



# *Scaleup and Design of Industrial Mixing Processes*

GARY B. TATTERSON

# Scaleup And Design Of Industrial Mixing Processes

**Michael Levin**



## **Scaleup And Design Of Industrial Mixing Processes:**

*Scaleup and Design of Industrial Mixing Processes* Gary B. Tatterson, 1994 *Non-Newtonian Flow in the Process Industries* R. P. Chhabra, John Francis Richardson, 1999 Non Newtonian fluid behaviour Rheometry for non Newtonian fluids Flow in pipes and conduits of non circular cross sections Flow of multi phase mixtures in pipes Particulate systems Heat transfer characteristics of non Newtonian fluids in pipes Momentum heat and mass transfer in boundary layers Liquid mixing *Pharmaceutical Process Scale-Up* Michael Levin, 2001-12-12 Focusing on scientific and practical aspects of process scale up this resource details the theory and practice of transferring pharmaceutical processes from laboratory scale to the pilot plant and production scale It covers parenteral and nonparenteral liquids and semi solids products derived from biotechnology dry blending and powder handling *Handbook of Industrial Mixing* Edward L. Paul, Victor A. Atiemo-Obeng, Suzanne M. Kresta, 2004-02-03 *Handbook of Industrial Mixing* will explain the difference and uses of a variety of mixers including gear mixers top entry mixers side entry mixers bottom entry mixers on line mixers and submerged mixers The Handbook discusses the trade offs among various mixers concentrating on which might be considered for a particular process *Handbook of Industrial Mixing* explains industrial mixers in a clear concise manner and also Contains a CD ROM with video clips showing different type of mixers in action and a overview of their uses Gives practical insights by the top professional in the field Details applications in key industries Provides the professional with information he did receive in school *Scale-Up Processes* Jamal Chaouki, Rahmat Sotudeh-Gharebagh, 2021-09-20 Common scale up methods are conventional where the blind piloting is essential This imposes huge investment and leads to failures mostly in solid processing However the limitations of resources current shortcomings short time to market demand are forced companies to minimize piloting With these situations in mind current digitalization outlook and computational facilities we proposed and developed a novel iterative scale up method with case studies which highly expedites the process innovation through the following key sequences *Process Technology* André B. de Haan, 2015-04-24 *Process Technology* provides a general overview about chemical and biochemical process technology It focuses on the structure and development of production processes main technological operations and the important aspects of process economics The theoretical foundations in each chapter are supplemented by case studies and examples in a clear and instructive manner to illustrate the practical aspects The author highlights operating principles reasons for application and available industrial equipment of technological operations Aim is to facilitate those without a process technology background in multi disciplinary cooperation with bio chemical engineers by providing an overview of this exciting field The textbook is organized into seven distinct parts Structure of the chemical industry and bio chemical processes Bio Chemical reaction engineering Molecular separations distillation extraction absorption adsorption Mechanical separations filtration sedimentation membranes Particle and final product manufacturing Development scale up design and safety of processes Major industrial process descriptions

**Industrial Process Scale-up** Jan Harmsen, 2019-05-16 Industrial Process Scale up A Practical Innovation Guide from Idea to Commercial Implementation Second Edition helps industrial process innovators in research development and commercial start ups assess the risks of commercial scale implementation also providing them with practical guidelines and methods to reduce the risks to acceptable levels In addition the book can be used in cooperation with industrial R D people and academic researchers to shape open innovation programs and in education as a reference book This updated edition has the latest literature and has been expanded with a scale up of pharmaceutical processes and their history in both academia and the process industries Offers easily accessible step by step and concise guidelines for industrial process scale up Explains each stage of the innovation funnel from research development demonstration and commercial implementation for any process type and branch Based on industrial experiences and practices that reduce the risks of commercial scale implementation of new processes to acceptable levels and reduce cost and time of process innovation

**Development of Biopharmaceutical Drug-Device Products** Feroz Jameel, John W. Skoug, Robert R. Nesbitt, 2020-03-13 The biotechnology biopharmaceutical sector has tremendously grown which led to the invention of engineered antibodies such as Antibody Drug Conjugates ADCs Bispecific T cell engager BITES Dual Variable Domain DVD antibodies and fusion proteins that are currently being used as therapeutic agents for immunology oncology and other disease conditions Regulatory agencies have raised the bar for the development and manufacture of antibody based products expecting to see the use of Quality by Design QbD elements demonstrating an in depth understanding of product and process based on sound science Drug delivery systems have become an increasingly important part of the therapy and most biopharmaceuticals for self administration are being marketed as combination products A survey of the market indicates that there is a strong need for a new book that will provide one stop shopping for the latest information and knowledge of the scientific and engineering advances made over the last few years in the area of biopharmaceutical product development The new book entitled Development of Biopharmaceutical Drug Device Products is a reference text for scientists and engineers in the biopharmaceutical industry academia or regulatory agencies With insightful chapters from experts in the field this new book reviews first principles covers recent technological advancements and provides case studies and regulatory strategies relating to the development and manufacture of antibody based products It covers topics such as the importance of early preformulation studies during drug discovery to influence molecular selection for development formulation strategies for new modalities and the analytical techniques used to characterize them It also addresses important considerations for later stage development such as the development of robust formulations and processes including process engineering and modeling of manufacturing unit operations the design of analytical comparability studies and characterization of primary containers pre filled syringes and vials Finally the latter half of the book reviews key considerations to ensure the development and approval of a patient centered delivery system design This involves the evolving regulatory framework with perspectives from both the US and EU

industry experts the role of international standards design control risk management human factors and its importance in the product development and regulatory approval process as well as review of the risk based approach to bridging between devices used in clinical trials and the to be marketed device Finally case studies are provided throughout The typical readership would have biology and or engineering degrees and would include researchers scientific leaders industry specialists and technology developers working in the biopharmaceutical field

Process Validation in Manufacturing of Biopharmaceuticals, Third Edition Anurag S. Rathore, Gail Sofer, 2012-05-09 Process Validation in Manufacturing of Biopharmaceuticals Third Edition delves into the key aspects and current practices of process validation It includes discussion on the final version of the FDA 2011 Guidance for Industry on Process Validation Principles and Practices commonly referred to as the Process Validation Guidance or PVG issued in final form on January 24 2011 The book also provides guidelines and current practices as well as industrial case studies illustrating the different approaches that can be taken for successful validation of biopharmaceutical processes Case studies include Process validation for membrane chromatography Leveraging multivariate analysis tools to qualify scale down models A matrix approach for process validation of a multivalent bacterial vaccine Purification validation for a therapeutic monoclonal antibody expressed and secreted by Chinese Hamster Ovary CHO cells Viral clearance validation studies for a product produced in a human cell line A much needed resource this book presents process characterization techniques for scaling down unit operations in biopharmaceutical manufacturing including chromatography chemical modification reactions ultrafiltration and microfiltration It also provides practical methods to test raw materials and in process samples Stressing the importance of taking a risk based approach towards computerized system compliance this book will help you and your team ascertain process validation is carried out and exceeds expectations

**Chemical Engineering and Chemical Process Technology - Volume III** Ryszard Pohorecki, John Bridgwater, M. Molzahn, Rafiqul Gani and Crispulo Gallegos, 2010-11-30 Chemical Engineering and Chemical Process Technology is a theme component of Encyclopedia of Chemical Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty Encyclopedias Chemical engineering is a branch of engineering dealing with processes in which materials undergo changes in their physical or chemical state These changes may concern size energy content composition and or other application properties Chemical engineering deals with many processes belonging to chemical industry or related industries petrochemical metallurgical food pharmaceutical fine chemicals coatings and colors renewable raw materials biotechnological etc and finds application in manufacturing of such products as acids alkalis salts fuels fertilizers crop protection agents ceramics glass paper colors dyestuffs plastics cosmetics vitamins and many others It also plays significant role in environmental protection biotechnology nanotechnology energy production and sustainable economical development The Theme on Chemical Engineering and Chemical Process Technology deals in five volumes and covers several topics such

as Fundamentals of Chemical Engineering Unit Operations Fluids Unit Operations Solids Chemical Reaction Engineering Process Development Modeling Optimization and Control Process Management The Future of Chemical Engineering Chemical Engineering Education Main Products which are then expanded into multiple subtopics each as a chapter These five volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts managers and decision makers and NGOs *Industrial Mixing Fundamentals with Applications* Gary B. Tatterson, 1995 Contains 21 papers addressing the industrial applications of chemical petrochemical and biochemical mixing and multiphase processing Some topics include hydrodynamic analysis of a two phase tubular reactor a new scale up rule and evaluation of traditional rules from a viewpoint of energy spectrum

**Advances in Industrial Mixing** Suzanne M. Kresta, Arthur W. Etchells, III, David S. Dickey, Victor A. Atiemo-Obeng, North American Mixing Forum, 2016-03-11 *Advances in Industrial Mixing* is a companion volume and update to the Handbook of Industrial Mixing The second volume fills in gaps for a number of industries that were not covered in the first edition Significant changes in five of the fundamental areas are covered in entirely updated or new chapters The original text is provided as a searchable pdf file on the accompanying USB This book explains industrial mixers and mixing problems clearly and concisely Gives practical insights by the top professionals in the field combining industrial design standards with fundamental insight Details applications in 14 key industries Six of these are new since the first edition Provides the professional with information he she did not receive in school Five completely rewritten chapters on mixing fundamentals where significant advances have happened since the first edition and seven concise update chapters which summarize critical technical information **Chemical Engineering Design** Ray Sinnott, Gavin Towler, 2019-05-26 *Chemical Engineering Design* SI Edition is one of the best known and most widely used textbooks available for students of chemical engineering The enduring hallmarks of this classic book are its scope and practical emphasis which make it particularly popular with instructors and students who appreciate its relevance and clarity This new edition provides coverage of the latest aspects of process design operations safety loss prevention equipment selection and much more including updates on plant and equipment costs regulations and technical standards Includes new content covering food pharmaceutical and biological processes and the unit operations commonly used Features expanded coverage on the design of reactors Provides updates on plant and equipment costs regulations and technical standards Integrates coverage with Honeywell's UniSim software for process design and simulation Includes online access to Engineering's Cleopatra cost estimating software **Fourth RILEM International Conference on Concrete and Digital Fabrication** Dirk Lowke, Niklas Freund, David Böhler, Friedrich Herding, 2024-08-31 This book gathers peer reviewed contributions presented at the 4th RILEM International Conference on Concrete and Digital Fabrication Digital Concrete held in Munich Germany on September 4-6 2024 Focusing on additive and automated manufacturing technologies for the fabrication of cementitious construction



materials such as 3D concrete printing powder bed printing and shotcrete 3D printing the papers highlight the latest findings in this fast growing field addressing topics like mixture design admixtures rheology and fresh state behavior alternative materials microstructure cold joints interfaces mechanical performance reinforcement structural engineering durability and sustainability automation and industrialization

**Chemical Process Equipment** James R. Couper, W Roy Penney, James R. Fair, Stanley M. Walas, 2005-01-20 Comprehensive and practical guide to the selection and design of a wide range of chemical process equipment Emphasis is placed on real world process design and performance of equipment Provides examples of successful applications with numerous drawings graphs and tables to show the functioning and performance of the equipment Equipment rating forms and manufacturers questionnaires are collected to illustrate the data essential to process design Includes a chapter on equipment cost and addresses economic concerns Practical guide to the selection and design of a wide range of chemical process equipment Examples of successful real world applications are provided Fully revised and updated with valuable shortcut methods rules of thumb and equipment rating forms and manufacturers questionnaires have been collected to demonstrate the design process Many line drawings graphs and tables illustrate performance data Chapter 19 has been expanded to cover new information on membrane separation Approximately 100 worked examples are included End of chapter references also are provided

**Non-Newtonian Flow and Applied Rheology** R. P. Chhabra, Swati A. Patel, 2025-03-01 Non Newtonian Flow and Applied Rheology Engineering Applications Third Edition bridges the gap between the theoretical work of the rheologist and the practical needs of those who have to design and operate the systems in which these materials are handled or processed This new edition addresses the rapid advances that are occurring in all aspects of the topics covered in this book such as new measurement techniques or new constitutive equations and more reliable information based on numerical simulations New solved examples are added in each chapter along with a list of problems at the end of the book This is an established and important reference for senior level mechanical engineers chemical and process engineers as well as any engineer or scientist who needs to study or work with these fluids including pharmaceutical engineers mineral processing engineers medical researchers water and civil engineers Extensively revised and expanded with material on new measurement techniques new constitutive equations and information based on numerical simulations Covers both basic rheology and fluid mechanics in non Newtonian fluids making it a truly self contained reference for anyone studying or working with the processing and handling of fluids Provides solved examples to illustrate and or aid understanding of the concepts Written by a world s leading expert in an accessible style

**Physicochemical Treatment Processes** Lawrence K. Wang, Yung-Tse Hung, Nazih K. Shammash, 2007-11-13 The past 30 years have seen the emergence of a growing desire worldwide to take positive actions to restore and protect the environment from the degrading effects of all forms of pollution air noise solid waste and water Because pollution is a direct or indirect consequence of waste the seemingly idealistic demand for zero discharge can be construed as an unrealistic demand for zero waste However as

long as waste exists we can only attempt to abate the subsequent pollution by converting it to a less noxious form Three major questions usually arise when a particular type of pollution has been identified 1 How serious is the pollution 2 Is the technology to abate it available and 3 Do the costs of abatement justify the degree of abatement achieved The principal intention of the Handbook of Environmental Engineering series is to help readers formulate answers to the last two questions The traditional approach of applying tried and true solutions to specific pollution problems has been a major contributing factor to the success of environmental engineering and has accounted in large measure for the establishment of a methodology of pollution control However realization of the ever increasing complexity and interrelated nature of current environmental problems makes it imperative that intelligent planning of pollution abatement systems be undertaken

Industrial Pharmacy Dr Muralidhar, Dr Narmada, 2024-02-03 Industrial Pharmacy From Pilot Plant to Market is a comprehensive guide that provides practical approaches to pharmaceutical product development With 37 exhaustive chapters it covers important topics such as pilot plant scale up techniques technology transfer protocols regulatory requirements quality management systems and Indian regulatory requirements The book helps readers understand the significance of personnel requirements space requirements raw materials and relevant documentation for solids liquid orals and semi solids It also provides insights into WHO guidelines for technology transfer clinical research protocols quality management concepts ISO quality systems standards and Indian regulatory requirements This book is an essential resource for pharmaceutical professionals and students who seek to advance healthcare through innovative pharmaceutical product development

Integration and Optimization of Unit Operations Barry A. Perlmutter, 2022-06-24 The chemical industry changes and becomes more and more integrated worldwide This creates a need for information exchange that includes not only the principles of operation but also the transfer of practical knowledge Integration and Optimization of Unit Operations provides up to date and practical information on chemical unit operations from the R D stage to scale up and demonstration to commercialization and optimization A global collection of industry experts systematically discuss all innovation stages complex processes with different unit operations including solids processing and recycle flows and the importance of integrated process validation The book addresses the needs of engineers who want to increase their skill levels in various disciplines so that they are able to develop commercialize and optimize processes After reading this book you will be able to acquire new skills and knowledge to collaborate across disciplines and develop creative solutions Shows the impacts of upstream process decisions on downstream operations Provides troubleshooting strategies at each process stage Asks challenging questions to develop creative solutions to process problems

AIChE Symposium Series American Institute of Chemical Engineers, 1972



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## **Table of Contents Scaleup And Design Of Industrial Mixing Processes**

1. Understanding the eBook Scaleup And Design Of Industrial Mixing Processes
  - The Rise of Digital Reading Scaleup And Design Of Industrial Mixing Processes
  - Advantages of eBooks Over Traditional Books
2. Identifying Scaleup And Design Of Industrial Mixing Processes
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Scaleup And Design Of Industrial Mixing Processes
  - User-Friendly Interface
4. Exploring eBook Recommendations from Scaleup And Design Of Industrial Mixing Processes

- Personalized Recommendations
  - Scaleup And Design Of Industrial Mixing Processes User Reviews and Ratings
  - Scaleup And Design Of Industrial Mixing Processes and Bestseller Lists
5. Accessing Scaleup And Design Of Industrial Mixing Processes Free and Paid eBooks
    - Scaleup And Design Of Industrial Mixing Processes Public Domain eBooks
    - Scaleup And Design Of Industrial Mixing Processes eBook Subscription Services
    - Scaleup And Design Of Industrial Mixing Processes Budget-Friendly Options
  6. Navigating Scaleup And Design Of Industrial Mixing Processes eBook Formats
    - ePub, PDF, MOBI, and More
    - Scaleup And Design Of Industrial Mixing Processes Compatibility with Devices
    - Scaleup And Design Of Industrial Mixing Processes Enhanced eBook Features
  7. Enhancing Your Reading Experience
    - Adjustable Fonts and Text Sizes of Scaleup And Design Of Industrial Mixing Processes
    - Highlighting and Note-Taking Scaleup And Design Of Industrial Mixing Processes
    - Interactive Elements Scaleup And Design Of Industrial Mixing Processes
  8. Staying Engaged with Scaleup And Design Of Industrial Mixing Processes
    - Joining Online Reading Communities
    - Participating in Virtual Book Clubs
    - Following Authors and Publishers Scaleup And Design Of Industrial Mixing Processes
  9. Balancing eBooks and Physical Books Scaleup And Design Of Industrial Mixing Processes
    - Benefits of a Digital Library
    - Creating a Diverse Reading Collection Scaleup And Design Of Industrial Mixing Processes
  10. Overcoming Reading Challenges
    - Dealing with Digital Eye Strain
    - Minimizing Distractions
    - Managing Screen Time
  11. Cultivating a Reading Routine Scaleup And Design Of Industrial Mixing Processes
    - Setting Reading Goals Scaleup And Design Of Industrial Mixing Processes
    - Carving Out Dedicated Reading Time
  12. Sourcing Reliable Information of Scaleup And Design Of Industrial Mixing Processes

- Fact-Checking eBook Content of Scaleup And Design Of Industrial Mixing Processes
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
- Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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