



# *Scaleup and Design of Industrial Mixing Processes*

GARY B. TATTERSON

# Scaleup And Design Of Industrial Mixing Processes

**Anurag S. Rathore, Gail Sofer**



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

**Scaleup and Design of Industrial Mixing Processes** Gary B. Tatterson, 1994      **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

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      *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

## **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

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 *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 **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      *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 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.      **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 *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 **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 **AIChE Symposium Series** American Institute of Chemical Engineers,1972 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

**Pharmaceutical Process Engineering and Scale-up Principles** Anil B. Jindal, 2023-07-03 The book offers a comprehensive overview of the unit operations involved in the manufacturing process of solid and liquid dosage forms along with the scale up of each operation This book is a valuable resource for professionals working in the pharmaceutical industry and researchers seeking to develop a comprehensive understanding of the various aspects of the manufacturing process The book is divided into four sections covering a range of topics Section I provide readers with a comprehensive understanding of the basic principles behind the manufacturing process of solid and liquid dosage forms Section II covers the different unit operations involved in the production of solid dosage forms including mixing granulation drying compression coating and size reduction This section includes case studies to provide readers with practical insights into the scale up principles involved in the manufacturing process Section III focuses on the manufacturing and scale up of liquid formulations covering topics such as mixing filtration and scale up of liquid mixing process This section offers a comprehensive understanding of the various aspects of the manufacturing process including the challenges and opportunities associated with the scale up of liquid formulations Finally Section IV includes two chapters that describe the manufacturing and scale up of advanced drug delivery systems including the manufacturing and scale up of nanoparticles and biotechnology derived products This section provides readers with insights into the development of innovative drug delivery systems and the challenges involved in their scale up Overall the book is an essential guide for professionals and researchers seeking a deeper understanding of the manufacturing process The case studies and practical examples offer valuable insights into the challenges and opportunities involved in the scale up process making it an indispensable resource for those involved in the pharmaceutical industry Only book that is dedicated to pharmaceutical process engineering and scale up Contain numerous case studies for easy reference Covers solid liquid and advanced dosage forms

**Batch and Semi-batch Reactors** Jonathan Worstell, 2015-02-26 Batch and Semi batch Reactors Practical Guides in Chemical Engineering is a cluster of short texts that provide a focused introductory view on a single subject The full library presents a basic understanding of the main topics in the chemical process industries allowing engineering professionals to quickly access information Each pocket publication can be easily carried or accessed electronically giving users a highly practical and applied presentation of the first principles engineers need know on a moment s notice The focused facts provided in each guide help users converse with experts in the field attempt their own initial troubleshooting check calculations and solve rudimentary problems Practical short concise information on the basics in a variety of topics related to chemical engineering Supported by industry examples to help readers solve real world problems Single subject volumes provide key facts for professionals Pocket publication format can be easily carried or accessed electronically



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