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Book reviews

Elements of Environmental Engineering: Thermodynamics and Kinetics
Kalliat T. Valsaraj, Lewis Publishers, Boca Raton, FL, 2nd Edition, 2000, $89.95, 679 pp., ISBN 1-56670-397-2

Chemical engineers, Valsaraj notes, are progressing from an end-of-the-pipe waste treatment mentality to close examination of chemical processes with a view toward pollution prevention. To prepare students for this task, chemical engineering departments are offering one or more courses on environmental topics. Inherent in the chemical engineer's approach to environmental control is a blend of mass transport and applied chemistry.

Inherent also in the chemical engineer's understanding of environmental control processes are chemical kinetics and chemical thermodynamics, the two main pillars of physical chemistry. Given that the author of this book is, by training, a physical chemist, but one flow teaching in a chemical engineering department, he is eminently well-qualified to write this text.

Valsaraj defines environmental engineering as "the study of the fate, transport, and effects of chemicals in the natural and engineered environments and the formulation of options for treatment and prevention of pollution". In my opinion, this book admirably addresses the topic in a most comprehensive (and mathematically rigorous) fashion.

The book has six (long) chapters which can be broadly classified into two sections: (1) chemical thermodynamics is the main topic of the first (Chapters 2 to 4) while (2) reaction kinetics is the main topic of the second (Chapters 5 and 6).

The book's coverage is best described by Valsaraj himself. "Chapter 2 is an introduction to the thermodynamics of homogeneous phases composed of single or multiple species. It also introduces the important concepts of free energy and chemical potential which are of paramount importance in dealing with equilibrium systems in environmental engineering. A concise description of surface thermodynamics is also included in Chapter 2. Chapter 3 is an extension of the thermodynamics of homogeneous systems to heterogeneous and multicomponent systems. The important concepts of activity and fugacity and non-ideal solutions and gases are dealt with within this chapter. Chapter 4 deals with the applications of the concepts developed in Chapters 2 and 3 on air–water, soil–water, and air–soil equilibria to illustrate the concept of equilibrium partitioning between compartments in environmental engineering. Applications of equilibrium thermodynamics in waste treatment operations are also described. Chapter 5 gives a short summary of the essential aspects of chemical reaction kinetics. Concepts such as reaction rates and activation energies are introduced and discussed. The concepts developed in Chapter 5 are used to illustrate the applications

of chemical kinetics in environmental waste treatment processes and biological systems in Chapter 6. Applications of reactor models and transport theory are exemplified in Chapter 6".

Each chapter is accompanied by numerous student problems (e.g. Chapter 2 has 42 problems; Chapter 3 has 94 problems) for student assignment. Selected (but not all) answers to these problems are found in the appendix.

I turn now to the last chapter, "Applications of Chemical Kinetics and Mass Transfer Theory". Here the author discusses reactors and reaction kinetics. Next comes a focus on the water environment including fate transport of contaminants (from waste to other media), air stripping and photocatalytic reactions. In the air environment subsection, Valsaraj discusses fate and transport (of air pollutants) models including the often-cited Gaussian model.

I was particularly (having taught an air pollution control course) interested in Valsaraj's treatment of air pollution control devices: gravity settlers (not often used industrially any more because of their low particle removal efficiency but interesting in particular in regard to the theory of particle deposition), cyclones and electrostatic precipitators (missing, however, was a discussion of fabric filters). In the control of gases and vapors, adsorption, absorption and thermal destruction were examined.

In Section 4 (Chapter 6), soil and sediment environments are discussed. This is a topic of long interest to Valsaraj's LSU colleague, Louis Thibodeaux. Fate and transport modelling and soil and groundwater treatment are two of the major subsections here.

Finally, a topic of real interest to me (having a biochemical engineering background) and that was Valsaraj's discussion of biochemical engineering. Michaelis-Menten and Monod Kinetics, long a basis of predicting the rate of biochemical reactions are treated first to lay the groundwork for bioengineering, microbial reactions. This chapter ends with 77 student problems.

My overall reaction is (as it was for the first edition) that this is a very good book, but an edition made much better by the increase in number of student problems and new examples of the theories discussed.

Gary F. Bennett

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Remediation Engineering of Contaminated Soils

Donald L. Wise, Debra J. Trantolo, Edward J. Cichon, Hilary I. Inyang, Ulrich Stottmeister (Eds.), Marcel Dekker Inc., New York, NY, 2000, $250.00, 1008 pp., ISBN 0-8247-0332-4

"Remediation Engineering of Contaminated Soils" is a companion volume to "Bioremediation of Contaminated Soils," also published by Dekker but in the month prior to the appearance of this book. This book is advertised as a comprehensive reference "offering thorough coverage of the remediation of soils contaminated by hazardous wastes."

In the context of a wide variety of topics, the book is "comprehensive." But it is really only a collection of a large number of research review papers on a wide variety of topics. The text does not (nor does it purport to) comprehensively discuss each and every soil remediation technology. Contributions were supplied by over 100 researchers and scientists. With 41