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Book Reviews

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Book Reviews

TRACE ELEMENTS IN FUEL, edited by Suresh P. Babu, x+216 pp.
American Chemical Society, Washington D.C., 1975 (Advances in Chemistry
Series 141).

The burning of fossil fuels is an important process whereby man mobilizes trace metals at rates which for certain elements appear significant globally in relation to those of natural weathering processes and which locally may require consideration from the standpoint of air pollution. There has thus been an increased interest in the occurrence and distribution of trace metals in coal, and in their behaviour during the processes of its preparation and combustion, and its conversion to other fuels, which may eventually lead to considerably increased utilisation of coal. This interest focusses particularly on those elements of greatest concern as potential pollutants, including arsenic, beryllium, cadmium, lead, mercury, nickel and selenium. Unfortunately elements of toxicological concern are frequently also those which either volatilise or become associated with fine particles emitted during combustion. Other aspects of the trace metals which are of concern include the relationship between respiratory disease in coal workers and the composition of mine dusts, and the economic potential for recovery of certain elements. This volume contains fifteen papers, originally given at a symposium in Chicago in 1973, which deal with trace elements in coal and related materials with the emphasis on analytical aspects.

Two useful reviews set much of the background. The first discusses the principal inorganic minerals present in coal and the affinities of various trace elements for the organic and inorganic fractions. Beryllium has a high organic affinity whereas arsenic, cadmium, mercury and lead are dominantly associated with the inorganic phases. The second review examines knowledge of the environmental toxicology of the trace metals. Between these reviews are nine papers primarily devoted to analytical techniques and four which are particularly concerned with the behaviour of trace elements in pretreatment, combustion and catalytic hydrogenation to produce oil. The use of mass balance approaches to investigate the fate of trace metals receives considerable attention and sampling methods for stack gases and particulates are treated in some detail. In accordance with the affinities already discussed the washing of

coal to remove the most dense material substantially reduces the concentrations of many significant trace elements as well as reducing the ash and sulphur contents with consequent reductions in the release of fly ash and emission of sulphur dioxide.

A wide range of methods of initial treatment of samples for analysis is discussed, including wet ashing, low and high temperature dry ashing, and oxygen bomb combustion. Applications of many methods of determination are treated in considerable detail: atomic absorption spectrophotometry with various atomization techniques, optical emission spectroscopy, spark source and thermal emission mass spectrometry, X-ray fluorescence and neutron activation with radiochemical separation or gamma spectrometry. The emphasis upon evaluation of procedures as well as the details of the methods developed makes many of these papers of wide analytical interest, particularly to those concerned with techniques for analysis of readily volatile elements. The volume thus contains much of interest to readers of this journal regardless of whether they have a specialised interest in fuel technology.

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MEASUREMENT, DETECTION AND CONTROL OF
ENVIRONMENTAL POLLUTANTS, International Atomic Energy
Agency Kärntner Ring 11, P.O. Box 590, A-1011 Vienna, Austria.
Price: US \$39.00.

Summary

Proceedings of a Symposium on the Development of Nuclear-Based Techniques for the Measurement, Detection and Control of Environmental Pollutants organized by the IAEA and held in Vienna from 15–19 March 1976. Environmental pollution is the consequence of socio-economic activities and natural changes. Intensive industrialization, massive urbanization and accelerated consumption of fossil fuels have speeded up pollution to an alarming degree. There must be restrictions on the emission of air-borne particulate matter, release of noxious gases and dispersion of toxic substances in water systems and on land: it is necessary to take preventive measures to protect the meteorological and ecological systems against the threat of constant but unabated pollution. The meeting served to review the status of the development of nuclear analytical methods and tracer techniques in their contribution to the monitoring of environmental pollutants. In the two

General Discussion sessions, three topics were thrown open for an exchange of views: intercomparison studies in multielement analysis; analytical techniques based on electron excitation; and the role of tracer technology in pollution studies.

Contents

Comprehensive investigations on the composition of air pollutants; Activation analysis of air-borne particulate matter; X-ray fluorescence and X-ray emission spectrometry techniques; Miscellaneous techniques in air pollution studies; Analysis of water pollutants and environmental samples; Intercomparison studies in multielement analysis—including a General Discussion; Tracer techniques in water pollution studies; and a General Discussion on analytical techniques for the measurement, detection and control of environmental pollutants, and their applicability.

Readership

Ecologists, analytical chemists and physicists, persons and bodies interested in environmental pollution and measurements thereof, standards laboratories interested in standard reference materials, hydrologists.

Suppliers

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ALL OTHER COUNTRIES: Please use order form below or contact your local bookseller.

UMWELTSCHUTZ AUS DER SICHT DER SICHT DER CHEMIE (in German) by Wolfgang Leithe, Wissenschaftliche Verlagsgesellschaft M.B.H. Stuttgart BRD, Price DM 42.—.

The book by Leithe attempts to cover a lot of ground in 134 text pages. Naturally this can only be a brief introduction into this vast topic. It defines and briefly describes sources of major air and water pollutants, their origin, their influence on the environment, legal aspects and means of control and abatement. Leithe deals also with waste problems, management and recycling of waste materials.

Only 22 out of the total 135 pages deal with analytical procedures. These deal particularly with major pollutants such as SO₂, nitrogen oxides, air and

water analysis in general. A few major analytical and chromatographic techniques are mentioned and some emphasis is placed on automation.

In the referee's opinion this book represents a useful starting point particularly for non-chemists or chemist administrators dealing with environmental pollution in the broader sense. Unfortunately there are only very few literature sources given, and these are mostly of German origin. For an analytical chemist somewhat familiar with environmental pollution aspects it will probably be only of limited usefulness. He would find the two specialized books on water and air analysis by the same author and publisher more to his taste.

DIE ANALYSE DER ORGANISCHEN VERUNREINIGUNGEN IN TRINK-, BRAUCH-UND ABWAESSERN

Von

Wolfgang Leithe

2., durchgesehene Auflage 1975.

XII, 175 Seiten. 22 Abbildungen,

26 Tabellen, 430 Literaturzitate. Lw. geb. DM 42,-

DIE ANALYSE DER LUFT UND IHRER VERUNREINIGUNGEN

in der freien Atmosphäre und am Arbeitsplatz

Von

Wolfgang Leithe

2., neubearbeitete und erweiterte Auflage

1974. XV, 303 Seiten,

49 Abbildungen, 29 tabellen

583 Literaturzitate.

Lw. geb. DM 74,-

ANALYTICAL METHODS IN OCEANOGRAPHY by Thomas R. P. Gibb Jr. (Editor) *Advances in Chemistry*, Series 147, 238 pages, \$26.50. American Chemical Society, Washington, D.C., 1975

The book contains 18 original papers dealing with the multilateral field of oceanographic analysis, which were presented at a symposium sponsored by the division of analytical chemistry at the 168th meeting of the American Chemical Society, Atlantic City, N.J., September 10-11, 1974.

Eleven papers are devoted to the determination of metal traces in sea water, two of these dealing with radioactive isotopes. Four papers cover the field of organic carbon in sea water, present in species such as chlorophyll, hydrocarbons, polycyclic compounds; two papers describe the properties of fluorite and silica sediments and one the determination of acid base equilibria in ocean water.

The main emphasis is on sampling procedures and sampling devices, contamination with trace elements and their loss during the sample preparation procedure and specific and sensitive end determination methods, namely AAS and anodic stripping polarography. Liquid-liquid extraction, electro-deposition, coprecipitation and complex exchangers (chelex and modified glass) are used for preconcentration of the trace metals. IR, UV, GC and GC-MS were used to determine and to identify organic pollutants. All the papers included reflect systematic practical work in enough detail to enable their reproduction. The book does not only give an overlook on modern methods of oceanographic analysis, it is also of interest to all chemists performing trace metal analysis.

MODERN CLASSICS IN ANALYTICAL CHEMISTRY—II. Editor Alvin L. Beilby; paperback, 310 pages, \$8.50. Publisher: American Chemical Society, 1155 Sixteenth St., N.W. Washington, D.C. 20036. (Reviewed by R. W. Frei, Sandoz Ltd., Basel.)

The purpose of this second volume of "Modern Classics in Analytical Chemistry" is the same as that of the first volume—to provide a selection of reprints of articles which can serve as supplementary reading material for analytical chemistry courses. In addition this volume should serve as a convenient source of articles for anyone wishing to keep abreast of recent advances in analytical chemistry.

The articles have been chosen from the 1970–1975 A-page articles in *Analytica. Chemistry*—"Report", "Instrumentation" and "The Analytical Approach". They include historical discussions, theoretical presentations, applied discussions, and solutions of analytical problems.

"Development of Analytical Chemistry As a Science" by Izaak M. Kolthoff is the lead-off article for this volume.

The first main group of articles deal with spectroscopic methods of analysis. Also included in this group are two articles which deal with surface and thin film analysis. Next come two articles on electroanalytical methods of analysis, followed by three articles on chromatography. An article on "GC/MS/Computers" illustrates how a combination of several techniques can lead to results greater than the sum of results with each technique alone. This article is followed by three articles dealing with the general use of computers

with analytical instrumentation. The next nine articles cover a variety of topics such as chemiluminescence, immobilized enzymes, trace analysis of inorganics, automation and pattern recognition.

Nine articles of the series "The Analytical Approach" have been included in this volume. These being directly taken from the realm of practical problem solving in industry and government should be particularly useful to teachers of analytical chemistry to help them make their courses more relevant.

The A-page articles have always been appreciated by analytical chemists and scientists using analytical techniques and having a collection of some of these more relevant articles makes it handy to the user. I believe that the editor did a good job in selecting and assembling the topics and articles. At this moderate price this book will be a good investment.

ORGANIC FUNCTIONAL GROUP ANALYSIS BY GAS CHROMATOGRAPHY by T. S. Ma and A. S. Ladas, Publisher: Academic Press. Places of publication: London, New York, San Francisco. Year: 1976. Number of pages: X + 173. Price: £6.80, US\$14.75. Reviewed by: B. Schreiber and R. W. Frei, Sandoz Ltd., Basle, Switzerland.

The development of sophisticated methods for structure analysis of organic compounds (eg. NMR, MS, IR) has displaced functional group analysis from this field. As a method for fast quantitative determination of organic compounds, however, it is still in use in research and control laboratories throughout the world. The trend to get more and more data from smaller samples caused the development of the methods from classical titrimetry to electrochemically indicated titrimetry and finally to gas chromatographic determination of the species resulting from group specific reactions. The big number of new group selective reagents used for derivatization of compounds prior to GC has supported this development.

In their book T. S. Ma and S. Ladas give a systematic approach to functional group analysis by GC including theory, apparatus, sample preparation and a collection of methods for the determination of all interesting functional groups. Literature references are covered up to 1975.

The first quarter of the book is dedicated to the sample preparation, the introduction of the sample into the GC system and the different possibilities to combine group selective reactions with GC. Pyrolysis, pre-column, on-column and post-column reactions, subtraction and peak shifting methods and special reaction vessels for derivatization are described in detail. A capture on how to use GC for qualitative organic analysis completes this part of the book. GC procedures for the following functional groups are given in the second part: Oxygen containing groups: Alkoxyl, carbohydrate, anhydride, carbonyl,

carboxyl, epoxy, ester, hydroxygroups and salts. Nitrogen containing groups: Alkimino, amino, azoxy, azo diazo, carbamate, carbonamide, carbonimide, cyano, isocyano, acido, nitro and nitrosogroups heterocyclic nitrogen, nitrite and nitrate as well as ureido and guanidino functions. Sulfur containing groups: Mercapto, sulfide, disulfide, sulfonamide, sulfone, sulfoxide, thiocarbamate and thioester group. In addition alkene, alkyne and alkylidene functions, active hydrogen, hydride, C-methylgroups and organometallic compounds including As, P, Si and heavy metals are taken into consideration.

It is the reviewers opinion that the book can be recommended as a laboratory desk top source for the practising analyst having already a good knowledge of GC. The methods are written in enough detail to be usable without resorting to the original literature.