Bioreaction Engineering, Volume 1— Fundamentals, Thermodynamics, Formal Kinetics, Idealized Reactor Types, and Operation Modes

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Most chemical engineers believe that biochemical engineering, especially bioreaction engineering, is mainly an experimental field in which advanced analytical techniques of chemical engineering (e.g., rigorous modeling) have not yet been applied. This view is supported by the fact that biochemical engineering courses in most universities lack advanced analytical treatment.

Engineers holding this view will be surprised to read *Bioreaction Engineering* (vol. 1). The first volume of the series (total of three volumes) covers bioreaction engineering at a level equivalent to most advanced chemical reactor engineering books.

Four types of bioreactors and their combinations are analyzed throughout the first volume, namely, stirred vessel batch, continuously stirred, tower, and loop reactors. Backmixing in the last two reactor types is described by dispersion models and generalized solutions are given in dimensionless form. The kinetics of growth and product formation are based on unstructured models. Specifically, growth is described by Monod type models and product formation by Luedeking-Piret type models. Equations of growth, product formation, and substrate utilization are derived for all reactor types (including combinations of more than one type) under conditions of nonlimited growth as well as under conditions of substrate or oxygen limitation. Substrate or product growth inhibition models are also considered. The material and energy balances section is based on the simple concepts of elemental balance, degree of reduction, carbon-mole of biological compounds, conversion yields, and maintenance coefficient. Finally, in the last section, the dynamic behavior of biological reactors is considered and issues of stability are presented.

The writing style of the book is easy to read and follow. It would be better, however, if the material were divided into a larger number of chap-

ters. In this first English edition, there are also several spelling errors, many of which appear to arise from the translation of the text from German to English. The reference list is extensive and relevant, showing the thoroughness of the author in examining both past and current literature.

In summary, this is a very well written and produced book that is useful to all biochemical engineers and especially to those who work on modeling of bioreactor systems that use microorganisms (enzyme reactors are not covered).

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Errata
Heterogeneous Modeling for the Alcoholic Fermentation Process
S. S. E. H. Elnashaie and G. Ibrahim
Vol. 19, No. 1, October 1988
Figure 7 in this paper is misplaced. The correct figure appears below.