ChE **book review**

ENVIRONMENTAL CHEMODYNAMICS:

Movement of Chemicals in Air, Water, and Soil, 2nd edn.

by *Louis J. Thibodeaux*

Published by *John Wiley & Sons, New York, NY; 593 pages, $69.95 (1996)*

Reviewed by

T. R. Marrero

University of Missouri-Columbia

Quality, quality! The Second Edition of *Environmental Chemodynamics* is a revised and updated version of the 1979 edition that is an outstanding contribution to chemical engineering textbooks for senior and graduate students. Because of its logical organization, completeness, and extensive index (23 pages), it is quite useful to the practicing engineer who has to review the concepts and calculation techniques of chemical equilibrium and transport processes relevant to the fate and rate of movement of chemicals across air-water, water-soil, soil-air interfaces.

This second edition has many figures (146) and tables (86) with useful illustrations of basic engineering principles and environmental data, plus 34 examples. Each chapter has many references, a majority from primary sources; a total of 369 references are cited. It includes 161 problems (50% more than the first edition), and most of them are practical. A solutions manual is available.

In two chapters, *Environmental Chemodynamics* presents clear and succinct descriptions of chemical engineering principles pertinent to the movement of chemicals in the environment. Three chapters describe the concepts, quantification techniques, and reliability of predictions for the interphase movement of chemicals. One chapter covers the basics of intraphase (air, water, and subterranean media) mass transfer.

The purpose of *Environmental Chemodynamics* is to teach, at a university level, the chemical engineering equilibrium and transport (heat, mass, and momentum) methods applicable to situations involving the movement of chemicals in the natural environment.

The author, Louis Thibodeaux, is the Jesse Coates Professor of Chemical Engineering at Louisiana State University. He is nationally and internationally known for his outstanding research and teaching in the area of environmental science and engineering. His activities in this area have transpired for more than twenty-five years.

A student must first become familiar with the systemic and mnemonic notation used in the text. This neat information is presented in chapter one and allows the specification of controlling factors for different environmental systems. Chapter one includes the definition of "trace" constituents that are important to environmental analyses and a classic example of mass transfer, the re-aeration of natural streams. This example is almost essential for chemical engineering students who have never considered quantitative problems outside of chemical process systems. The reader of chapter one also learns that the law of conservation of mass was first experimentally established by Antoine Lavoisier in 1777.

Chemical engineering basic principles of thermodynamics and transport phenomena are well covered in chapters two and three, respectively. These two chapters teach fundamentals required for the problems presented in the four subsequent chapters. Topics include chemical and thermal equilibrium at environmental interfaces, diffusion, mass transfer, and turbulence. The understanding of these concepts and phenomena for the prediction of chemical movement in the environment is essential to the environmental engineer and complements earlier classroom studies by chemical engineering students. Fundamentals are clearly explained in this book.

The final four chapters are the "meat" of *Environmental Chemodynamics.* The major topics are: Chemical Exchange Between Air and Water (Chapter 4); Chemical Exchange Between Water and Adjoining Earthen Material (Chapter 5); Chemical Exchange Between Air and Soil (Chapter 6); and Intraphase Chemical Transport and Fate (Chapter 7).

Each major topic is divided into subtopics that define the applicable terms, illustrate the concepts and systems, and provide examples and problems from actual events and research studies. The text is not esoteric. Figures illustrate the concepts and explicitly specify the systems of interest. Data in table form are immediately available to the students; these environmental data are not readily found in other chemical engineering textbooks or handbooks. Chapter four well explains a method to calculate the desorption (absorption) of gases from aerated basins and rivers. Chapter five emphasizes the determination of chemical movement at the bottom of quiescent water bodies (ponds, lakes) and flowing streams. Chapter six divides the chemical movement across the air-soil interface into two regions: through the lower layer of the atmosphere and through the upper layer of earthen material. The last chapter presents mathematical models for chemical movement in surface water and well-known methods of mass transport in the lower atmosphere.

In conclusion, this reviewer's opinion is that *Environmental Chemodynamics* is an excellent resource for practicing engineers as well as the best textbook available for the teaching the fate and transport of chemicals in the environment. The editors of the Wiley-Interscience Series in Environmental Science and Technology are to be commended for including this text in their series on Environmental Science and Technology. ❐