

Separation Of Mixtures By Pertraction Or Membrane Based

Liquid Membranes: Principles and Applications in Chemical Separations and Wastewater Treatment discusses the principles and applications of the liquid membrane (LM) separation processes in organic and inorganic chemistry, analytical chemistry, biochemistry, biomedical engineering, gas separation, and wastewater treatment. It presents updated, useful, and systematized information on new LM separation technologies, along with new developments in the field. It provides an overview of LMs and LM processes, and it examines the mechanisms and kinetics of carrier-facilitated transport through LMs. It also discusses active transport, driven by oxidation-reduction, catalytic, and bioconversion reactions on the LM interfaces; modifications of supported LMs; bulk aqueous hybrid LM processes with water-soluble carriers; emulsion LMs and their applications; and progress in LM science and engineering. This book will be of value to students and young researchers who are new to separation science and technology, as well as to scientists and engineers involved in the research and development of separation technologies, LM separations, and membrane reactors. - Provides comprehensive knowledge-based information on the principles and applications of a variety of liquid membrane separation processes. - Contains a critical analysis of new technologies published in the last 15 years.

This book is intended to serve as a "one-stop" reference resource for important research accomplishments in the area of nanostructured polymer membranes and their processing and characterizations. It will be a very valuable reference source for university and college faculties, professionals, post-doctoral research fellows, senior graduate students, and researchers from R&D laboratories working in the area of polymer nanobased membranes. The various chapters are contributed by prominent researchers from industry, academia and government/private research laboratories across the globe and comprise an up-to-date record on the major findings and observations in the field.

Table of Contents Preface Acknowledgments for the first edition Acknowledgments for the second edition 1 Overview of Membrane Science and Technology 1 2 Membrane Transport Theory 15 3 Membranes and Modules 89 4 Concentration Polarization 161 5 Reverse Osmosis 191 6 Ultrafiltration 237 7 Microfiltration 275 8 Gas Separation 301 9 Pervaporation 355 10 Ion Exchange Membrane Processes - Electrodialysis 393 11 Carrier Facilitated Transport 425 12 Medical Applications of Membranes 465 13 Other Membrane Processes 491 Appendix 523 Index 535.

The present book contains a comparison of existing theoretical models developed in order to describe membrane separation processes. In general, the permeation equations resulting from these models give inaccurate predictions of the mutual effects of the permeants involved, due to the simplifications adopted in their derivation. It is concluded that an optimum description of transport phenomena in tight (diffusion-type) membranes is achieved with the "solution-diffusion" model. According to this model each component of a fluid mixture to be separated dissolves in the membrane and passes through by diffusion in response to its gradient in the chemical potential. A modified Flory-Huggins equation has been derived to calculate the solubility of the permeants in the membrane material. Contrary to the original Flory-Huggins equation, the modified equation accounts for the large effect on solubility of crystallinity and elastic strain of the polymer chains by swelling. The equilibrium sorption of liquids computed with this equation was found to be in good agreement with experimental results. Also, the sorption of gases in both rubbery and glassy polymers could be described quantitatively with the modified Flory-Huggins equation without any need of the arbitrary Langmuir term, as required in the conventional "dual-mode" sorption model. Furthermore, fewer parameters are required than with the at least identical accuracy.

Simulation of Chemical Processes

Membrane Separations Technology

From Analysis and Modeling to Technology Applications

Liquid Membranes

Green Solvents II

Membrane Technologies and Applications

The main challenge in modern solvent extraction separation is that most techniques are mainly empirical, specific and particular for narrow fields of practice and require a large degree of experimentation. This concise and modern book provides a complete overview of both solvent extraction separation techniques and the novel and unified competitive complexation/solvation theory. This novel and unified technique presented in the book provides a key for a preliminary quantitative prediction of suitable extraction systems without experimentation, thus saving researchers time and resources. Analyzes and compares both classical and new competitive models and techniques Offers a novel and unified competitive complexation / solvation theory that permits researchers to standardize some parameters, which decreases the need for experimentation at R&D Presents examples of applications in multiple disciplines such as chemical, biochemical, radiochemical, pharmaceutical and analytical separation Written by an outstanding scientist who is prolific in the field of separation science

This book is the second in the series of publications in this field by this publisher, and contains a number of latest research developments on ionic liquids (ILs). This promising new area has received a lot of attention during the last 20 years. Readers will find 30 chapters collected in 6 sections on

recent applications of ILs in polymer sciences, material chemistry, catalysis, nanotechnology, biotechnology and electrochemical applications. The authors of each chapter are scientists and technologists from different countries with strong expertise in their respective fields. You will be able to perceive a trend analysis and examine recent developments in different areas of ILs chemistry and technologies. The book should help in systematization of knowledges in ILs science, creation of new approaches in this field and further promotion of ILs technologies for the future. This book provides an example of the successful and rapid expansion of bioengineering within the world of the science. It includes a core of studies on bioengineering technology applications so important that their progress is expected to improve both human health and ecosystem. These studies provide an important update on technology and achievements in molecular and cellular engineering as well as in the relatively new field of environmental bioengineering. The book will hopefully attract the interest of not only the bioengineers, researchers or professionals, but also of everyone who appreciates life and environmental sciences.

*ESCAPE-20 is the most recent in a series of conferences that serves as a forum for engineers, scientists, researchers, managers and students from academia and industry to present and discuss progress being made in the area of "Computer Aided Process Engineering" (CAPE). CAPE covers computer-aided methods, algorithms and techniques related to process and product engineering. The ESCAPE-20 scientific program reflects the strategic objectives of the CAPE Working Party: to check the status of historically consolidated topics by means of their industrial application and to evaluate their emerging issues. * Includes a CD that contains all research papers and contributions * Features a truly international scope, with guest speakers and keynote talks from leaders in science and industry * Presents papers covering the latest research, key topical areas, and developments in computer-aided process engineering (CAPE)*

Separations Chemistry

Fundamental Modeling of Membrane Systems

Separation and Purification Technologies in Biorefineries

Membrane Technology for Water and Wastewater Treatment, Energy and Environment

Handbook of Biofuels Production

Processing and Characterization

The Handbook of Membrane Separations: Chemical, Pharmaceutical, and Biotechnological Applications provides detailed information on membrane separation technologies as they have evolved over the past decades. To provide a basic understanding of membrane technology, this book documents the developments dealing with these technologies. It explores chemical, pharmaceutical, food processing and biotechnological applications of membrane processes ranging from selective separation to solvent and material recovery. This text also presents in-depth knowledge of membrane separation mechanisms, transport models, membrane permeability computations, membrane types and modules, as well as membrane reactors.

Key features: The most comprehensive resource available on the biodiversity of algal species, their industrial production processes and their use for human consumption in food, health and varied applications. Emphasis on basic and applied research, addressing aspects of scale-up for commercial exploitation for the development of novel phytochemicals (phytochemicals from algae). Addresses the underexplored and underutilized potential of chemicals from marine sources for health benefits. Each chapter, written by expert contributors from around the world, includes Summary Points,

Figures and Tables, as well as up-to-date references. The first book in this two-volume set explores the diversity of algal constituents for health and disease applications. The commercial value of chemicals of value to food and health is about \$6 billion annually, of which 30 percent relates to micro and macro algal metabolites and products for health food applications. This comprehensive volume looks in detail at algal genomics and metabolomics as well as mass production of microalgae. As a whole, the two-volume set covers all micro and macro algal forms and their traditional uses; their constituents which are of value for food, feed, specialty chemicals, bioactive compounds for novel applications, and bioenergy molecules. Bio-business and the market share of algae-based products are also dealt with, providing global perspectives.

Separation and purification processes play a critical role in biorefineries and their optimal selection, design and operation to maximise product yields and improve overall process efficiency. Separations and purifications are necessary for upstream processes as well as in maximising and improving product recovery in downstream processes. These processes account for a significant fraction of the total capital and operating costs and also are highly energy intensive.

Consequently, a better understanding of separation and purification processes, current and possible alternative and novel advanced methods is essential for achieving the overall techno-economic feasibility and commercial success of sustainable biorefineries. This book presents a comprehensive overview focused specifically on the present state, future challenges and opportunities for separation and purification methods and technologies in biorefineries. Topics covered include:

Equilibrium Separations: Distillation, liquid-liquid extraction and supercritical fluid extraction. Affinity-Based Separations: Adsorption, ion exchange, and simulated moving bed technologies. Membrane Based Separations: Microfiltration, ultrafiltration and diafiltration, nanofiltration, membrane pervaporation, and membrane distillation. Solid-liquid Separations: Conventional filtration and solid-liquid extraction. Hybrid/Integrated Reaction-Separation Systems: Membrane bioreactors, extractive fermentation, reactive distillation and reactive absorption. For each of these processes, the fundamental principles and design aspects are presented, followed by a detailed discussion and specific examples of applications in biorefineries. Each chapter also considers the market needs, industrial challenges, future opportunities, and economic importance of the separation and purification methods. The book concludes with a series of detailed case studies including cellulosic bioethanol production, extraction of algae oil from microalgae, and production of biopolymers. Separation and Purification Technologies in Biorefineries is an essential resource for scientists and engineers, as well as researchers and academics working in the broader conventional and emerging bio-based products industry, including biomaterials, biochemicals, biofuels and bioenergy.

The conventional solvents used in chemical, pharmaceutical, biomedical and separation processes represent a great challenge to green chemistry because of their toxicity and flammability. Since the beginning of "the 12 Principles of Green Chemistry" in 1998, a general effort has been made to replace conventional solvents with environmentally benign substitutes. Water has been the most popular choice so far, followed by ionic liquids, surfactant, supercritical fluids, fluorinated solvents, liquid polymers, bio-solvents and switchable solvent systems. Green Solvents Volume I and II provides a throughout overview of the different types of solvents and discusses their extensive applications in fields such as

extraction, organic synthesis, biocatalytic processes, production of fine chemicals, removal of hydrogen sulphide, biochemical transformations, composite material, energy storage devices and polymers. These volumes are written by leading international experts and cover all possible aspects of green solvents' properties and applications available in today's literature. Green Solvents Volume I and II is an invaluable guide to scientists, R&D industrial specialists, researchers, upper-level undergraduates and graduate students, Ph.D. scholars, college and university professors working in the field of chemistry and biochemistry.

Solvent Extraction

Membrane Technologies for Biorefining

Novel Water Treatment and Separation Methods

Intensification of Liquid-Liquid Processes

Comprehensive Biotechnology

Handbook of Biofuels Production, Second Edition, discusses advanced chemical, biochemical, and thermochemical biofuels production routes that are fast being developed to address the global increase in energy usage. Research and development in this field is aimed at improving the quality and environmental impact of biofuels production, as well as the overall efficiency and output of biofuels production plants. The book provides a comprehensive and systematic reference on the range of biomass conversion processes and technology. Key changes for this second edition include increased coverage of emerging feedstocks, including microalgae, more emphasis on by-product valorization for biofuels' production, additional chapters on emerging biofuel production methods, and discussion of the emissions associated with biofuel use in engines. The editorial team is strengthened by the addition of two extra members, and a number of new contributors have been invited to work with authors from the first edition to revise existing chapters, thus offering fresh perspectives. Provides systematic and detailed coverage of the processes and technologies being used for biofuel production Discusses advanced chemical, biochemical, and thermochemical biofuels production routes that are fast being developed to address the global increase in energy usage Reviews the production of both first and second generation biofuels Addresses integrated biofuel production in biorefineries and the use of waste materials as feedstocks

Due to increasing demand for potable and irrigation water, new scientific research is being conducted to deal with wastewater from a variety of sources. Novel Water Treatment and Separation Methods: Simulation of Chemical Processes presents a selection of research related to applications of chemical processes for

wastewater treatment, separation techniques, and modeling and simulation of chemical processes. Among the many topics are: degradation of herbicide removal of anionic dye efficient sun-light driven photocatalysis removal of copper and iron using green activated carbon defluoridation of drinking water removal of calcium and magnesium from wastewater using ion exchange resins degradation of vegetable oil refinery wastewater novel separation techniques, including microwave-assisted extraction and more The volume presents selected examples in wastewater treatment, highlighting some recent examples of processes such as photocatalytic degradation, emulsion liquid membrane, novel photocatalyst for degradation of various pollutants, and adsorption of heavy metals. The book goes on to explore some novel separation techniques, such as microwave-assisted extraction, anhydrous ethanol through molecular sieve dehydration, batch extraction from leaves of *Syzygium cumini* (known as jambul, jambolan, jamblang or jamun), and reactive extraction. These novel separation techniques have proved be advantageous over conventional methods. The volume also looks at modeling and simulation of chemical processes, including chapters on flow characteristics of novel solid-liquid multistage circulating fluidized bed, mathematical modeling and simulation of gasketed plate heat exchangers, optimization of the adsorption capacity of prepared activated carbon, and modeling of ethanol/water separation by pervaporation, along with topics on simulation using CHEMCAD software. The diverse chapters share and encourage new ideas, methods, and applications in ongoing advances in this growing area of chemical engineering and technology. It will be a valuable resource for researchers and faculty and industrialists as well as for students.

Membrane Technologies for Biorefining highlights the best practices needed for the efficient and environmentally-compatible separation techniques that are fundamental to the conversion of biomass to fuels and chemicals for use as alternatives to petroleum refining. Membrane technologies are increasingly of interest in biorefineries due to their modest energy consumption, low chemical requirements, and excellent separation efficiency. The book provides researchers in academia and industry with an authoritative overview of the different types of membranes and highlights the ways in which they can be applied in biorefineries for the production of chemicals and biofuels. Topics have been selected to highlight both the variety of raw materials treated in biorefineries and the range of biofuel and chemical end-products. Presents the first book to focus specifically on membrane technologies in biorefineries Provides a comprehensive overview of the different types of membranes and highlight ways in which they can be applied in biorefineries for the production of chemicals and biofuels Topics selected highlight both the variety of raw materials treated using membranes in

biorefineries and the range of biofuel and chemical end-products

Realizing that water, energy and food are the three pillars to sustain the growth of human population in the future, this book deals with all the above aspects with particular emphasis on water and energy. In particular, the book addresses applications of membrane science and technology for water and wastewater treatment, energy and environment. Th

Volume I Food, Health and Nutraceutical Applications

Applications and Perspectives

Principles and Applications

Membrane Handbook

Progress in Molecular and Environmental Bioengineering

Chemical Engineering Abstracts

Ionic Liquids in Separation Technology reports on the most important fundamental and technological advances in separation processes using ionic liquids. It brings together the latest developments in this fascinating field, supplements them with numerous practical tips, and thus provides those working in both research and industry with an indispensable source of information. The book covers fundamental topics of physical, thermal, and optical properties of ionic liquids, including green aspects. It then moves on to contexts and applications, including separation of proteins, reduction of environmental pollutants, separation of metal ions and organic compounds, use in electrochromic devices, and much more. For the specialist audience the book serves as a recompilation of the most important knowledge in this field, whereas for starting researchers in ionic liquid separation technology the book is a great introduction to the field. First book in the marketplace dedicated to ionic liquids in separation technology Contributions from scientists in academia and researchers in industry ensure the coverage of both scientific fundamentals and industrial applications Covers a broad collection of applications in separation technology which makes the book a single source of information Includes many practical tips for researchers in industry and scientists who apply ionic liquids in their work

Membrane processes have wide industrial ap This handbook reviews the published litera plications covering many existing and emerging ture, presents an in-depth description of com uses in the chemical, petrochemical, petroleum, mercialized membrane processes, and gives a state-of-the-art review of new membrane pro environmental, water treatment, pharmaceutical, medical, food, dairy,

beverage, paper, text concepts under development. It is intended for, and electronic industries. The existing aim to be a single source of underlying principles, membranes, membrane modules, process applications include: (1) dialysis for the purification of human blood (the artificial kidney), (2) sign, applications, and cost estimates. It is also electro dialysis for the desalination of brackish water, (3) reverse theory and practice. osmosis for the desalination of seawater, (4) There are several groups which may benefit ultrafiltration for the concentration of large proteins from this handbook. It can be used as educational molecules from cheese, casein whey, and tional material for industrial personnel engaged milk, and (5) microfiltration for the sterilization in membrane separations. For scientists and of pharmaceutical and medical products, beer, engineers active in research and development in wine, and soft drinks. Since membrane process synthetic membranes, it will serve as a single process generally have low capital investment, as source of reference for the entire field.

This text describes how plastics, rubber, and fibers are synthesized, processed into useful materials, characterized, and compounded with fillers and other additives to improve performance for specific applications. Their use in a wide variety of technologies including membrane separations, electronics, and energy production and storage is described. A new chapter in the Third Edition shows how computer correlations and simulations can be used to predict properties of new plastics and to better understand how existing plastics perform.

Separation of chemical species is a gate to final success of synthesis and preparation of compounds in pure and defined state. Variability of natural and artificial mixtures to be treated is enormous. Task of chemistry is to separate components of homogeneous mixtures (the gaseous and liquid solutions). The book concentrates on understanding the basic philosophies of both equilibrium and nonequilibrium chemical thermodynamics and engineering performance that lay in principle of separation technique such as distillation, crystallization, centrifugation, sorption, membrane separations, chromatography, and liquid-liquid extraction. Specific phenomena connected with photochemical separation, isotope composition, and radioactivity are discussed as well. The book is written for advanced students of chemistry having the knowledge of physical chemistry. Calculation examples are based on the international system of units. Unique list of over 1,300 full references covers scientific literature of the eighteenth to the twenty-first centuries.

**Revised and Expanded Edition
Chiral Separation Techniques**

Transport Mechanisms in Membrane Separation Processes

ISEC '88

MEMBRANE SEPARATION PROCESSES

A Practical Approach

The chapters of this book are based upon lectures presented at the NATO Advanced Study Institute on Membrane Processes in Separation and Purification (March 21 - April 2, 1993, Curia, Portugal), organized as a successor and update to a similar Institute that took place 10 years ago (p.M.Bungay, H.K. Lonsdale, M.N. de Pinho (Eds.): Synthetic Membranes: Science, Engineering and Applications, NATO ASI Series, Reidel, Dordrecht, 1986). The decade between the two NATO Institutes witnesses the transition from individually researched membrane processes to an applied and established membrane separation technology, as is reflected by the contents of the corresponding proceeding volumes. By and large, the first volume presents itself as a textbook on membrane processes, still valid, while the present volume focuses on areas of separation need as amenable to membrane processing: Biotechnology and Environmental Technology. Accordingly, the contributions to this volume are grouped into "Membranes in Biotechnology" (11 papers), "Membranes in Environmental Technology" (6 papers), and "New Concepts" (4 papers). This is followed by one contribution each on "Energy Requirements" and "Education", i.e., membrane processes within an academic curriculum. The book thus amounts to a state of the art of applied membrane processing and may well augment the more fundamental approach of its predecessor. Comprehensive Membrane Science and Engineering, Second Edition is an interdisciplinary and innovative reference work on membrane science and technology. Written by leading researchers and industry professionals from a range of backgrounds, chapters elaborate on recent and future developments in the field of membrane science and explore how the field has advanced since the previous edition published in 2010. Chapters are written by academics and practitioners across a variety of fields, including chemistry, chemical engineering, material science, physics, biology and food science. Each volume covers a wide spectrum of applications and advanced technologies, such as new membrane materials (e.g. thermally rearranged polymers, polymers of intrinsic microporosity and new hydrophobic fluoropolymer) and processes (e.g. reverse electrodialysis, membrane contractors, membrane crystallization, membrane condenser, membrane dryers and membrane emulsifiers) that have only recently proved their full potential for industrial application. This work covers the latest advances in membrane science, linking fundamental research with real-

life practical applications using specially selected case studies of medium and large-scale membrane operations to demonstrate successes and failures with a look to future developments in the field. Contains comprehensive, cutting-edge coverage, helping readers understand the latest theory Offers readers a variety of perspectives on how membrane science and engineering research can be best applied in practice across a range of industries Provides the theory behind the limits, advantages, future developments and failure expectations of local membrane operations in emerging countries

Membrane techniques provide a broad science and technology base. Although there are several books in the traditional membrane field, there is a great need for a highly comprehensive book. This refereed book covers materials from highly respected researchers. This title is highly multidisciplinary in nature and should be extremely valuable to scientists and engineers involved in a variety of activities. Students and faculty members around the world will find this title to be an excellent reference book. Invited contributions from leading researchers in the field Coverage of topic is of value to scientists/engineers working in a variety of related fields [separations/reactions, advanced biofunctional materials, contactor designs] Aims to fill market gap for a highly comprehensive book containing advances in both synthetic and biofunctional/bimimetic membranes

The Handbook of Membrane Separations: Chemical, Pharmaceutical, Food, and Biotechnological Applications, Second Edition provides detailed information on membrane separation technologies from an international team of experts. The handbook fills an important gap in the current literature by providing a comprehensive discussion of membrane application

Principles and Applications in Chemical Separations and Wastewater Treatment

Ionic Liquids in Separation Technology

Properties and Applications of Ionic Liquids

Chemical, Pharmaceutical, Food, and Biotechnological Applications

Membrane Contactor Technology

Downstream Processing in Biotechnology

This concise and systematically organized text, now in its second edition, gives a clear insight into various membrane separation processes. It covers the fundamentals as well as the recent developments of different processes along with their industrial applications and the products. It includes the basic principles, operating parameters, membrane hardware, flux equation, transport mechanism, and applications of membrane-based

technologies. Membrane separation processes are largely rate-controlled separations which require rate analysis for complete understanding. Moreover, a higher level of mathematical analysis, along with the understanding of mass transfer, is also required. These are amply treated in different chapters of the book to make the students comprehend the membrane separation principles with ease. This textbook is primarily designed for undergraduate students of chemical engineering, biochemical engineering and biotechnology for the course in membrane separation processes. Besides, the book will also be useful to process engineers and researchers. **KEY FEATURES** • Provides sufficient number of examples of industrial applications related to chemical, metallurgical, biochemical and food processing industries. • Focuses on important biomedical applications of membrane-based technologies such as blood oxygenator, controlled drug delivery, plasmapheresis, and bioartificial organs. • Includes chapter-end short questions and problems to test students' comprehension of the subject. **NEW TO THIS EDITION** • A new section on membrane cleaning is included. Membrane fabrication methods are supplemented with additional information (Chapter 2). • Additional information on silt density index, forward osmosis and sea water desalination (Chapter 3). • Physicochemical parameters affecting nanofiltration, determination of various resistances using resistance in series model and few more industrial applications with additional short questions (Chapter 4). • Membrane cross-linking methods used in pervaporation, factors affecting pervaporation and few more applications (Chapter 9). • Membrane distillation, membrane reactor with different modules, types of membranes and reactions for membrane reactor (Chapter 13).

Fundamental Modelling of Membrane Systems: Membrane and Process Performance summarizes the state-of-the-art modeling approaches for all significant membrane processes, from molecular transport, to process level, helping researchers and students who carry out experimental research save time and accurately interpret experimental data. The book provides an overview of the different membrane technologies, handling micro-, ultra-, and nanofiltration, reverse and forward osmosis, pervaporation, gas permeation, supported liquid membranes, membrane contactors, membrane bioreactors and ion-exchange membrane systems. Examples of hybrid membrane systems are also included. Presents an accessible reference on how to model membranes and membrane processes Provides a clear, mathematical description of mass transfer in membrane systems Written by well-known, prominent authors in the field of membrane science

Explore and review novel techniques for intensifying transport and reaction in liquid-liquid and related systems with this essential toolkit. Topics include discussion of the principles of process intensification, the nexus

between process intensification and sustainable engineering, and the fundamentals of liquid-liquid contacting, from an expert with over forty-five years' experience in the field. Providing promising directions for investment and for new research in process intensification, in addition to a unique review of the fundamentals of the topic, this book is the perfect guide for senior undergraduate students, graduate students, developers, and research staff in chemical engineering and biochemical engineering.

An eye-opening exploration of membrane contactors from a group of industry leaders In **Membrane Contactor Technology: Water Treatment, Food Processing, Gas Separation, and Carbon Capture**, an expert team of researchers delivers an up-to-date and insightful explanation of membrane contactor technology, including transport phenomena, design aspects, and diverse process applications. The book also includes explorations of membrane synthesis, process, and module design, as well as rarely discussed process modeling and simulation techniques. The authors discuss the technical and economic aspects of this increasingly important technology and examine the geometry, flow, energy and mass transport, and design aspects of membrane contactor modules. They also cover a wide range of application opportunities for this technology, from the materials sciences to process engineering. **Membrane Contactor Technology** also includes: A thorough introduction to the membrane contactor extraction process, including dispersion-free membrane extraction processes and supported liquid membrane processes Comprehensive explorations of membrane transport theory, including discussions of diffusional mass and heat transfer modeling, as well as numerical modeling In-depth examinations of module configuration and geometry, including design and flow configuration Practical discussions of modes of operation, including membrane distillation, osmotic evaporation, and forward osmosis Perfect for process engineers, biotechnologists, water chemists, and membrane scientists, **Membrane Contactor Technology** also belongs in the libraries of chemical engineers, polymer chemists, and chemists working in the environmental industry.

Chemical, Pharmaceutical, Food, and Biotechnological Applications, Second Edition

20th European Symposium of Computer Aided Process Engineering

Membrane Technology and Applications

Process and Chemical Engineering

Progress and Developments in

New Insights into Membrane Science and Technology: Polymeric and Biofunctional Membranes

This is a completely revised and updated sequel to 'A Practical Approach to Chiral Separations by Liquid

Chromatography' by the same editor. The scope has been extended to further chiral separation techniques like electrophoresis, membrane separations, or biological assays. More emphasis is put on preparative separation techniques. From reviews of the previous edition: 'A team of experts from academic and industrial laboratories throughout the world have compiled their findings and experience to make this book an exceptionally timely and unique contribution to the field' European Journal of Drug Metabolism 'The dense mass of information contained in this book will make it a valuable resource ...' Chemical Engineering Research '... this is a worthwhile addition to the expanding chiral literature and the book should be of value to those working in this field' The Analyst

This research level reference book has been co-written by Enrico Drioli, perhaps one of the world's best known researchers into membrane technology. The application of membrane technology to chemical transformation and molecular separation are beginning to be exploited in the pharmaceutical science and biotechnology industries, but there is a need for researchers and students to have up-to-date literature - and this book provides it. The book will be of interest to students of chemistry, chemical engineering, pharmacy and biotechnology.

Comprehensive Biotechnology, Third Edition 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

Comprehensive Membrane Science and EngineeringElsevier

Applications In Biotechnology And The Pharmaceutical Industry

Handbook of Membrane Separations

Polymer Science and Technology

Comprehensive Membrane Science and Engineering

Conference Papers

Mass Transfer in Multicomponent Mixtures

The field of membrane separation technology is presently in a state of rapid growth and innovation. Many different membrane separation processes have been developed during the past half century and new processes are constantly emerging from academic, industrial, and governmental laboratories. While new membrane separation processes are

being conceived with remarkable frequency, existing processes are also being constantly improved in order to enhance their economic competitiveness. Significant improvements are currently being made in many aspects of membrane separation technology: in the development of new membrane materials with higher selectivity and/or permeability, in the fabrication methods for high-flux asymmetric or composite membranes, in membrane module construction and in process design. Membrane separation technology is presently being used in an impressive variety of applications and has generated businesses totalling over one billion U.S. dollars annually. The main objective of this book is to present the principles and applications of a variety of membrane separation processes from the unique perspectives of investigators who have made important contributions to their fields. Another objective is to provide the reader with an authoritative resource on various aspects of this rapidly growing technology. The text can be used by someone who wishes to learn about a general area of application as well as by the knowledgeable person seeking more detailed information.

This booklet is designed to bridge the gap between handbooks and technical literature and aims at graduate students or experienced readers. Commercial flow sheeting simulation software is increasingly available and is used in the early steps of process design in industry. As to this, more sophisticated and precise models based on activities instead of concentrations should be used. After an introductory chapter there is in Chapter 2 an intensive discussion of reactive phase equilibria of ionic and non-ionic solutes based on chemical potentials. Chapter 3 introduces to multicomponent diffusion and mass transfer. However, the main focus is on the reactive mass transfer on rigid and mobile surfaces where the interfacial reaction, molecular diffusion and adsorption layers are decisive. The respective extraction of zinc with a cation exchanger and of acetic acid with an anion exchanger is discussed as case studies. Since adsorption layers and surfactants have a major impact on liquid-liquid extraction efficiency, the final chapter reviews several techniques which make use of polymeric species in an extractive process. A short review is also given on extraction apparatus and the hydrodynamics (hydraulic design, droplet population balances) of columns. Much of the booklet is based on the PhD works of C. Czaplá (2000), G. Modes (2000), H. Klocker (1996), T. Kronberger (1995), M. Marters (2000), M. Roos (2000), M. Traving (2000) and B. Wachter (1996) who I wish to thank for their fruitful contributions.

Membrane technologies play an increasingly important role in unit operations for resource recovery, pollution prevention, and energy production, as well as environmental monitoring and quality control. They are also key component technologies of fuel cells and bioseparation applications. Membrane Technologies and Applications provides essential data and background information on various dimensions of membrane technologies, with a major focus on their practical application. Membranes of inorganic materials offer cost-effective solutions for simple to complex separation problems. This book is designed for anyone interested in water and wastewater treatment, membrane suppliers, as well as students

and academics studying the field.

Ionic liquids, including the newer subcategory of deep eutectic solvents, continue to attract a great deal of research attention in an even increasing number of areas, including traditional areas such as synthesis (organic and materials), electrochemistry, and physical property studies and predictions, as well as less obvious areas such as lubrication and enzymatic transformations. In this volume, recent advances in a number of these different areas are reported and reviewed, thus granting some appreciation for the future that ionic liquid research holds and affording inspiration for those who have not previously considered the application of ionic liquids in their area of interest.

Membrane and Process Performance

ESCAPE-20

Nanostructured Polymer Membranes, Volume 1

Reactive Extraction

Classical and Novel Approaches

Water Treatment, Food Processing, Gas Separation, and Carbon Capture

The current book gives an excellent insight into downstream processing technology and explains how to establish a successful strategy for an efficient recovery, isolation and purification of biosynthetic products. In addition to the overview of purification steps and unit operations, the authors provide practical information on capital and operating costs related to downstream processing.

Biocatalytic Membrane Reactors

Ionic Liquids

Handbook of Algal Technologies and Phytochemicals

Membrane Processes in Separation and Purification