can be assessed by a number of methods presented in the following chapters, making use of freshwater, estuarine and marine benthic community structures (chapters 4 and 5), particular ecosystem functional attributes (chapter 6), and specific biota species, namely plankton, macrophytes, benthic organisms, fishes, etc ... (chapters 7 to 10). Biomarkers in hazard assessments of contaminated sediments are discussed in chapter 11. The problems of the bioavailability of contaminants in sediments to aquatic biota and their accumulation throughout the food chain are dealt with in chapters 12 and 13. In chapter 14 and as a summary of the preceding chapters an integrative approach for the overall assessment of the status of the aquatic system is presented. Finally, three chapters are devoted to the management of the contaminated sediments: the US EPA strategy (chapter 15), and the Puget Sound (chapter 16) and Elisabeth River (chapter 17) case studies.

The sequence of topics and the comprehensive coverage of the area will benefit not only environmental scientists and particularly ecotoxicologists, but also decisionmakers. Moreover, each chapter includes a series of recommendations and future directions for research, which will interest postgraduate students considering careers in this area.

BIOMARKERS. Biochemical, Physiological and Histological Markers of Anthropogenic Stress, edited by R.J. Huggett (Virginia Institute of Marine Sciences), R. A. Kimerle (Monsanto Company), P.M. Mehrle (ABC Laboratories), H.L. Bergman (University of Wyoming), 347 pages, Lewis Publishers Inc., Chelsea, MI, USA (1992). ISBN 0-87371-505-5.

The book is the result of the eight Pellston Workshop held in Keystone Colorado in July 1989, sponsored by SETAC. Despite the late publication of these Proceedings (a too often unlucky situation) this is a timely and valuable contribution to the field of environmental

toxicology and, particularly, to the assessment of sublethal effects of pollutants in organisms.

A previous book on this topic, which reported on the current state of science on biomarker research has already been reviewed in the Journal. (Biomarkers of environmental contamination, edited by J.F. Mc Carthy and L.R. Shugart) (see *Intern. J. Environ. Anal. Chem.*, **46**, 299, 1992).

However, the rate at which biomarkers are being used is increasing and there is a need for a careful evaluation of them. Their proper use has many potential benefits, but their improper application or interpretation of the results have severe misleadings. Therefore, criteria for evaluating their strengths and weaknesses should be developed. The relative sensitivity and the persistence of the response, the biological as well as the chemical specificity of the biomarker and the applicability to field conditions are some of the aspects that require particular attention.

It is worth to mention that the individual chapters of the present book provide some guidelines along these criteria. The six chapters are based on discussion papers of well known scientists and address the following types of biomarkers: DNA alterations, proteins, metabolites, immunological, histopathological and physiological-non specific.

Each topic includes a comprehensive presentation of the different bioindicators and the state-of-the art of their present knowledge with a literature coverage well updated till 1991. More interestingly, the potential value of each indicator and research needs for new or improved biomarkers for understanding toxic effects of chemicals on biota, are discussed. This makes the volume particularly attractive to environmental scientists, chemical manufacturers, regulatory agencies and, particularly, for educational programmes or specialized courses on ecotoxicology.

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