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Book reviews

Industrial Gas Handbook: Gas Separation and Purification, F.G. Kerry. CRC Press/Taylor & Francis Group, Boca Raton, FL (2007). 549 pp., Price: US\$ 169.95, ISBN: 978-0-8493-9005-2

“The molecular chemistry of gases is well known and it seems unlikely that any new discoveries will cause Lavoisier, the father of modern chemistry, to turn in his grave. On the other hand, there are always new applications to discover, or to develop some of which will require phenomenal quantities of well known industrial gases.” So ends this book, written by a mechanical engineer based on his lifetime experience of 60 years—and I might add, well written.

The book has 14 chapters covering virtually every aspect of the topic offering “. . . detailed discussions and up-to-date approaches to process cycles for cryogenic separation of air, adsorption processes for front-end air purification, and related process control instrumentation.” In addition, the book “. . . covers topics such as chronological development, industrial applications, air separation technologies, noble gases, front end purification systems, insulation, non-cryogenic separation, safety, cleaning for oxygen systems, economics, and product liquefaction, storage and transportation.”

One feature I appreciated was a historical review (at appropriate points) of discoveries and developments of gases and their uses. This historical review starts with a discussion of the Eighteenth Century work of French physicist Guillaume Amontons in thermometry and mathematics which led to the supposition of absolute zero. This discussion of the historical background of the topic being reviewed provides the reader with some understanding of the development of the field.

The book has the following 14 chapters:

1. Gas separation and purification of industrial gases
2. Industrial applications
3. Separation technology
4. Rare (noble) gases
5. Front-end purification systems
6. Product liquefaction, storage, and transportation
7. Insulation
8. Special gases
9. Noncryogenic separations
10. Cryogenic equipment, materials, and machinery
11. Instrumentation and controls
12. Safety
13. Cleaning for oxygen systems
14. Economics

Safe gas handling practices are discussed in several places in the book. Several short sections discuss: (1) safety of liquid carbon monoxide, (2) dangerous side effects of nitrous oxide, (3) safety in LNG transmission and storage, and (4) pressure safety

relief valves. All the foregoing are found in the chapter dealing with individual gases. Chapter 12, however, is totally devoted to safety.

To readers of this journal, Chapter 12 probably would be of the most interest as there can be grave consequences due to improper handling of fuels mixed with air or pure oxygen. Kerry discusses inflammability and detonation wave velocities of numerous gases as well as safe design procedures, limits of contaminants, as well as safe practices in general.

The book has many excellent features in addition to being very well written and thoroughly covering the topic. The prose is well-supplemented with numerous tables, figures, and pictures of equipment that add tremendously to the understanding of the processes being discussed.

In the text, Kerry includes the theory behind each operation as needed but does not take it to exhaustion. As appropriate, he includes worked examples to illustrate the theory. He has not, however, included student problems (probably because he has written a book for the practicing professional and not for academics, which he is not).

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Biotechnology for Fuels and Chemicals: The Twenty-Eighth Symposium, J.R. Mielenz, K.T. Klasson, W.S. Adney, J.D. McMillan (Eds.). Humana Press, Totowa, NJ (2007). 1009 pp., Price: US\$ 149.00, ISSN: 0273-2289

While published as a book, this material is essentially four volumes (V136–140) of a journal entitled *Applied Chemistry and Biotechnology*. This book contains 77 papers presented at the Twenty-Eighth Symposium on Biotechnology for Fuels and Chemicals which was held 30 April–3 May, 2006 in Nashville, TN. With the growing interest in alternative fuels and chemicals, this symposium and its resulting publication were, to say the least, timely.

The conference had 10 sessions, the titles of which are listed below:

- Enzyme catalysis and engineering
- Plant biotechnology and genomics
- Biomass fractionation and hydrolysis
- New and developing industrial bioproducts
- Feedstock supply and logistics
- Microbial catalysis and metabolic engineering
- Bioprocessing and separation R&D
- Bio/thermo-chemical integrated biorefinery
- Life cycle analysis/sustainability
- International biomass/biofuels update

A quick review of the above list of session titles reveals a wide range in coverage of topics in the conference whose impacts were noted by the author of the first paper in the book. Akin, of the USDA Laboratory in Athens, Georgia, writes:

“Corn-to-ethanol production and use is rapidly expanding. With the phase-out of methyl tertiary butyl ether, which has been used as an oxygenate for more efficient burning of gasoline, ethanol has been added in ever increasing quantities. Further, the desire to use even higher ratios of ethanol as a fuel related to improved national security, trade imbalance, and use of agricultural products has driven up the demand, price, and production. With greater emphasis on fuel ethanol, lignocellulose as substrate for fermentation has been given an increased priority.”

The author goes on to discuss the use of this substrate to produce fermentable materials.

Given that a comprehensive review of the 77 papers in this volume was clearly beyond the scope of space available, I have selectively abstracted material that caught my attention:

- A paper entitled “Biodiesel Fuel Production by the Transesterification Reaction of Soybean Oil Using Immobilized Lipase” was presented by scientists from Brazil. The authors describe the enzymatic alcoholysis of soybean oil with methanol and ethanol using a commercial immobilized lipase.
- Another paper from Brazil discussed the “Enzymatic Hydrolysis Optimization to Ethanol Production by Simultaneous Saccharification and Fermentation.” The authors noted that: “There is tremendous interest in using agro-industrial wastes such as cellulignin as starting materials for production of fuels and chemicals.”
- A third Brazilian paper entitled “Use of Glucose Oxidase in a Membrane Reactor for Gluconic Acid Production” was important because of the high availability of glucose obtained from sucrose and starch which are abundant natural resources. There is a high market demand (over 100,000 tons/year worldwide) for gluconic acid, a product largely used in food as an acidulant, as a chemical for surface cleaning, and in the pharmaceutical industry (gluconate salts).
- Swedish biochemists presented a paper entitled “The Potential in Bioethanol Production from Waste Fiber Sludges in Pulp Mill-Based Biorefineries.” I quote from the abstract: “Industrial production of bioethanol from fibers that are unusable for pulp production in pulp mills offers an approach to product diversification and more efficient exploitation of the raw material. In an attempt to utilize fibers flowing to the biological waste treatment, selected fiber sludges from three different pulp mills were collected, chemically analyzed, enzymatically hydrolyzed, and fermented for bioethanol production.”
- A contribution from chemical engineers at my own university was entitled “Mitigation of Cellulose Recalcitrants to Enzymatic Hydrolysis by Ionic Liquid Pretreatment.” The authors note that the efficient hydrolysis of cellulose-to-glucose is critically

important in producing fuels and chemicals from renewable feedstocks.

- The last paper to be reviewed was presented by Converse of Dartmouth College, Hanover, New Hampshire. The paper is entitled “Renewable Energy in the United States: Is There Enough Land?” The author concludes that: “A renewable energy supply scenario, capable of meeting the 2001 US energy demand indicates that there is enough land to support a renewable energy system but that the utilization of biomass will be limited by its land requirement.”

The above extremely limited reviews of only a few of the book's papers illustrate the wide coverage of material published. What is unique in this volume was the fact that it is essentially a hard cover production in a single book of four volumes of a periodical.

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Biophysico-Chemical Processes of Heavy Metals and Metalloids in Soil Environments, A. Violante, P.M. Huang, G.M. Gadd (Eds.). John Wiley & Sons Inc., Hoboken, NJ (2008). 678 pp., Price: US\$ 135.00, ISBN: 978-0-471-73778-0

“Pollution induced by heavy metals and metalloids in soils is a serious environmental problem because, in comparison with the atmosphere and water, the soil environment has a much lower ability to recover from toxic effects. In soil, trace elements potentially toxic to plants and other living organisms are involved in chemical and biological reactions such as solution and surface complexation, precipitation, sorption-desorption, and oxidation-reduction. These elements interact with a series of clay minerals, humic substances, metal oxides, microorganisms, extracellular enzymes, biopolymers, and other organic and inorganic ligands. Their behavior depends on chemical and physicochemical as well as biological processes and their interactions with microbial activities. These physicochemical-biological interactions would influence the transfer of these elements from the inorganic and organic soil constituents to the soil solution and to plants and contaminate the terrestrial food chain, thus endangering human and animal health. Biogeochemical processes operating in soil environmental that affect the fate, behavior and bioavailability of metals and metalloids are currently an area of active research.

As a recognition of the importance of biophysico-chemical processes of metals and metalloids in soil environments, we initiated the first volume of the IUPAC-Wiley book series “Biophysico-Chemical Processes in Environmental Systems.” This volume, which consists of 15 chapters, is organized into three parts: Fundamentals of Biotic and Abiotic Interactions of Trace metals and Metalloids with Soil Components; Transformations and Dynamics of Metals and Metalloids as Influenced by Soil-Root-Microbe Interactions; and Speciation, Mobility, and Bioavailability of Metals and Metalloids and Restoration of Contaminated Soils.”

The editors have assembled a series of excellent papers that cover both the theoretical and practical aspects of metal contami-