

Membrane Separation Processes By Kaushik Nath

This book on hollow fiber contactors presents an up-to-date compilation of the latest developments and milestones in this membrane technology. Hollow Fiber Membrane Contactors: Module Fabrication, Design and Operation, and Potential Applications provides a comprehensive discussion of hollow fiber membrane applications (including a few case studies) in biotechnology, chemical, food, and nuclear engineering. The chapters in this book have been classified using the following, based on different ways of contacting fluids with each other: Gas-liquid contacting; Liquid-liquid contacting; Supported liquid membrane; Supported gas membrane; Fluid-fluid contacting. Other features include: Discusses using non-dispersive solvent extraction, hollow fiber strip dispersion, hollow fiber supported liquid membranes and role of process intensification in integrated use of these processes Provides technical and economic perspectives with several case studies related to specific scenarios Demonstrates module fabrication, design, operation and maintenance of hollow fiber contactors for different applications and performance Presents discussion on newer concepts like membrane emulsification, membrane nanoprecipitation, membrane crystallization and membrane condenser Special focus on emerging areas such as the use of hollow fiber contactor in back end of nuclear fuel cycle, membrane distillation, dehumidification of air and gas absorption and stripping Discusses theoretical analysis including computational modeling of different hollow fiber membrane processes, and presents emphasis on newly developed area of hollow fiber membrane based analytical techniques Presents discussion on upcoming area dealing with hollow fiber contactors-based technology in fermentation and enzymatic transformation and in chiral separations This book is equally suited for newcomers to the field, as well as for engineers and scientists that have basic knowledge in this field but are interested in obtaining more information about specific future applications.

Membrane Contactors: Fundamentals, Applications and Potentialities, Volume 11 covers new operations that could be efficiently used to improve the performance of a variety of industrial production cycles in applications ranging from biotechnology to agrofood. This book focuses on the basic "principles of work": required membrane materials and properties; major operating parameters; the importance of module configuration and design and; the performance of membrane contactors in specific processes. The authors' dynamic approach to this subject makes Membrane Contactors: Fundamentals, Applications and Potentialities, Volume 11 the most comprehensive book currently available on all aspects related to the 'membrane contactor world'. * Describes new unit operations in process engineering * Covers a wide variety of industrial applications, from biotechnology to agrofood * Applicable to process intensification and sustainable growth strategies

The brief primarily focuses on the performance analysis of CNT based interconnects in current research scenario. Different CNT structures are modeled on the basis of transmission line theory. Performance comparison for different CNT structures illustrates that CNTs are more promising than Cu or other materials used in global VLSI interconnects. The brief is organized into five chapters which mainly discuss: (1) an overview of current research scenario and basics of interconnects; (2) unique crystal structures and the basics of physical properties of CNTs, and the production, purification and applications of CNTs; (3) a brief technical review, the geometry and equivalent RLC parameters for different single and bundled CNT structures; (4) a comparative analysis of crosstalk and delay for different single and bundled CNT structures; and (5) various unique mixed CNT bundle structures and their equivalent electrical models.

Cold atmospheric plasma (CAP) emerges as a possible new modality for cancer treatment. This book provides a comprehensive introduction into fundamentals of the CAP and plasma devices used in plasma medicine. An analysis of the mechanisms of plasma interaction with cancer and normal cells including description of possible mechanisms of plasma selectivity is included. Recent advances in the field, the primary challenges and future directions are presented.

Vapour permeation and membrane distillation are two emerging membrane technologies for the production of vapour as permeate, which, in addition to well-established pervaporation technology, are of increasing interest to academia and industry. As efficient separation and concentration processes, they have high potential for use in the energy, water, chemical, food and pharmaceutical sectors. Part One begins by covering the fundamentals, preparation and characterization of pervaporation, before going on to outline the associated systems and applications. State of the art uses, future trends and next generation pervaporation are then discussed. Part Two then explores the preparation, characterization, systems and applications of membranes for vapour permeation, followed by modelling and the new generation of vapour permeation membranes. Finally, Part Three outlines the fundamentals of membrane distillation and its applications in integrated systems, before the book concludes with a view of the next generation. Explores three emerging membrane technologies that produce vapour as a permeate. Looks at the fundamentals, applications, state of the art uses and next generation of each technology. Provides an authoritative guide for chemical engineers and academic researchers interested in membrane technologies for desalination, process water/steam treatment, water purification, VOCs removal and other aspects of pollution control, industrial process chemistry, renewable energy production or separation and concentration in the food/pharmaceutical industries.

Separation processes are challenging steps in any process industry for isolation of products and recycling of reactants. Membrane technology has shown immense potential in separation of liquid and gaseous mixtures, effluent treatment, drinking water purification and solvent recovery. It has found endless popularity and wide acceptance for its small footprint, higher selectivity, scalability, energy saving capability and inherent ease of integration into other unit operations. There are many situations where the target component cannot be separated by distillation, liquid extraction, and evaporation. The different membrane processes such as pervaporation, vapor permeation and membrane distillation could be used for solving such industrial bottlenecks. This book covers the entire array of fundamental aspects, membrane synthesis and applications in the chemical process industries (CPI). It also includes various applications of pervaporation, vapor permeation and membrane distillation in industrially and socially relevant problems including separation of azeotropic mixtures, close-boiling compounds, organic-organic mixtures, effluent treatment along with brackish and seawater desalination, and many others. These processes can also be applied for extraction of small quantities of value-added compounds such as flavors and fragrances and selective removal of hazardous impurities, viz., volatile organic compounds (VOCs) such as vinyl chloride, benzene, ethyl benzene and toluene from industrial effluents. Including case studies, this is a must-have for any process or chemical engineer working in the industry today. Also valuable as a learning tool, students and professors in chemical engineering, chemistry, and process engineering will benefit greatly from the groundbreaking new processes and technologies described in the volume.

This study concentrates on a general optimization of a particular class of membrane separation processes: those involving batch

diafiltration. Existing practices are explained and operational improvements based on optimal control theory are suggested. The first part of the book introduces the theory of membrane processes, optimal control and dynamic optimization. Separation problems are defined and mathematical models of batch membrane processes derived. The control theory focuses on problems of dynamic optimization from a chemical-engineering point of view. Analytical and numerical methods that can be exploited to treat problems of optimal control for membrane processes are described. The second part of the text builds on this theoretical basis to establish solutions for membrane models of increasing complexity. Each chapter starts with a derivation of optimal operation and continues with case studies exemplifying various aspects of the control problems under consideration. The authors work their way from the limiting flux model through increasingly generalized models to propose a simple numerical approach to the general case of optimal operation for batch diafiltration processes. Researchers interested in the modelling of batch processes or in the potential industrial applications of optimal control theory will find this monograph a valuable source of inspiration, instruction and ideas. The topics covered in this proceedings volume include: Synthesis, characterization and processing (including some novel approaches) of a variety of polyimides and other high temperature polymers; structure-property relationships; segmental dynamics in polyimide materials; photoalignable polyimides; photoconductivity and photosensitivity of polyimides; ultrafiltration membranes from polyetherimide; polymer materials for nonlinear optical applications; alignment of SWNTs in rigid-rod polymer compositions; surface modification of polyimide; adhesion of Cu to polyimide surfaces; and polyimide erosion in a low Earth orbit space environment.

MEMBRANE SEPARATION PROCESSES PHI Learning Pvt. Ltd.

During the dyeing process, losses of colorants to the water sources can be toxic and mutagenic and also decreases light penetration and photosynthesis activity. In recent years, since textile industry can generate large volumes of effluents, textile wastewater treatments have received considerable attention. The aim of this book is to look into textile wastewater treatments shortly. It is designed for readers who study on textile dyeing effluent. I would like to record my sincere thanks to authors for their contributions.

Membrane Modification: Technology and Applications is written for engineers, scientists, graduate students, and researchers in the field of membrane science and technology, materials science, applied physics, chemistry, and environmental science. The book presents the complete range of membrane modification techniques used to increase efficiency of membrane processes. The book starts with an examination of the use of membrane modification to optimize the performance of membranes used in industry. It concludes by demonstrating how membrane modification can improve separation processes in industrial sectors that are recognized as global polluters of water sources. Features Illustrates the use of Electrochemical Impedance Spectroscopy (EIS) in the characterization of commercial and novel membranes Overviews various surface modification techniques applied to enhance the bulk and surface properties of nanofiber membranes Covers the factors affecting membrane fouling and the use of nanoparticles in membrane modification processes Explores the use of plasma treatment for the modification of polymeric membranes Written by professors, engineers, and researchers in the field, the book covers recent advances and comprehensively describes novel and most-used membrane characterization techniques. Modification of different materials and geometrics include flat-sheet, hollow-fiber, and nano-fiber membranes as well as different membrane processes such as reverse osmosis, membrane distillation, gas separation, pervaporation, and membrane fuel cells. Chapters contain tables, figures, photographs, and theoretical equations to aid with reader comprehension.

This book presents comprehensive reviews on the latest developments of nanotechnologies to detect and remove pollutants in water, air and food. Polymer nanocomposites, nanoparticles from microbes and the application of nanotechnologies for desalination and agriculture are also discussed. Pollution of water and air by contaminants and diseases is a major health issue leading globally to millions of deaths yearly according to the World Health Organization. Such issue requires advanced methods to clean environmental media.

Membrane technology is an important part of the separation technology. This volume broadly addresses the field of membranes and membrane processes. It highlights developments in the field, as well as research opportunities for the future.

With conventional materials contributing greatly to environmental waste, biodegradable and natural composites have grown in interest and display low environmental impact at low cost across a wide range of applications. This book provides an overview of different biodegradable and natural composites and focuses on efforts into increasing their mechanical performance to extend their capabilities and applications.

The book Modeling in Membranes and Membrane-Based Processes is based on the idea of developing a reference which will cover most relevant and "state-of-the-art" approaches in membrane modeling. This book explores almost every major aspect of modeling and the techniques applied in membrane separation studies and applications. This includes first principle-based models, thermodynamics models, computational fluid dynamics simulations, molecular dynamics simulations, and artificial intelligence-based modeling for membrane separation processes. These models have been discussed in light of various applications ranging from desalination to gas separation. In addition, this breakthrough new volume covers the fundamentals of polymer membrane pore formation mechanisms, covering not only a wide range of modeling techniques, but also has various facets of membrane-based applications. Thus, this book can be an excellent source for a holistic perspective on membranes in general, as well as a comprehensive and valuable reference work. Whether a veteran engineer in the field or lab or a student in chemical or process engineering, this latest volume in the "Advances in Membrane Processes" is a must-have, along with the first book in the series, Membrane Processes, also available from Wiley-Scrivener.

A growing proportion of the world's population is dependent on Seawater Desalination as a source of fresh water for both potable and civil use. One of the main drawbacks of conventional desalination technologies is the substantial energy requirement, which is facing cost increases in the global energy market. "Seawater Desalination" presents an overview of conventional and non-conventional technologies, with a particular focus on the coupling of renewable energies with desalination processes. The first section of this book presents, in a technical but reader-friendly way, an overview of currently-used desalination processes, from thermal to membrane processes, highlighting the relevant technical features, advantages and disadvantages, and development potential. It also gives a rapid insight into the economic aspects of fresh water production from seawater. The second section of the book presents novel processes which use Renewable Energies for fresh water production. From the first solar still evaporators, which artificially reproduced the natural cycle of water, technology has progressed to develop complex systems to harness energy from the sun, wind, tides, waves, etc. and then to use this energy to power conventional or novel desalination processes. Most of

these processes are still at a preliminary stage of development, but some are already being cited as examples in remote areas, where they are proving to be valuable in solving the problems of water scarcity. A rapid growth in these technologies is foreseen in the coming years. This book provides a unique foundation, within the context of present and future sustainability, for professionals, technicians, managers, and private and public institutions operating in the area of fresh water supply.

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Introduction to Process Engineering and Design covers basic principles to design alternate systems, develop process diagrams and select the best alternative to be adopted. Multiple industrial examples provided in the book will enhance the skills of the readers for innovative designs. Salient Features: • Focuses on process design of chemical plants and equipment • State-of-the-art technique of supercritical extraction, reactive distillation, short path distillation discussed • Process Flow-charts are provided throughout the book

This book covers newly emerging two-dimensional nanomaterials which have been recently used for the purpose of water purification. It focuses on the synthesis methods of 2D materials and answers how scientists/engineers/nanotechnologist/environmentalists could use these materials for fabricating new separation membranes and most probably making commercially feasible technology. The chapters are written by a collection of international experts ensuring a broad view of each topic. The book will be of interest to experienced researchers as well as young scientists looking for an introduction into 2D materials-based cross-disciplinary research.

Climate resilience and growing population are the two main global challenges that encourage the development of an affordable and sustainable source of vegetable protein to ensure future food security. Advanced scientific programs and agro-food developments should be proprietarily on-demand to face different stresses in order to maintain yield and quality of seed production. In this regard, legume crops are key sustainable alternatives for healthier diets while contributing to appropriate natural resource management. Taken together, the 11 chapters in this book represent a generous addition to the progress in our understanding of climate-resilient legumes, hoping to contribute to the improvement of global food security in the future.

Despite constant significant advances, cardiovascular as well as more general outcomes of hemodialysis treatment remain unsatisfactory. The introduction of innovative 'high retention onset' membranes has led to the development of a new treatment modality called 'expanded hemodialysis' (HDx), which is the focus of this book. This new therapy is likely to benefit end-stage kidney disease patients, thanks to enhanced removal of molecules retained by current dialysis techniques. HDx is simple to set up and application does not require special hardware or specific nursing skills. This book contains emerging evidence and fascinating new hypotheses on HDx. It is highly recommended for all physicians and healthcare professionals who are caring for dialysis patients and are seeking innovation and improved care solutions. It will also be of considerable interest to students and fellows.

Applications of Advanced Green Materials provides a comprehensive and authoritative review on recent advancement in green materials in various applications. Each chapter is focused on a specific application of advanced green materials from packaging to sensor technology, biomedical to environmental applications, textile to catalysis to electronic shielding applications, supercapacitors, drug delivery, tissue engineering, bioelectronic, gas storage and separation, etc. This book also discusses life cycle assessment and circular economy of green materials and their future prospective. The book is unique with contributions from renowned scientists working on biopolymers and biocomposites, bioactive and biodegradable materials, composites, and metallic natural materials. This book is an essential resource for academicians, researchers, students and professionals interested in exploring potential of advanced green materials. Includes up to date information on applications of advanced green materials Each chapter is specifically discussing a particular application with examples Present a unified approach to discuss in detail about origin, synthesis and application of green materials

This book features a special subsection of Nanomedicine, an application of nanotechnology to achieve breakthroughs in healthcare. It exploits the improved and often novel physical, chemical and biological properties of materials only existent at the nanometer scale. As a consequence of small scale, nanosystems in most cases are efficiently uptaken by cells and appear to act at the intracellular level. Nanotechnology has the potential to improve diagnosis, treatment and follow-up of diseases, and includes targeted drug delivery and regenerative medicine; it creates new tools and methods that impact significantly upon existing conservative practices. This volume is a collection of authoritative reviews. In the introductory section we define the field (intracellular delivery). Then, the fundamental routes of nanodelivery devices, cellular uptake, types of delivery devices, particularly in terms of localized cellular delivery, both for small drug molecules, macromolecular drugs and genes; at the academic and applied levels, are covered. The following section is dedicated to enhancing delivery via special targeting motifs followed by the introduction of different types of intracellular nanodelivery devices (e.g. a brief description of their chemistry) and ways of producing these different devices. Finally, we put special emphasis on particular disease states and on other biomedical applications, whilst diagnostic and sensing issues are also included. Intracellular delivery / therapy is a highly topical which will stir great interest. Intracellular delivery enables much more efficient drug delivery since the impact (on different organelles and sites) is intracellular as the drug is not supplied externally within the blood stream. There is great potential for targeted delivery with improved localized delivery and efficacy.

Food materials are processed prior to their consumption using different processing technologies that improve their shelf life and maintain their physicochemical, biological, and sensory qualities. Introduction to Advanced Food Process Engineering provides a general reference on various aspects of processing, packaging, storage, and quality control and assessment systems, describing the basic principles and major applications of emerging food processing technologies. The book is divided into three sections, systematically examining processes from different areas of food process engineering. Section I covers a wide range of advanced food processing technologies including osmo-concentration of fruits and vegetables, membrane technology, nonthermal processing, emerging drying technologies, CA and MA storage of fruits and vegetables, nanotechnology in food processing, and computational fluid dynamics modeling in food processing. Section II describes food safety and various non-destructive quality assessment systems using machine vision systems, vibrational spectroscopy, biosensors, and chemosensors. Section III explores waste management, by-product utilization, and energy conservation in food processing industry. With an emphasis on novel food processes, each chapter contains case studies and examples to illustrate state-of-the-art applications of the technologies discussed.

This book provides useful information about bioremediation, phytoremediation, and mycoremediation of wastewater and some aspects of the chemical wastewater treatment processes, including ion exchange, neutralization, adsorption, and

disinfection. Additionally, this book elucidates and illustrates the wastewater treatment plants in terms of plant sizing, plant layout, plant design, and plant location. Cutting-edge topics include wet air oxidation of aqueous wastes, biodegradation of nitroaromatic compounds, biological treatment of sanitary landfill leachate, bacterial strains for the bioremediation of olive mill wastewater, gelation of arabinoxylans from maize wastewater, and modeling wastewater evolution.

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).

Biological nitrogen fixation has essential role in N cycle in global ecosystem. Several types of nitrogen fixing bacteria are recognized: the free-living bacteria in soil or water; symbiotic bacteria making root nodules in legumes or non-legumes; associative nitrogen fixing bacteria that resides outside the plant roots and provides fixed nitrogen to the plants; endophytic nitrogen fixing bacteria living in the roots, stems and leaves of plants. In this book there are 11 chapters related to biological nitrogen fixation, regulation of legume-rhizobium symbiosis, and agriculture and ecology of biological nitrogen fixation, including new models for autoregulation of nodulation in legumes, endophytic nitrogen fixation in sugarcane or forest trees, etc. Hopefully, this book will contribute to biological, ecological, and agricultural sciences.

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.

Green Sustainable Process for Chemical and Environmental Engineering and Science: Switchable Solvents explores the preparation, properties, chemical processes and applications of this class of green solvents. The book provides an in-depth overview on the area of switchable solvents in various industrial applications, focusing on the purification and extraction of chemical compounds utilizing green chemistry protocols that include liquid-liquid, solid-liquid, liquid-gas and lipids separation technologies. In addition, it includes recent advances in greener extraction and separation processes. This book will be an invaluable guide to students, professors, scientists and R&D industrial specialists working in the field of sustainable chemistry, organic, analytical, chemical engineering, environmental and pharmaceutical sciences.

Provides a broad overview of switchable solvents in sustainable chemical processes Compares the use of switchable solvents as greener solvents over conventional solvents Outlines eco-friendly organic synthesis and chemical processes using switchable solvents Lists various industrial separations/extraction processes using switchable solvents

This book is a printed edition of the Special Issue "Bioconversion Processes" that was published in Fermentation This systematically organized and well-balanced book compresses within the covers of a single volume the theoretical principles and techniques involved in bio-separations, also called downstream processing. These techniques are derived from a range of subjects, for example, physical chemistry, analytical chemistry, bio-chemistry, biological science and chemical engineering. Organized in its 15 chapters, the text covers in the first few chapters topics related to chemical engineering unit operations such as filtration, centrifugation, adsorption, extraction and membrane separation as applied to bio-separations. The use of chromatography as practiced at laboratory as well as industrial scale operation and related techniques such as gel filtration, affinity and pseudoaffinity chromatography, ion-exchange chromatography,

electrophoresis and related methods have been discussed. The important applications of these techniques have also been highlighted.

Thermal Induced Membrane Separation Processes describes the fundamental and advanced areas associated with the field of thermal induced membrane separation processes. It includes extensive coverage of material selection, types, and theory of thermal induced membrane fabrication, characterization, and modification. This book focuses on the applications of various thermal induced membrane processes and discusses ancillary topics related to the subject, such as membrane modules, membrane contactors and reactors, preparation and characterization techniques, smart membranes, fouling and its mitigation, and economic analysis of the thermal induced membrane separation processes. Thermal Induced Membrane Separation Processes elaborates on every aspect on the thermal induced membranes in a simple and straightforward manner, helping readers ranging from students to researchers in academia and the industry to understand the processes for successful execution and implementation into their research. Covers entire field of thermal induced membranes, providing basic to advanced knowledge of thermal induced membranes in a single source Presents state-of-art research in the field Includes the most up-to-date examples of the fabrication, modification, and applications of thermal induced membranes

The indiscriminate use of medications and their inadequate disposal have resulted in them being released into the environment via municipal, hospital and industrial discharges. This volume critically examines the presence of pharmaceuticals in aquatic ecosystems, the hazards they entail, and how to minimize their impact on the environment. The topics covered include: historical findings that have made the development of the discipline ecopharmacovigilance possible; the main exposure routes, fate and life cycle of pharmaceuticals in water; occurrence data and the impact on biodiversity; methods used for the detection, analysis and quantification of pharmaceuticals in water and for their removal; current legislation on the presence of emerging contaminants in water; biosensors for environmental analysis and monitoring; and the measures needed to reduce the existing problems. This book is aimed at students, academics and research workers in the fields of toxicology, ecology, microbiology and chemistry, as well as those in the pharmaceutical industry, health sector professionals, and members of government bodies involved in environmental protection and legislation.

Emerging Technologies for Sustainable Desalination Handbook provides professionals and researchers with the latest treatment activities in the advancement of desalination technology. The book enables municipalities and private companies to custom-design sustainable desalination plants that will minimize discharge, energy costs and environmental footprint. Individual case studies are included to illustrate the benefits and drawback of each technique. Sections discuss a multitude of recently developed, advanced processes, along with notable advances made in existing technologies. These processes include adsorption, forward osmosis, humidification and dehumidification, membrane distillation, pervaporation and spray type thermal processes. In addition, theoretical membrane materials, such as nanocomposite and carbon nanotube membranes are also explored. Other chapters cover the desalination of shale gas, produced water, forward osmosis for agriculture, desalination for crop irrigation, and seawater for sustainable agriculture. International in its coverage, the chapters of this handbook are contributed by leading authors and researchers in all relevant fields. Expertly explains recent advances in sustainable desalination technology, including nanocomposite membranes, carbon nanotube membranes, forward reverse osmosis and desalination by pervaporation Provides state-of-the-art techniques for minimizing system discharge, energy cost and environmental footprint Includes individual case studies to illustrate the benefits and drawbacks of each technique Discusses techniques for the custom-design of sustainable desalination plants for municipalities, private companies and industrial operations

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The first guide to compile current research and frontline developments in the science of process intensification (PI), Re-Engineering the Chemical Processing Plant illustrates the design, integration, and application of PI principles and structures for the development and optimization of chemical and industrial plants. This volume updates professionals on emerging PI equipment and methodologies to promote technological advances and operational efficacy in chemical, biochemical, and engineering environments and presents clear examples illustrating the implementation and application of specific process-intensifying equipment and methods in various commercial arenas.

Modern membrane science and technology aids engineers in developing and designing more efficient and environmentally-friendly processes. The optimal material and membrane selection as well as applications in the many involved industries are provided. This work is the ideal introduction for engineers working in membrane science and applications (wastewater, desalination, adsorption, and catalysis), process engineers in separation science, biologists and biochemists, environmental scientists, and most of all students. Its multidisciplinary approach also stimulates thinking of hybrid technologies for current and future life-saving applications (artificial organs, drug delivery).

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