BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Fuels from Biomass and Wastes

Editors	Donald L. Klass and George H. Emert
Publisher	Butterworths, Woburn, Massachusetts (1981)
Pages	592
Price	$39.95
Reviewer	John S. Niederkorn

As a consequence of the world energy crisis in the early 1970s, availability of energy resources--mainly that of oil and natural gas--became an issue of outstanding importance, which provoked many concerns about the fate of civilization. These concerns are justified because the depletion of world oil resources may become a reality after the next few decades.

Taking into account that in 1982 the contribution of oil and natural gas to the world energy production is decisive, being 45 and 20%, respectively, the intensive search for new energy supplies became a major objective of scientific and technological activities.

As we approach the end of the century, the energy need increases exponentially and by then it is expected to be more than double the consumption in 1982. This energy requirement expressed in tons of conventional coal is equal to 25 billion against the 11 billion at present.

Now, it is difficult to forecast, even for the not very distant future, what the final solution to the energy supply problem will be. Nevertheless, we know that coal and coal fuel products will be used to a greater extent than they are today. However, atmospheric pollution from combustion products limits the exploitation of the almost inexhaustible coal reserve of the earth. The nuclear fission energy alternative already plays an important role and contributes ~6% to the world energy production, but so far the ecological impact of this kind of energy resource is slowing down its development. Direct utilization or conversion to electricity of solar energy still encounters considerable technological and economic difficulties. It is unlikely that during the next few decades solar energy will attain prominence. It seems that the commercial utilization of thermonuclear energy is not expected to become a reality before the middle of the next century.

The question is not only the increase of energy production, but also the specific quality of the fuel produced. This circumstance justifies the consistent research for new energy resources of biological origin, which can provide liquid or liquefiable fuels necessary for internal combustion engines.

As we find in the book, *Fuels from Biomass and Wastes*, a new way to the efficient and cheap use of solar energy is through biomass. The general definition is given by the editors as follows: "The biomass is an intermediate raw material land and water based vegetation in the form of trees, grasses, plants and algae—which can be converted to a broad range of useful energy forms." In addition to that, the biomass is frequently a waste, and not at all in negligible amounts, that requires appropriate management and disposal. This waste can be also transformed into fuel material, and the final result will be a new source of energy instead of management and disposal expenses. The importance of biomass as an energy resource is obvious because "the annual biomass energy stored worldwide is about ten times the total energy used by man each year."

This volume evolved from a symposium on this subject, sponsored by the American Chemical Society and the American Institute of Chemical Engineers at the Second Chemical Congress of the North American Continent in Las Vegas, Nevada, August, 24-29, 1980. The contents of this edition are organized into seven sections and 31 chapters, which are really papers from different authors. The impressive number of 665 references complements the material presented.

After introducing the general topic of fuels from biomass and wastes and appropriate technologies, section one contains 6 papers that are devoted to biomass procurement and production. Section two treats the biological and thermal gasification issues of biomass in 13 papers. Section three covers the technique and methods of hydrolysis of biomass and the extraction of fuel product. This section contains 4 papers. The technological issues of fermentation ethanol are presented in section four in 4 papers. Section five also contain 4 papers on natural and thermal liquefaction of biomass. Section six is devoted to environmental and health aspects of biomass energy systems. Finally, section seven presents particular systems and some case studies.

This book, containing 31 papers and 665 references from 71 authors, edited by Donald L. Klass, vice-president of the Institute of Gas Technology, and George H. Emert, the director of the Biomass Research Center at the University of Arkansas at Fayetteville, is considered to be an excellent source of up-to-date information for professionals and students and a good source of inspiration for researchers in the field of biomass as a readily available, inexpensive, and almost inexhaustible source of energy.

John S. Niederkorn studied metallurgical engineering and materials science at Ural's Polytechnical Institute in Sverdlovsk and earned his doctorate at the Institute of Non-Ferrous Metals and Gold in Moscow, USSR. His scientific and engineering activity in the field of metallurgy and materials science includes mostly interdisciplinary topics concerned with energy-related materials.

He has completed numerous research and engineering projects on nuclear materials, radioactive waste management, rare metals ore processing, and semiconductor materials. His research interests are in the fields of advanced chemical and physical separation methods and mass transfer in homogeneous and heterogeneous systems. He has published several textbooks and numerous papers; he has also endeavored to disseminate the state of scientific knowledge in the communication media and in books.

From 1966 he was head of the research laboratory and from 1974, head of the research division at the Research and Engineering Center for Radioactive and Rare Metals in Bucharest, Rumania. In 1982 he joined the Research and Development Division of New Mexico Institute of Mining and Technology.

Nuclear Waste Management
(The Ocean Alternative)

Editor	Thomas C. Jackson
Publisher	Pergamon Press, Inc., Elmsford, New York (1981)
Pages	124
Price	$17.50
Reviewer	John S. Niederkorn

According to the publication *Nuclear News* of February 1983, at the end of 1982 the total number of operating nuclear power plants was 230 worldwide and their overall capacity was 153 266 MW(electric). More than 233 units are under construction, with a 201 010-MW(electric) projected capacity. The U.S. nuclear energy production is 35.7% of the world production of this type of energy source.

As we can see, the rate of development of nuclear energy used for energy production is very high worldwide. Many experts are considering that, without its increasing application, it will not be possible to satisfy the exponentially growing energy need of mankind. In spite of the expected significant role of nuclear plants in energy production, its consolidation is endangered by environmental issues. Indeed, spent nuclear fuel contains very strongly radioactive fission products and transuranic elements that are both very harmful to biological environment. For instance, a 1000-MW(electric) nuclear plant produces 280 to 300 tons of spent fuel annually that contains ~3.5 tons of fission products and 2.4 tons of transuranic elements, mostly plutonium. Either, the spent fuel or, if it was processed, the high-level radioactive products must be safely isolated from the biological environment for thousands of years.

The handling of radioactive waste, temporary disposal, and especially the ultimate isolation are overly complex and difficult problems. Unfortunately so far, there is no safe and generally accepted long-term disposal technology available. The research activity to solve this problem is intensively developing in several directions. The underground radioactive waste burial in geologically stable regions of basalt, granite, or salt host rocks might be an acceptable solution. However, during the last 30 yr, sea disposal was the most common practice worldwide, alongside of the controlled temporary surface disposal.

The volume, *Nuclear Waste Management (The Ocean Alternative)*, edited by Thomas E. Jackson and sponsored by the Oceanic Society is devoted to the history, the results of disposal site controls, and the prospects of the ocean burial alternative of low- and high-level radioactive waste materials. The content of the book is divided into eight chapters, containing eight principal papers, eight comments, questions, and answers.

The explanation of basic material begins with the paper of Robert S. Dyer entitled "Sea Disposal of Nuclear Waste; A Brief History," which is devoted to the past practices and policies of sea disposal of radioactive waste. After reviewing the scope of American sea disposal programs between 1946 and 1970, the survey results of radioactive wastes at 35 U.S. dump sites are examined. The decision to halt sea disposal in 1970 and current federal laws are also discussed.

W. L. Templeton devoted his paper to "The Basis of the Revised IAEA Definition as Related to the Dumping of Low Level Radioactive Wastes in the Deep Ocean." Also in connection with low-level nuclear waste disposal, Dr. Kieho Park discusses the topic of "Potential Priorities for Scientific Studies of Deep-Sea Life." The last paper concerning the low-level waste issue is given by Robert Dyer on "A Review of Field Studies at United States Dump Sites."

An extensive article by Dr. Charles Hollister entitled "A Review of Current Science and Technology for Disposal of High Level Radioactive Wastes Within Geological Formations of the Deep Seabed" examines the geologically passive seabed zones covered by clay deposits as a prospective radioactive waste burial site. He considers that the high ion-exchange capacity of the clay or other sedimentary deposits may capture radioactive elements that manage to escape from their original packages.

The last part of the book is devoted to the policy issues of the sea disposal of nuclear wastes. The paper of Dr. David Deese, "A Discussion of National and International Political Legal Considerations" is followed by Clifton Curtis's article entitled "An Examination of United States Policy Trends."

This publication of the Oceanic Society is an excellent source of information about the conceptual and technological issues as well as on the national policy and legal considerations in the field of ocean alternatives of radioactive waste burial.

Although this book is an excellent synthesis of knowledge in a vitally important field of general and special interests, maybe it is proper to recall from the book, the remarks by W. L. Templeton: "Our understanding of the processes occurring in the deep oceans is insufficient to permit the construction of a single comprehensive model of the movements of radionuclides. The original oceanographic model used for the provisional definition was inapplicable for long-lived isotopes in finite sized basins."