

Tingyue Gu

Mathematical Modeling and Scale-Up of Liquid Chromatography

With Application Examples

Second Edition



 Springer

Mathematical Modeling And Scale Up Of Liquid Chromatography With Application Examples

Jack Cazes



Mathematical Modeling And Scale Up Of Liquid Chromatography With Application Examples:

Mathematical Modeling and Scale-Up of Liquid Chromatography Tingyue Gu, 2015 Tingyue Gu's second edition provides a comprehensive set of nonlinear multicomponent liquid chromatography LC models for various forms of LC such as adsorption size exclusion ion exchange reversed phase affinity isocratic gradient elution and axial radial flow LC. Much has advanced since the first edition of this book and the author's software described here is now used for teaching and research in 32 different countries. This book comes together with a complete software package with graphical user interface for personal computers offered free for academic applications. Additionally, this book provides detailed methods for parameter estimation of mass transfer coefficients bed voidage particle porosity and isotherms. The author gives examples of how to use the software for predictions and scale up. In contrast to the first edition, authors do not need to deal with complicated math. Instead, they focus on how to obtain a few parameters for simulation and how to compare simulation results with experimental data. After reading the detailed descriptions in the book, a reader is able to use the simulation software to investigate chromatographic behavior without doing actual experiments. This book is aimed at readers who are interested in learning about LC behaviors and at those who want to scale up LC for preparative and large scale applications. Both academic personnel and industrial practitioners can benefit from the use of the book. This new edition includes New models and software for pellicular cored beads in liquid chromatography. Introduction of user friendly software with graphical user interface. Detailed descriptions on how to use the software. Step by step instructions on parameter estimation for the models. New mass transfer correlations for parameter estimation. Experimental methods for parameter estimation. Several actual examples using the model for product development and scale up. Updated literature review.

Mathematical Modeling and Scale-up of Liquid Chromatography Tingyue Gu, 2012-12-06 Liquid chromatography has proved to be one of the most important tools for separations. Rapid development in biotechnology has increased the demand for chromatography in analytical preparative and large scale applications. The understanding of the dynamics of chromatography is imperative for the scale up. This book is a systematic treatment of the general rate models for various forms of liquid chromatography including adsorption size exclusion affinity reversed phase hydrophobic interaction and radial flow chromatography. Thermodynamic and mass transfer effects in liquid chromatography are discussed. Applications of computer programs for the rate models are described and the procedures for the scale up of preparative and large scale liquid chromatography using the general rate models are given.

Mathematical Modeling and Scale-Up of Liquid Chromatography Tingyue Gu, 2015-04-06 Tingyue Gu's second edition provides a comprehensive set of nonlinear multicomponent liquid chromatography LC models for various forms of LC such as adsorption size exclusion ion exchange reversed phase affinity isocratic gradient elution and axial radial flow LC. Much has advanced since the first edition of this book and the author's software described here is now used for teaching and research in 32 different countries. This book comes together with a

complete software package with graphical user interface for personal computers offered free for academic applications. Additionally, this book provides detailed methods for parameter estimation of mass transfer coefficients, bed voidage, particle porosity, and isotherms. The author gives examples of how to use the software for predictions and scale up. In contrast to the first edition, authors do not need to deal with complicated math. Instead, they focus on how to obtain a few parameters for simulation and how to compare simulation results with experimental data. After reading the detailed descriptions in the book, a reader is able to use the simulation software to investigate chromatographic behavior without doing actual experiments. This book is aimed at readers who are interested in learning about LC behaviors and at those who want to scale up LC for preparative and large scale applications. Both academic personnel and industrial practitioners can benefit from the use of the book. This new edition includes new models and software for pellicular cored beads in liquid chromatography, introduction of user friendly software with graphical user interface, detailed descriptions on how to use the software, step by step instructions on parameter estimation for the models, new mass transfer correlations for parameter estimation, experimental methods for parameter estimation, several actual examples using the model for product development and scale up, updated literature review.

Ion-Exchange Chromatography and Related Techniques Pavel Nesterenko, Colin Poole, Yan Sun, 2023-11-15. *Ion Exchange Chromatography and Related Techniques* defines the current state of the art in ion exchange chromatography and related techniques and their implementation in laboratory and industrial practice. This book provides a compact source of information to facilitate the transfer of knowledge and experience acquired by separation science specialists to colleagues from diverse backgrounds who need to acquire fundamental and practical information to facilitate progress in research and management functions reliant on information acquired by separation. Individual chapters written by recognized experts lending credibility to the work will allow this book to serve as a high value reference source of current information for analytical and biopharmaceutical chemists. Includes individual chapters written by recognized authoritative and visionary experts in the field to provide an overview and focused treatment of a single topic. Presents comprehensive coverage of ion exchange techniques from theory to methods to selected applications for ions and biopolymers. Provides tables and diagrams with commonly used data to facilitate practical work, comparison of results and decision making.

Lattice Boltzmann Modeling for Chemical Engineering, 2020-06-19. *Lattice Boltzmann Modeling for Chemical Engineering* Volume 56 in the *Advances in Chemical Engineering* series highlights new advances in the field with this new volume presenting interesting chapters on simulations of homogeneous and heterogeneous chemical reactions, LBM for 3D chemical reactors, LBM simulations of PEM fuel cells, LBM for separation processes, LBM for two phase flow bio reactors and more. Provides the authority and expertise of leading contributors from an international board of authors. Presents the latest release in the *Advances in Chemical Engineering* series. Includes the latest information on *Lattice Boltzmann Modeling for Chemical Engineering*.

Biochromatography M. A. Vijayalakshmi, 2002-02-14. The field of bioseparation and

biochromatography in particular is advancing very rapidly as our knowledge of the properties of molecules and atomic forces increases This volume covers the basic principles of biochromatography in detail It assesses different techniques and includes a large number of applications providing the reader with a mult **Comprehensive Biotechnology** ,2019-07-17

Comprehensive Biotechnology Third Edition Six Volume Set unifies in a single source a huge amount of information in this growing field The book covers scientific fundamentals along with engineering considerations and applications in industry agriculture medicine the environment and socio economics including the related government regulatory overviews This new edition builds on the solid basis provided by previous editions incorporating all recent advances in the field since the second edition was published in 2011 Offers researchers a one stop shop for information on the subject of biotechnology Provides in depth treatment of relevant topics from recognized authorities including the contributions of a Nobel laureate Presents the perspective of researchers in different fields such as biochemistry agriculture engineering biomedicine and environmental science **Bioprocess Technology** Mr. Rohit Manglik,2024-01-12 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources Specializing in competitive exams and academic support EduGorilla provides comprehensive and well structured content tailored to meet the needs of students across various streams and levels Process Modeling, Simulation, and Environmental Applications in Chemical Engineering Bharat A. Bhanvase,Rajendra P. Ugwekar,2016-10-14 In this valuable volume new and original research on various topics on chemical engineering and technology is presented on modeling and simulation material synthesis wastewater treatment analytical techniques and microreactors The research presented here can be applied to technology in food paper and pulp polymers petrochemicals surface coatings oil technology aspects among other uses The book is divided into five sections modeling and simulation environmental applications materials and applications processes and applications analytical methods Topics include modeling and simulation of chemical processes process integration and intensification separation processes advances in unit operations and processes chemical reaction engineering fuel and energy advanced materials CFD and transport processes wastewater treatment The valuable research presented here will be of interest to researchers scientists industry practitioners as well as upper level students **Downstream Industrial Biotechnology** Michael C. Flickinger,2013-07-17 DOWNSTREAM INDUSTRIAL BIOTECHNOLOGY An affordable easily accessible desk reference on biomanufacturing focused on downstream recovery and purification Advances in the fundamental knowledge surrounding biotechnology novel materials and advanced engineering approaches continue to be translated into bioprocesses that bring new products to market at a significantly faster pace than most other industries Industrial scale biotechnology and new manufacturing methods are revolutionizing medicine environmental monitoring and remediation consumer products food production agriculture and forestry and continue to be a major area of research The downstream stage in industrial biotechnology refers to recovery isolation and purification of the microbial products from cell

debris processing medium and contaminating biomolecules from the upstream process into a finished product such as biopharmaceuticals and vaccines Downstream process design has the greatest impact on overall biomanufacturing cost because not only does the biochemistry of different products e g peptides proteins hormones antibiotics and complex antigens dictate different methods for the isolation and purification of these products but contaminating byproducts can also reduce overall process yield and may have serious consequences on clinical safety and efficacy Therefore downstream separation scientists and engineers are continually seeking to eliminate or combine unit operations to minimize the number of process steps in order to maximize product recovery at a specified concentration and purity Based on Wiley s Encyclopedia of Industrial Biotechnology Bioprocess Bioseparation and Cell Technology this volume features fifty articles that provide information on down stream recovery of cells and protein capture process development and facility design equipment PAT in downstream processes downstream cGMP operations and regulatory compliance It covers Cell wall disruption and lysis Cell recovery by centrifugation and filtration Large scale protein chromatography Scale down of biopharmaceutical purification operations Lipopolysaccharide removal Porous media in biotechnology Equipment used in industrial protein purification Affinity chromatography Antibody purification monoclonal and polyclonal Protein aggregation precipitation and crystallization Freeze drying of biopharmaceuticals Biopharmaceutical facility design and validation Pharmaceutical bioburden testing Regulatory requirements Ideal for graduate and advanced undergraduate courses on biomanufacturing biochemical engineering biopharmaceutical facility design biochemistry industrial microbiology gene expression technology and cell culture technology Downstream Industrial Biotechnology is also a highly recommended resource for industry professionals and libraries

European Symposium on Computer Aided Process Engineering - 10 Sauro Pierucci, 2000-05-10

This book includes papers presented at ESCAPE 10 the 10th European Symposium on Computer Aided Process Engineering held in Florence Italy 7 10th May 2000 The scientific program reflected two complementary strategic objectives of the Computer Aided Process Engineering CAPE Working Party one checked the status of historically consolidated topics by means of their industrial application and their emerging issues while the other was addressed to opening new windows to the CAPE audience by inviting adjacent Working Parties to co operate in the creation of the technical program The former CAPE strategic objective was covered by the topics Numerical Methods Process Design and Synthesis Dynamics Control Process Modeling Simulation and Optimization The latter CAPE strategic objective derived from the European Federation of Chemical Engineering EFCE promotion of scientific activities which autonomously and transversely work across the Working Parties terms of references These activities enhance the exchange of the know how and knowledge acquired by different Working Parties in homologous fields They also aim to discover complementary facets useful to the dissemination of tools and of novel procedures As a consequence the Working Parties Environmental Protection Loss Prevention and Safety Promotion and Multiphase Fluid Flow were invited to assist in the organization of sessions in the area of A Process Integrated Approach

for Environmental Benefit Loss Prevention and Safety Computational Fluid Dynamics A total of 473 abstracts from all over the world were evaluated by the International Scientific Committee Out of them 197 have been finally selected for the presentation and reported into this book Their authors come from thirty different countries The selection of the papers was carried out by twenty eight international reviewers These proceedings will be a major reference document to the scientific and industrial community and will contribute to the progress in Computer Aided Process Engineering

Scale-Up and Optimization in Preparative Chromatography Anurag Rathore,Ajoy Velayudhan,2002-09-26 Presenting guidelines to predict and improve separation system performance this book contains numerous case studies illustrating the practice of scale up principles in process development It offers solutions to limitations that occur in real world purification schemes methods to model optimize and characterize nonlinear separation processes data comparisons from all stages of production and industrial separation schemes for products such as synthetic molecules antibody fragments IgG growth factors and plasmid DNA The book covers external constraints separation economics correlations for transport and kinetic phenomena and the configuration and parameters of column design

Preparative Chromatography for Separation of Proteins Arne Staby,Anurag S. Rathore,Satinder Ahuja,2017-02-02 Preparative Chromatography for Separation of Proteins addresses a wide range of modeling techniques strategies and case studies of industrial separation of proteins and peptides Covers broad aspects of preparative chromatography with a unique combination of academic and industrial perspectives Presents Combines modeling with compliance using of Quality by Design QbD approaches including modeling Features a variety of chromatographic case studies not readily accessible to the general public Represents an essential reference resource for academic industrial and pharmaceutical researchers

Marine Phenolic Compounds Jose Ricardo Perez Correa,Raquel Mateos,Herminia Dominguez,2023-02-09 Marine Phenolic Compounds Science and Engineering is a comprehensive resource on these secondary metabolites Phenolic compounds are secondary metabolites with increasing scientific commercial and general population interest for their wide distribution variety and potential applications Less studied than terrestrial sources marine organisms contain highly interesting phenolic compounds due to their exclusive structures In addition the distinctive features of the marine solid matrix requires novel process technology approaches The high productivity of marine biomass makes it a renewable source of valuable components with potential for commercial applications Includes a section on chemical characterization of highly variable structures from marine phenolics Provides the chemical composition and structure of these important marine compounds Presents the bioavailability and bioactivities of marine phenolics to help facilitate the design of new products Contains contributions from a global team of experts who address the challenges of working with marine phenolic compounds

Advances in Chemical Engineering ,2009-06-29 The cross fertilization of physico chemical and mathematical ideas has a long historical tradition This volume of Advances in Chemical Engineering is almost completely dedicated to a conference on Mathematics in Chemical Kinetics and Engineering MaCKiE 2007 which was

held in Houston in February 2007 bringing together about 40 mathematicians chemists and chemical engineers from 10 countries to discuss the application and development of mathematical tools in their respective fields Updates and informs the reader on the latest research findings using original reviews Written by leading industry experts and scholars Reviews and analyzes developments in the field

Encyclopedia of Chromatography (Print) Jack Cazes,2001-06-29 This practical single volume source collects up to date information on chromatographic techniques and methodologies for the solution of analytical and preparative problems applicable across a broad spectrum of disciplines including biotechnology pharmaceuticals environmental sciences polymers food additives and nutrients pathology toxicology fossil fuels and nuclear chemistry It highlights real world applications easy to read fundamentals of problem solving and material identification methods and detailed references Written by over 180 esteemed international authorities and containing over 300 chapters 2600 works cited and 1000 drawings equations tables and photographs the Encyclopedia of Chromatography covers high performance liquid thin layer gas affinity countercurrent supercritical fluid gel permeation and size exclusion chromatographies as well as capillary electrophoresis field flow fractionation hyphenated techniques and more PRINT

ONLINE PRICING OPTIONS AVAILABLE UPON REQUEST AT e reference taylorandfrancis com [Handbook of Methods and Instrumentation in Separation Science](#) ,2009-11-11 Handbook of Methods and Instrumentation in Separation Science Volume 1 provides concise overviews and summaries of the main methods used for separation It is based on the Encyclopedia of Separation Science The handbook focuses on the principles of methods and instrumentation It provides general concepts concerning the subject matter it does not present specific procedures This volume discusses the separation processes including affinity methods analytical ultracentrifugation centrifugation chromatography and use of decanter centrifuge and dye Each methodology is defined and compared with other separation processes It also provides specific techniques principles and theories concerning each process Furthermore the handbook presents the applications benefits and validation of the processes described in this book This handbook is an excellent reference for biomedical researchers environmental and production chemists flavor and fragrance technologists food and beverage technologists academic and industrial librarians and nuclear researchers Students and novices will also find this handbook useful for practice and learning One stop source for information on separation methods General overviews for quick orientation Ease of use for finding results fast Expert coverage of major separation methods Coverage of techniques for all sizes of samples pico level to kilo level

Environmental Biotechnology Hans-Joachim Jördening,Josef Winter,2006-03-06 A deeper insight into the complex processes involved in this field covering the biological chemical and engineering fundamentals needed to further develop effective methodologies The book devotes detailed chapters to each of the four main areas of environmental biotechnology wastewater treatment soil treatment solid waste treatment and waste gas treatment dealing with both the microbiological and process engineering aspects The result is the combined knowledge contained in the extremely successful volumes 11a

through 11c of the Biotechnology series in a handy and compact form *The Cumulative Book Index* ,1996 A world list of books in the English language *Natural Product Extraction* Juliana M Prado,Mauricio A Rostagno,2022-07-20 Natural products are used by the food pharmaceutical and cosmetics industries and extraction technologies and potential applications for plant extracts are of interest to many industrial sectors Extraction of natural products in an economic and environmentally friendly way is of high importance to all industries involved The second edition of this book presents an updated holistic in depth view of the more environmentally benign techniques available for the extraction of natural products along with their newest applications and case studies Conventional and emerging extraction techniques are discussed in detail New topics include enzymes pulsed electric energy and on line in line analysis Written for academics and industrialists working in both natural product extraction and green chemistry this new edition provides a valuable update on current trends in the field

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