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Book Reviews

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BOOK REVIEWS

AIR POLLUTION AND PLANT METABOLISM, edited by Sigurd Schulte-Hostede, GSF, D-8042 Neuherberg, and three experts from Leatherhead and Lancaster, UK, 381 pages (including 32 tables, 94 figures, but unfortunately no index, which makes literature research in the interesting field difficult), cloth, format 248 × 170 mm, ISBN 1-85166-230-8, Elsevier Applied Science, London and New York (1988), £44.00.

Twenty lectures presented by experts from the USA, UK, FRG, Japan, France, Switzerland, Ireland and Poland at the Second International Symposium on Air Pollution and Plant Metabolism (April 1987) were included into these proceedings. The First Symposium took place in August 1982 at Oxford University, UK, the Third is anticipated for 1991 at the University of Cornell, Ithaca, N.Y. State, USA. Throughout the book air pollution is in principle understood to consist of SO₂ (eventually NO_x) and/or O₃. Only exceptionally HF, H₂S, cadmium, and low molecular PAH's are mentioned (e.g. on pages 175–185 by P. Dizengremel and A. Citerne, University of F-54506 Nancy) as potentially interfering pollutants. The aim of the engaged plant scientists is to ensure that progress in the various aspects of the physiology and biochemistry of responses to these atmospheric pollutants and their products is reviewed. Influences on stomata, injuries at the tissue level, membrane and protein disturbances, reactions of free radicals, oxidation stress, influences on assimilation and metabolism in chloroplasts, and impacts on symbiotic organisms (such as mycorrhizal fungi or host plant insects) are thus discussed in detail. Unfortunately it is not always clear, which changes have been measured in an exact way and how the schemes for metabolisms may be quantitatively supported. It is concluded that better understanding of the general mechanisms of sensitivity or tolerance to environmental stresses is necessary. Perhaps the plant physiologists should agree in a first step on concentration on fewer species for further studies to make diagnoses of air pollution injuries better comparable and to make faster progress.

E. MERIAN

METAL SPECIATION (THEORY, ANALYSIS AND APPLICATION), edited by James R. Kramer (McMaster University, Hamilton, Ontario, Canada) and Herbert E. Allen (Drexel University, Philadelphia, Pennsylvania), 357 pages (including 111 figures, 31 tables, and a good subject index of 11 pages), linen, format 235 × 158 mm, ISBN 0-87371-140-8, Lewis Publishers, Inc., Chelsea, Michigan 48118, USA (1988).

It is obvious that the knowledge of the physico-chemical forms (i.e. species) is

required when the reason for a study relates to fate, bioavailability and effects. The book represents the proceedings of a workshop on metal speciation (see for instance IAEAC Newsletter No. 10/1987, and TRAC 6(9), p. x, October 1987), which was held at Jekyll Island (Georgia) in May 1987, together with the 17th Annual IAEAC Symposium on Environmental Analytical Chemistry. A critical selection of the presentations by experts in the fields of analytical chemistry, environmental engineering, nutrition, oceanography and soil chemists was made by the excellent chairmen and editors. Besides the three main topics "theory, measurements, and fate and effects", nature of metal binding, size separation methods, extraction techniques, voltammetric and chromatographic techniques, multi-ligand systems, and bioavailability to humans, plants and aquatic organisms are discussed.

Fifteen chapters were written by such estimated experts as James O. Leckie, Jacques Buffle, André Tessier, Edward D. Goldberg, Rufus L. Chaney, Alistair M. Gunn, and John M. Wood. They refer to aqueous aluminium systems, to coordination and interactions at solid/solution interfaces, reactions and transports in groundwater and non-perturbable water, binding and partitioning, marine chemistry of platinum group metal ions, transfer in environmental foodchains and in microorganisms, separation and recovery. The book thus can be recommended to analytical and environmental chemists, ecotoxicologists, and administrators who need a better interdisciplinary understanding of environmental impacts, or a background for risk assessment.

E. MERIAN

ENVIRONMENTAL IMPACT ASSESSMENT (EIA), Guidance Documents, MARC Reports Nos. 41 and 42, by Frank C. Go, 55 resp. 60 pages (including 13 resp. 22 figures, 7 resp. 14 tables, references, but no indices), paper board, format 210 × 148 mm, ISBN 0-905918-37-1 and 0-905918-38-X, The Monitoring and Assessment Research Centre (MARC). King's College, University of London SW10 0QX, UK (1987/1988), £5.00 or US \$10.00.

MARC (in operation since 1975 (and supported by UNEP and WHO) develops and applies techniques for the assessment of pollution problems of global, regional or local significance. A series of major guidance documents has already been developed. Now the methodological issues and substantive problems of decision-making and designed proposals that focus on classes of projects that affect human and welfare, as well as operational cost benefit analysis (CBA), are treated. Environmental impact assessment (EIA) is part of the overall planning process. CBA can assist the process of objective formulation and choice. It allows to order information. Even though CBA is typically inexact when many of the benefits are social and intangible or are diffused and difficult to quantify the process of systematic accounting can contribute to informed decision-making.

The brochures are thus structured into methodological issues, substantive issues, decision criteria and rules, cost effectiveness analysis (CEA), discount rates, time

horizons, inflation effects, and case studies (the optimum automotive emission control levels with a CBA framework, the impact of further reduction of lead in gasoline, impacts of projected changes in water quality and aquatic habitats in river systems, the impacts of an Australian national park to be created, and the annual benefits and costs of combined sewer overflow controls in Boston and Seattle, looking also at recreational benefits). A new two part runoff model was for instance built, based on the unit hydrograph technique providing the input to a transport model.

E. MERIAN

SELENIUM (Environmental Health Criteria 58), edited by a WHO task group under the chairmanship of Professor Dr. Anthony T. Diplock, Guy's Hospital Medical School, University of London, London SE1 9RT, UK (Rapporteur Dr. Orville A. Levander, U.S.D.A. Human Nutrition Research Center, Beltsville, Maryland, USA), 306 pages (including 13 figures, 57 tables, 59 pages of valuable literature references, but unfortunately no index), soft cover, format 210 × 140 mm, ISBN 92-4-154258-6, World Health Organization, CH-1211 Geneva (1987), SFr. 24.00.

This important latest concentrated review is structured into nine chapters:

- Summary and Recommendations for Future Research
- Chemical and Physical Properties: Analytical Methods
- Sources, Transport and Cycling of Selenium in the Environment
- Levels of Environmental Models
- Human Exposure
- Metabolism of Selenium
- Effects of Selenium on Animals
- Effects of Selenium on Man
- Evaluation of the Health Risks Associated with Excessive or Deficient Selenium Exposure.

An advantage is that experts evaluated carefully which data can be confirmed. Not much information is found on speciation (biological effects of some compounds are discussed), and analytical chemistry rather refers just to element determination (selenite and selenomethionine are mentioned in relation to food and animal metabolism). Analytical methods for the determination in biological materials are however evaluated. As sensitive analytical techniques fluorometry, neutron activation, and atomic absorption spectrometry are mentioned. One finds balanced information on physiological roles, on cytotoxicity (contraversal), on anti-mutagenicity, on carcinogenicity, on anti-carcinogenicity, and of course on observations related to deficiency and to occupational exposure. Anybody dealing with selenium compounds must have this background publication.

E. MERIAN

ORGANOMETALLIC COMPOUNDS IN THE ENVIRONMENT (Principles and Reactions), edited by Dr. Peter J. Craig, School of Chemistry, Leicester

Polytechnic, UK, 368 pages (including 56 figures, 76 tables, references added to the chapters, and an index (which is unfortunately not very helpful, when looking for instance for bioalkylation, mutagenicity, micro-organisms, or speciation) of 4 pages), hard cover, format 241 × 164 mm, ISBN 0-582-46361-0, Longman Group Ltd., Harlow, Essex CM19 5AA, UK (1986), £35.00.

The author defines organometallic compounds as those with metal-to-carbon bonds, and presents very good information on products formed by natural processes, and on anthropogenic commercial products entering the environment. The underlying aspects are well discussed in the comprehensive study, and the book is a must for environmental chemists and for governmental authorities, especially to give them a specific background for better understanding complex dynamic environmental interactions.

In an eventual second edition the volume could be improved in its structuring (including index extension), because it is somewhat difficult to find subjects in the handbook. The otherwise well-presented volume is structured somewhat arbitrarily in 10 chapters, of which chapter 1 (on Occurrence and Pathways), chapter 8 (on Methyl Transfer Reactions on Environmental Significance), and chapter 9 (on Organometallic Compounds in Polymers; one misses however discussion of environmental effects of pigments and of stabilizers other than organotin compounds) give a more general background, while the other seven chapters are related to specific organometallic compounds (especially on mercury, tin, lead, arsenic, silicon, selenium, tellurium, antimony, cobalt, and manganese derivatives).

In chapter 1 one finds a good introduction to the role of methylcobalamine coenzyme in the environment, to methylation by natural iodomethane, and enzymatic transfer processes. The role of microorganisms in environmental methylation and demethylation is however not adequately discussed in the book (literature is referred to relatively arbitrarily; fundamental results by J. Buffle, T. C. Hutchinson, L. Mart, H. W. Nürnberg, B. H. Olson, P. S. Rambal, R. M. Steffan, M. Stoeppler, W. Stumm and D. R. Turner are for instance not even mentioned). One misses also metallothionein in the index, and a comprehensive presentation of analytical chemistry, related to speciation (the crucial separation, identification and quantification of organoarsenic compounds need for instance a more concrete description and discussion, as a basis for bioavailability and ecotoxicological studies).

E. MERIAN

ORGANOMETALLIC CHEMISTRY (an Overview), by John S. Thayer, University of Cincinnati, Ohio 45221, USA, 170 pages (including 23 figures, 5 tables, latest references added to each chapter, an author index (also for the literature in the references; one misses however the names of a few experts). a good subject index of 6 pages, and a compound index of 10 pages), hard cover, format 243 × 161 mm, ISBN 0-89573-121-5, VCH Publishers Inc., New York 10010, USA (1988), DM 68.00.

The author informs especially on concepts of metal carbon binding and its

interactions, which are often not discussed in either inorganic or organic standard textbooks. Besides industrial and biological applications are mentioned. After a first chapter on the development of the discipline "Organometallic Chemistry" nine chapters deal with metal-carbon bonds (including synthesis and ionic, electron-deficient, sigma and synergistic bonds), three chapters on biology are related to medicinal and biochemical uses, toxicological aspects and biocidal aspects (mammals, nonmammalian vertebrates, invertebrates, microorganisms, and plants, including antifouling, herbicidal organometalloids and growth regulators) and to environmental occurrence and transformation. Bioalkylation, redistribution, biological magnification, and environmental cycles were especially discussed. An afterword chapter handles especially latest literature, for instance on the behavior of organotin compounds in antifouling preparations. With the clear structure and the indices it is easy to get access to information on organic derivatives of reactive and heavy metals and of metalloids. Immunological and genetic studies are also briefly mentioned, but unfortunately there are no references to analytical chemistry (besides of the use of some (radioactive) organometal(loid)s as biological probes) and to speciation.

E. MERIAN

LEAD, MERCURY, CADMIUM AND ARSENIC IN THE ENVIRONMENT (SCOPE 31), edited by Professor Thomas C. Hutchinson and K. M. Meema, Institute for Environmental Studies, University of Toronto, Ontario M5S 1A4, Canada, 360 pages (including 35 figures, 96 tables, references added to the chapters, and a good index of 12 pages), hard cover, format 235 × 158 mm, ISBN 0-471-91126-7, John Wiley & Sons, Chichester-New York-Brisbane-Toronto-Singapore (1987), £48.95.

This important and excellent book describes the pathways and rates at which lead, mercury, cadmium and arsenic, and their compounds cycle in the air, in soils, through crops and native ecosystems, and in rivers, lakes and oceans (including areas of long residence times: sinks). Contributions from natural versus man-made sources are compared. Food sources (including the aquatic-based food chain) and exposure to particular high-risk groups, e.g. young children and elderly populations) are explained. The authors differentiate also between problems of developing countries and those in the industrialized world.

The volume contains the results of a Workshop on Metal Cycling in Toronto, September 1984, and literature up to 1985. Part I consists in a workshop summary and five group reports; Part II are in principle proceedings of 21 contributed papers (some of them dealing with regional fluxes in India, Australia, Nigeria, Hong Kong, United States, Egypt, Ivory Coast, Poland and Scandinavia). It is also demonstrated where the gaps in environmental chemistry are. For instance there is a high degree of uncertainty in elemental fluxes, and in the significance of (the often incomplete) information on chemical forms of the four elements (though metal speciation may have a substantial influence on the behavior and biological effects). Combustion temperature determines many atmospheric emissions. Some results are based on biomonitoring, herbarium and museum specimens, sediments

and peat cores, annual rings in trees, annual deposition of ice in glacial cores (to monitor historical changes), etc. Of special interest to environmental chemists are the latest information on sources and global cycles of lead, cadmium and arsenic, while the Mercury Group Report has formulated nine open questions. One finds also very good data on emissions, deposition, transports, transfer across the air-sea interface and speciation in waters. An advantage is that the co-authors tried to evaluate which data can be confirmed.

E. MERIAN

CADMIUM IN THE AQUATIC ENVIRONMENT, edited by Jerome O. Nriagu and John B. Sprague, Burlington and Guelph, Ontario, Canada, 272 pages (including 18 figures, 43 tables, references added to the chapters, and an index of 8 pages), linen, format 240 × 167 mm, ISBN 0-471-85884-6, Wiley-Interscience, New York, USA (1987), £59.65.

Fourteen Canadian and German contributors provided an account of current research on the chemistry and toxicology of cadmium in natural waters. Aquatic ecosystems are particularly sensitive to cadmium pollution mainly because of:

- the very low levels of this toxicant in waters and biomass of prehistoric times
- the strong tendency of the food web to bioaccumulate this element.

The first four chapters focus on the sources (natural vs. anthropogenic), behavior, and fate of cadmium in natural waters. These are followed by three good chapters on the biocycling and effects of cadmium on freshwater biota. The ecotoxicity of cadmium to marine biota are covered by the next two chapters. The final chapter presents a succinct review of the analytical chemistry of cadmium in natural waters. A very clear overview on contamination control, project design and analytical input, sample handling, concentration techniques, determination techniques, reliability of literature data and reference materials, and analytical recommendations is presented. A common goal of the biological chapters has been to relate the uptake and toxicity of cadmium to the key biogeochemical processes. Biological monitoring of the sensitivity of ecosystems and the biochemical interactions of cadmium with other metals are also covered in various chapters. The volume thus provides the scientific rationale for the continuing effort to establish water quality criteria and standards for cadmium.

E. MERIAN

ANALYSIS OF SURFACE WATERS, by Dr. Hubert Hellmann, Federal German Institute of Hydrology, D-5400 Koblenz, 275 pages (including 189 figures, 49 tables, literature references (mainly German literature of the 1970's) added to each chapter, and an index of 5 pages), hard cover, format 246 × 172 mm, ISBN 0470-20924-0, Ellis Horwood Limited/John Wiley & Sons, Chichester, UK (1987), US \$89.95.

The original German edition (Georg Thieme Verlag, D-7000 Stuttgart 1) has been translated by B. D. Hemmings. In the area of investigation one should never

overlook the truth that processes occurring in the environment occupy a continuum in space and time. Surface waters and, to a very special degree, flowing waters, demonstrate beyond all doubt that sampling must be performed within a space/time context in order to derive meaningful facts. The need for keeping a critical eye on trends in the data was thus tried to be taken into account (mercury and cadmium measurements, which resulted usually in too high results (also because levels were higher 10 to 20 years ago, for instance in the river Rhine) are however not discussed, no reference is found in the index). The volume is useful for those concerned with water quality monitoring and water quality protection.

The analysis of surface waters is thus a complex task, extending from proper sampling to detailed and conscientious interpretation of the measurements. The question arises: "what is the actual meaning of results?". Classification of the subject matter is reflected by the treatment of specific materials, based upon the author's practical experience and investigation of the subject. Numerical examples show the importance of paying attention to hydrological factors, e.g. discharge and transport of suspended solids. Typical interpretations include estimates of production and consumption to produce a balance sheet of substances released into the environment. The book contains three parts:

- General Principles
- Analysis (including Sampling)
- Further Evaluation (including Cross-connections and Transport).

One misses however newer information, for instance by J. Albaiges, U. Förstner and W. Salomons, the group of H. W. Nürnberg, and W. Stumm and W. Giger (including the conclusions of some recent significant symposia, such as the Conferences on Heavy Metals in the Environment and on Environmental Contamination, the Annual IAEAC Symposia on Analytical Chemistry of Pollutants (Environmental Analytical Chemistry), and the IAEAC Workshops on the Analytical and Environmental Chemistry of Hydrocarbons. In the case of trace metals the author discusses dissolved and undissolved fractions, but does not go into details regarding speciation (influenced also by redox-potentials and complexation). But more emphasis is laid on monitoring of organic compounds (whereby transformations are practically not considered), and within the group of pesticides practically only older organohalogen compounds are treated (one misses for instance the key word "organophosphorus compounds" in the index). Besides handling the regularly appearing pollutants one should perhaps also learn how to deal with accidents (events). But besides these drawbacks, which may be overcome in a new edition, the book is very valuable, particularly since it makes reliable recommendations, tested in practice. Besides the analytical chemistry of hydrocarbons, organohalogens and detergents (EDTA and NTA are still missing) in waters, sediments and sludges, the discussion of mass flows and balances are of general interest (e.g. for hydrocarbons in Lake Constance).

E. MERIAN

THE HANDBOOK OF ENVIRONMENTAL CHEMISTRY, Volume 2, "Reactions and Processes", Part D (with six Contributions), edited by Professor Dr. Otto Hutzinger, University of D-8580 Bayreuth, 210 pages (including 47 figures, 55

tables, references added to each chapter, and a subject index of 4 pages), linen, format 248 × 172 mm, ISBN 3-540-15547-3, Springer-Verlag, Berlin-Heidelberg-New York (1988), DM 186.00.

The editor states that environmental chemistry is concerned with reactions in the environment (distribution and equilibria between environmental compartments). Six excellent contributions on aquatic, atmospheric and soil processes were now added to the earlier 26 publications in Parts A, B and C of Volume 2 (see for instance *Intern. J. Environ. Anal. Chem.* **15**, 319–320 (1983) and **23**, 158–160 (1985)).

Rainer Herrmann, D-8580 Bayreuth discusses hydrological cycles, looking at flows (e.g. in soils and sediments) and modelling catchments infiltrations and runoffs.

N. O. Crossland and C. J. M. Wolff, Sittingbourne, Kent ME9 8AG, UK and NL-1003 AA Amsterdam make experiments in outdoor ponds, and inform therefore on their construction, management and use in experimental ecotoxicology.

Theodore Mill and William Mabey, Menlo Park, California 94025 and San Francisco, California 94103 report on hydrolysis of organic chemicals. Mechanisms are kinetically described, as well as structure activity relationship parameters. Subsections handle with temperature and salt effects, and metal ion catalysis.

Michael Waldichuk, West Vancouver, British Columbia V7V 1N6, Canada studies exchange of pollutants and other substances between the atmosphere and the oceans. He includes for instance information on global fluxes, enrichment factors, and the behavior of CO₂, methane and other hydrocarbons, halogenated hydrocarbons, and trace elements, basing himself especially on the SEAREX-Program (Sea Air Exchange) of the World Meteorological Organization, Geneva, Switzerland.

P. B. Tinker and P. B. Barraclough, Swindon SN2 1EU and Harpenden, Herts. AL5 2JQ, UK describes root-soil interactions, and the influences of pH changes and of microbiological populations. Root density depends on soil properties and genetic composition of the plant. Mathematical modelling of nutrient uptake, symbiotic systems, and very short inorganic and organic toxicities (especially aluminium toxicity) are explained.

Finally, C. M. Menzie, Washington D.C., USA presents a 22-page table for various reaction types in the environment, indicating always the critical compound, the critical metabolite, and the relevant literature reference (all in all 155 references). He demonstrates especially the generality of these reactions in nature, for instance the transformations to more polar material, decreased lipid solubility, and increased elimination.

Part D is thus highly recommended to all practising scientists in interdisciplinary fields.

E. MERIAN