

# Two types of common heat transfer application in bioreactor operation



- In situ batch sterilization of liquid medium. In this process, the fermenter vessel containing medium is heated using steam and held at the sterilization temperature for a period of time; cooling water is then used to bring the temperature back to normal operating conditions
- Temperature control during reactor operation. Metabolic activity of cells generates heat. Some microorganisms need extreme temperature conditions (e.g. psychrophilic, thermophilic microorganisms)

Heat transfer configurations for bioreactors: jacketed vessel, external coil, internal helical coil, internal baffle-type coil, and external heat exchanger.

# Chapter Sterilization And Bioreactor Operation

**Ross Carlson, Kate Morrissey, Pauline  
M. Doran**



## Chapter Sterilization And Bioreactor Operation:

*An Introduction to Bioreactor Hydrodynamics and Gas-Liquid Mass Transfer* Enes Kadic, Theodore J. Heindel, 2014-03-14  
Reviews and compares the major types of bioreactors defines their pros and cons and identifies research needs and figures of merit that have yet to be addressed Describes common modes of operation in bioreactors Covers the three common bioreactor types including stirred tank bioreactors bubble column bioreactors and airlift bioreactors Details less common bioreactors types including fixed bed bioreactors and novel bioreactor designs Discusses advantages and disadvantages of each bioreactor and provides a procedure for optimal bioreactor selection based on current process needs Reviews the problems of bioreactor selection globally while considering all bioreactor options rather than concentrating on one specific bioreactor type

**Bioprocess Engineering** Shijie Liu, 2020-04-07 Bioprocess Engineering Kinetics Sustainability and Reactor Design Third Edition is a systematic and comprehensive textbook on bioprocess kinetics molecular transformation bioprocess systems sustainability and reaction engineering The book reviews the relevant fundamentals of chemical kinetics batch and continuous reactors biochemistry microbiology molecular biology reaction engineering and bioprocess systems engineering introducing key principles that enable bioprocess engineers to engage in the analysis optimization selection of cultivation methods design and consistent control over molecular biological and chemical transformations The quantitative treatment of bioprocesses is the central theme in this text however more advanced techniques and applications are also covered Includes biological molecules and chemical reaction basics cell biology and genetic engineering Describes kinetics and catalysis at molecular and cellular levels along with the principles of fermentation Covers advanced topics and treatise in interactive enzyme and molecular regulations also covering solid catalysis Explores bioprocess kinetics mass transfer effects reactor analysis control and design

*Bioprocess Engineering Principles* Ross Carlson, Kate Morrissey, Pauline M. Doran, 2024-09-27 Bioprocess Engineering Principles Third Edition provides a solid introduction to bioprocess engineering for students with a limited engineering background The book explains process analysis from an engineering perspective using worked examples and problems that relate to biological systems Application of engineering concepts is illustrated in areas of modern biotechnology such as recombinant protein production bioremediation biofuels drug development and tissue engineering as well as microbial fermentation With new and expanded material this remains the book of choice for students seeking to move into bioprocess engineering Includes more than 350 problems that demonstrate how fundamental principles are applied in areas such as biofuels bioplastics bioremediation tissue engineering site directed mutagenesis recombinant protein production and drug development as well as for traditional microbial fermentation Provides in depth treatment of fluid flow turbulence mixing and impeller design reflecting recent advances in our understanding of mixing processes and their importance in determining the performance of cell cultures Focuses on underlying scientific and engineering principles rather than on specific biotechnology applications providing a sound basis for teaching bioprocess engineering Presents new

or expanded coverage of such topics as enzyme kinetics downstream processing disposable reactors genetic engineering and the technology of fermentation     Upstream Industrial Biotechnology, 2 Volume Set Michael C. Flickinger, 2013-07-22

Biotechnology represents a major area of research focus and many universities are developing academic programs in the field This guide to biomanufacturing contains carefully selected articles from Wiley's Encyclopedia of Industrial Biotechnology Bioprocess Bioseparation and Cell Technology as well as new articles 80 in all and features the same breadth and quality of coverage and clarity of presentation found in the original For instructors advanced students and those involved in regulatory compliance this two volume desk reference offers an accessible and comprehensive resource     Biotechnology Engineering Vinayaka B. Shet, Sandesh Kanthakere, Nabisab Mujawar Mubarak, Rama Rao Karri, Mohammad Hadi Dehghani, 2025-08-26

Biotechnology Engineering A Practical Approach on Bioprocess Development from Lab to Industrial Scale offers a comprehensive guide on biotechnology engineering focusing on transforming research and development into commercially viable industrial processes The book addresses the needs of the market by providing structured chapters practical methods and real world case studies Readers will gain valuable insights into bioprocessing basics scalable solutions optimization techniques and collaboration opportunities The text also covers essential regulatory compliance information bridging the gap between theoretical knowledge and practical applications The book is a vital resource for academics scientists engineers and professionals in bioprocess development It includes detailed discussions calculations and case studies modern bioreactors and software tools used in the industry Serving as a desktop reference it effectively combines theory with real world applications to support the development of bioprocesses on all scales Helps readers understand the practical approach involved in bioprocess developments Includes calculations and case studies that are essential for independently scaling up bioprocesses from Erlenmeyer flask studies to bioreactors Provides insights into auditing requirements for the bioprocess industry     **Solid-State Fermentation Bioreactors** David A. Mitchell, Nadia Krieger, Marin Berovic, 2006-08-02

This concise professional reference provides a fundamental framework for the design and operation of solid state fermentation bioreactors enabling researchers currently working at laboratory scale to scale up their processes The authors survey bioreactor types in common use and describe in depth how to plan a project and model heat transfer phenomena The book includes case studies and a review of practical issues involved in bioreactor performance

**Biochemical Engineering Fundamentals** James Edwin Bailey, David F. Ollis, 1986 Biochemical Engineering Fundamentals 2 e combines contemporary engineering science with relevant biological concepts in a comprehensive introduction to biochemical engineering The biological background provided enables students to comprehend the major problems in biochemical engineering and formulate effective solutions     **Chemical Engineering Progress**, 1992

**Comprehensive Biotechnology: The principles of biotechnology** Murray Moo-Young, 1985 V 1 The principles of biotechnology Scientific fundamentals v 2 The principles of biotechnology Engineering considerations v 3 The practice of

biotechnology Current commodity products v 4 The practice of biotechnology Speciality products and service activities

Biotechnology: Fundamentals of biochemical engineering Hans-Jürgen Rehm, Gerald Reed, 1981      **Bioreactors in**

**Biotechnology** Alan H. Scragg, 1991 Discusses many aspects of bioreactor use and design in biotechnology There is coverage of conventional and airlift bioreactor design instrumentation control and simulation of bioreactor runs bioreactors for plant and animal culture and a descriptions of experiments      **Membrane BioReactors WEF Manual of Practice**

Water Environment Federation, 2011-09-13 The Definitive Guide to Membrane Bioreactors for Wastewater Treatment This Water Environment Federation resource presents best practices for the use of membrane bioreactors for wastewater treatment The book begins with an overview of membrane and biological process fundamentals followed by coverage of membrane bioreactor system integrated process design The physical design of features unique to membrane bioreactors and the procurement of membrane equipment are discussed This authoritative manual also covers the operation of properly designed membrane bioreactor facilities Membrane Bioreactors covers Membrane bioreactor capabilities Membrane fundamentals Biological process fundamentals Membrane bioreactor process design Membrane bioreactor facility design Membrane bioreactor membrane equipment procurement Membrane bioreactor operation      Biotechnology Hans-Jürgen

Rehm, Gerald Reed, 1981      **Cell Culture Labfax** Michael Butler, M. Butler, M. Dawson, 1992 Interest has steadily increased in the mammalian cell cultures for a wide variety of applications Cell Culture Labfax is a convenient user friendly reference tool for all researchers and students in biology biotechnology and biomedicine who currently use or will need to use animal cell culture This new volume in the LABFAX Series comprehensively covers reference data relevant to cell culture thus eliminating the need to search through a variety of journals manuals and catalogs Spiral bound with a hard case for durability this book can be used as a prime reference tool at the laboratory bench An index helps locate facts quickly This data book complements protocol oriented laboratory guides with up to date data and references on cell lines culture techniques cell characterization separation cloning media preservation growth factors products equipment safety terminology suppliers and associations      **Current Engineering Practice** , 1986      Solid Substrate Cultivation H.W.

Doelle, D.A. Mitchell, C.E. Rolz, 1992-11-30 The book deepens the understanding of the solid substrate culture technique in order to widen the engineering base needed to encourage its practical use Theories of practical relevance are explained in detail      *Hepatitis B Surface Antigen Expression in Plant Cell Culture* Mark Lionel Smith, 2002      **Studies in Viable Cell Immobilization** Colin Webb, George A. Dervakos, 1996-02-09 This book provides a coherent analysis of viable cell immobilization an emerging technology spanning a number of disciplines Using detailed examples drawn from a variety of commercially relevant large scale fermentation reactions the book covers both the practical and theoretical aspects of this technology The authors discuss progress in the design of immobilized cell reactors emphasizing mixing fluidization characteristics and carrier stability Mathematical models and results from computer simulations describe the dynamic

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