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Principles of Bioprocesses Engineering

Bioprocesses engineering refers to the systematic study of the scientific and engineering principles utilized for large-scale purification of biological products: biopharmaceuticals, biochemicals, foods, nutraceuticals and diagnostic reagents. Bioprocesses engineering, both as an academic topic as well as an industrial practice has undergone

Principles of Bioprocesses Engineering

Bioprocesses engineering deals with the scientific and engineering principles involved in large-scale separation and purification of biological products. It is a key component of most chemical engineering/biotechnology/bioprocess engineering programmes.

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This book discusses the underlying principles of bioprocesses engineering written from the perspective of an undergraduate course. It covers membrane based bioprocesses in much more detail than some of the other books on bioprocesses engineering. Based largely on the lecture notes the author developed to teach the course, this book is ...

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Bioprocesses. Sedimentation, Centrifugation, and Filtration. Membrane Separations. Precipitation, Crystallization, and Extraction. Principles of Liquid Chromatography. Liquid Chromatography Scale-Up. Principles of Gradient Elution Chromatography. Principles of Bioseparations for Biopharmaceuticals and Recombinant Protein Products.

Bioprocesses Engineering: Principles, Practice, and...

Industrial Bioprocesses offers comprehensive coverage of bioprocesses including all unit operations. This new book offers a careful balance between the fundamentals of bioprocesses processing and the practical applications in industry today.

Principles of Bioprocesses Engineering

Bioprocesses engineering deals with the scientific and engineering principles involved in large-scale separation and purification of biological products. It is a key component of most chemical engineering/biotechnology/bioprocess engineering programmes. This book discusses the underlying principles of bioprocesses engineering written from the perspective of an undergraduate course. It covers membrane based bioprocesses in much more detail than some of the other books on bioprocesses engineering. Based largely on the lecture notes the author developed to teach the course, this book is especially suitable for use as an undergraduate level textbook, as most other textbooks are targeted at graduate students.

Multidisciplinary resource for graduate studies and the biotechnology industry Knowledge of the genetic basis of biological functioning continues to grow at an astronomical rate, as do the challenges and opportunities of applying this information to the production of therapeutic compounds, specialty biochemicals, functional food ingredients, environmentally friendly biocatalysts, and new bioproducts from renewable resources. While genetic engineering of living organisms transforms the science of genomics into treatments for cancer, diabetes, and heart disease, or products for industry and agriculture, the science and technology of bioprocesses are the keys to delivering these products in a purified form suitable for use by people. The methods, theory, and materials that reduce the science of bioprocesses to practice, whether in the laboratory or the plant, are the subjects of Bioprocesses Engineering. Examples address purification of biomolecules ranging from recombinant proteins to gene therapy products, with footnotes detailing economics of the products. Mechanistic analysis and engineering design methods are given for: * Isochratic and gradient chromatography * Sedimentation, centrifugation, and filtration * Membrane systems * Precipitation and crystallization Topics addressed within this framework are: stationary phase selection; separations development; modeling of ion exchange, size exclusion, reversed phase, hydrophobic interaction, and affinity chromatography; the impact of regulatory issues on chromatography process design; organization of separation strategies into logical sequences of purification steps; and bridges between molecular biology, combinatorial methods, and separations science. A result of teaching and developing the subject matter over ten years, Bioprocesses Engineering is an ideal text for graduate students, as well as a timely desk book for process engineers, process scientists, researchers, and research associates in the pharmaceutical, food, and life sciences industries.

This systematically organized and well-balanced book compresses within the covers of a single volume the theoretical principles and techniques involved in bio-separations, also called downstream processing. These techniques are derived from a range of subjects, for example, physical chemistry, analytical chemistry, bio-chemistry, biological science and chemical engineering. Organized in its 15 chapters, the text covers in the first few chapters topics related to chemical engineering unit operations such as filtration, centrifugation, adsorption, extraction and membrane separation as applied to bioprocesses. The use of chromatography as practiced at laboratory as well as industrial scale operation and related techniques such as gel filtration, affinity and pseudofinity chromatography, ion-exchange chromatography, electrophoresis and related methods have been discussed. The important applications of these techniques have also been highlighted.

Designed for undergraduates, graduate students, and industry practitioners, Bioprocesses Science and Engineering fills a critical need in the field of bioprocesses. Current, comprehensive, and concise, it covers bioprocesses unit operations in unprecedented depth. In each of the chapters, the authors use a consistent method of explaining unit operations, starting with a qualitative description noting the significance and general application of the unit operation. They then illustrate the scientific application of the operation, develop the required mathematical theory, and finally, describe the applications of the theory in engineering practice, with an emphasis on design and scaleup. Unique to this text is a chapter dedicated to bioprocesses process design and economics, in which a process simulator, SuperPro Designer® is used to analyze and evaluate the production of three important biological products. New to this second edition are updated discussions of moment analysis, computer simulation, membrane chromatography, and evaporation, among others, as well as revised problem sets. Unique features include basic information about bioproducts and engineering analysis and a chapter with bioprocesses laboratory exercises. Bioprocesses Science and Engineering is ideal for students and professionals working in or studying bioprocesses, and is the premier text in the field.

The bioprocessing engineering of today includes downstream process engineering such as waste water, material and gas treatment. Taking this tendency into account, bioprocessing engineers gathered in Japan as a special research group under the main theme of "Recovery and Recycle of Resources to Protect the Global Environment". The scope of this book is based on the conference, and deals not only with recent advances in bioprocessing engineering in a narrow sence, but also the environmental engineering which includes waste water treatment and bioremediation. The contributors of this book cover many disciplines such as chemical engineering, analytical chemistry, biochemistry, and microbiology. Bioprocessing Engineering will stimulate young engineers and scientists who will develop bioprocessing engineering further in the 21st century, and contribute to a world-wide attention to the global environment

Industrial Bioprocesses offers comprehensive coverage of bioprocesses including all unit operations. This new book offers a careful balance between the fundamentals of bioprocesses processing and the practical applications in industry today. It is laid out in a methodical way with preliminary chapters covering general approaches to bioprocesses for commercially important biomacromolecules, thermodynamics and mass transfer principles, and following chapters addressing unit operations such as filtration and chromatography. Lab experiments are included which emphasize obtaining scale up parameters as well as commonly used operating conditions are included.

The emergence and refinement of techniques in molecular biology has changed our perceptions of medicine, agriculture and environmental management. Scientific breakthroughs in gene expression, protein engineering and cell fusion are being translated by a strengthening biotechnology industry into revolutionary new products and services. Many a student has been enticed by the promise of biotechnology and the excitement of being near the cutting edge of scientific advancement. However, graduates trained in molecular biology and cell manipulation soon realise that these techniques are only part of the picture. Reaping the full benefits of biotechnology requires manufacturing capability involving the large-scale processing of biological material. Increasingly, biotechnologists are being employed by companies to work in co-operation with chemical engineers to achieve pragmatic commercial goals. For many years aspects of biochemistry and molecular genetics have been included in chemical engineering curricula, yet there has been little attempt until recently to teach aspects of engineering applicable to process design to biotechnologists. This textbook is the first to present the principles of bioprocess engineering in a way that is accessible to biological scientists. Other texts on bioprocess engineering currently available assume that the reader already has engineering training. On the other hand, chemical engineering textbooks do not consider examples from bioprocessing, and are written almost exclusively with the petroleum and chemical industries in mind. This publication explains process analysis from an engineering point of view, but refers exclusively to the treatment of biological systems. Over 170 problems and worked examples encompass a wide range of applications, including recombinant cells, plant and animal cell cultures, immobilised catalysts as well as traditional fermentation systems. * * First book to present the principles of bioprocess engineering in a way that is accessible to biological scientists * Explains process analysis from an engineering point of view, but uses worked examples relating to biological systems * Comprehensive, single-authored * 170 problems and worked examples encompass a wide range of applications, involving recombinant plant and animal cell cultures, immobilized catalysts, and traditional fermentation systems * 13 chapters, organized according to engineering sub-disciplines, are grouped in four sections - Introduction, Material and Energy Balances, Physical Processes, and Reactions and Reactors * Each chapter includes a set of problems and exercises for the student, key references, and a list of suggestions for further reading * Includes useful appendices, detailing conversion factors, physical and chemical property data, steam tables, mathematical rules, and a list of symbols used * Suitable for course adoption - follows closely curricula used on most bioprocessing and process biotechnology courses at senior undergraduate and graduate levels.

This book is a short introduction to the engineering principles of harnessing the vast potential of microorganisms, and animal and plant cells in making biochemical products. It was written for scientists who have no background in engineering, and for engineers with minimal background in biology. The overall subject dealt with is process, but the coverage goes beyond the process of biomanufacturing in the bioreactor, and extends to the factory of cell's biosynthetic machinery. Starting with an overview of biotechnology and organism, engineers are eased into biochemical reactions and life scientists are exposed to the technology of production using cells. Subsequent chapters allow engineers to be acquainted with biochemical pathways, while life scientist learn about stoichiometric and kinetic principles of reactions and cell growth. This leads to the coverage of reactors, oxygen transfer and scale up. Following three chapters on biomanufacturing of current and future importance, i.e. cell culture, stem cells and synthetic biology, the topic switches to product purification, first with a conceptual coverage of operations used in bioprocessing, and then a more detailed analysis to provide a conceptual understanding of chromatography, the modern workhorse of bioprocessing. Drawing on principles from engineering and life sciences, this book is for practitioners in biotechnology and bioengineering. The author has used the material within this book for a course for advanced students in both engineering and life sciences. To this end, problems are provided at the end of each chapter.

Separation Process Principles with Applications Using Process Simulator, 4th Edition is the most comprehensive and up-to-date treatment of the major separation operations in the chemical industry. The 4th edition focuses on using process simulators to design separation processes and prepares readers for professional practice. Completely rewritten to enhance clarity, this fourth edition provides engineers with a strong understanding of the field. With the help of an additional co-author, the text presents new information on bioprocesses throughout the chapters. A new chapter on mechanical separations covers settling, filtration and centrifugation including mechanical separations in biotechnology and cell lysis. Boxes help highlight fundamental equations. Numerous new examples and exercises are integrated throughout as well.

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