

Membrane And Desalination Technologies Handbook Of Environmental Engineering

Handbook of Research on Resource Management for Pollution and Waste Treatment
Food Engineering Handbook
Handbook of Membrane Separations
Handbook of Industrial Membrane Technology
Desalination of Seawater
Membrane Characterization
Membrane and Membrane Reactors Operations in Chemical Engineering
Membrane Technology and Engineering for Water Purification
Handbook of Membrane Reactors
Membrane Technology for Water and Wastewater Treatment, Energy and Environment
Handbook of Industrial Membrane Technology
Seawater Desalination
UF/MF Membrane Water Treatment
Graphene-based Membranes for Mass Transport Applications
Membrane and Desalination Technologies
Desalination Engineering: Operation and Maintenance
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Emerging Technologies for Sustainable Desalination Handbook
Membrane Handbook
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The CRC Handbook of Mechanical Engineering, Second Edition
Urban Water Reuse Handbook
Handbook of Environmental Engineering: Membrane and desalination technologies
Membrane Handbook
Physicochemical Treatment Processes
Pretreatment for Reverse Osmosis Desalination
Membrane Separation Principles and Applications
Renewable Energy Powered Desalination Handbook
Emerging Technologies for Sustainable Desalination Handbook
Handbook of Industrial Membranes
Advanced Physicochemical Treatment Processes
Fundamentals of Salt Water Desalination
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Handbook of Membrane Separations
Reverse Osmosis
Sustainable Desalination Handbook

Handbook of Research on Resource Management for Pollution and Waste Treatment

Membrane reactors are increasingly replacing conventional separation, process and conversion technologies across a wide range of applications. Exploiting advanced membrane materials, they offer enhanced efficiency, are very adaptable and have great economic potential. There has therefore been increasing interest in membrane reactors from both the scientific and industrial communities, stimulating research and development. The two volumes of the Handbook of membrane reactors draw on this research to provide an authoritative review of this important field. Volume 2 reviews reactor types and industrial applications, beginning in part one with a discussion of selected types of membrane reactor and integration of the technology with industrial processes. Part two goes on to explore the use of membrane reactors in chemical and large-scale hydrogen production from fossil fuels. Electrochemical devices and transport applications of membrane reactors are the focus of part three, before part four considers the use of membrane reactors in environmental engineering, biotechnology and medicine. Finally, the book concludes with a discussion of the economic aspects of membrane reactors. With its distinguished editor and international team of expert contributors, the two volumes of the Handbook of membrane

reactors provide an authoritative guide for membrane reactor researchers and materials scientists, chemical and biochemical manufacturers, industrial separations and process engineers, and academics in this field. Discusses integration of membrane technology with industrial processes Explores the use of membrane reactors in chemical and large-scale hydrogen production from fossil fuels Considers electrochemical devices and transport applications of membrane reactors

Food Engineering Handbook

This manual contains necessary and useful information and data in an easily accessible format relating to the use of membranes. Membranes are among the most important engineering components in use today, and each year more and more effective uses for membrane technologies are found - for example: water purification, industrial effluent treatment, solvent dehydration by per-vaporation, recovery of volatile organic compounds, protein recovery, bioseparations and many others. The pace of change in the membrane industry has been accelerating rapidly in recent years, occasioned in part by the demand of end-users, but also as a result of the investment in R&D by manufacturers. To reflect these changes the author has obtained the latest information from some of the leading suppliers in the business. In one complete volume this unique handbook gives practical guidance to using selected membrane processes in individual industries while also providing a useful guide to equipment selection and usage.

Handbook of Membrane Separations

Handbook of Industrial Membrane Technology

This outstanding reference is ideal for those who require in-depth and accurate information about reverse osmosis technology and water chemistry. Professionals in this rapidly expanding field will appreciate the features of this outstanding resource. The book features a full description of the RO process, a comprehensive review of membrane technology and system design, and describes the economic benefits of RO and other desalination technologies. System designers, membrane manufacturers, water purification experts, consultants, separations technologists, and chemical engineers will find Reverse Osmosis an invaluable tool.

Desalination of Seawater

This Special Issue is aimed at highlighting the potentialities of membrane and membrane reactor operations in various sectors of chemical engineering, based on application of the process intensification strategy. In all of the contributions, the

principles of process intensification were pursued during the adoption of membrane technology, demonstrating how it may lead to the development of redesigned processes that are more compact and efficient while also being more environmental friendly, energy saving, and amenable to integration with other green processes. This Special Issue comprises a number of experimental and theoretical studies dealing with the application of membrane and membrane reactor technology in various scientific fields of chemical engineering, such as membrane distillation for wastewater treatment, hydrogen production from reforming reactions via inorganic membrane and membrane photoassisted reactors, membrane desalination, gas/liquid phase membrane separation of CO₂, and membrane filtration for the recovery of antioxidants from agricultural byproducts, contributing to valorization of the potentialities of membrane operations.

Membrane Characterization

The past thirty years have witnessed a growing worldwide desire that positive actions be taken to restore and protect the environment from the degrading effects of all forms of pollution—air, water, soil, and noise. Because pollution is a direct or indirect consequence of waste, the seemingly idealistic demand for “zero discharge” can be construed as an unrealistic demand for zero waste. However, as long as waste continues to exist, we can only attempt to abate the subsequent pollution by converting it to a less noxious form. Three major questions usually arise when a particular type of pollution has been identified: (1) How serious is the pollution? (2) Is the technology to abate it available? and (3) Do the costs of abatement justify the degree of abatement achieved? This book is one of the volumes of the Handbook of Environmental Engineering series. The principal intention of this series is to help readers formulate answers to the last two questions above. The traditional approach of applying tried-and-true solutions to specific pollution problems has been a major contributing factor to the success of environmental engineering, and has accounted in large measure for the establishment of a “methodology of pollution control.” However, the realization of the ever-increasing complexity and interrelated nature of current environmental problems renders it imperative that intelligent planning of pollution abatement systems be undertaken.

Membrane and Membrane Reactors Operations in Chemical Engineering

Food Engineering Handbook: Food Process Engineering addresses the basic and applied principles of food engineering methods used in food processing operations around the world. Combining theory with a practical, hands-on approach, this book examines the thermophysical properties and modeling of selected processes such as chilling, freezing, and dehydration. A complement to Food Engineering Handbook: Food Engineering Fundamentals, this text: Discusses size reduction, mixing, emulsion, and encapsulation Provides case studies of solid-liquid and supercritical fluid extraction Explores fermentation, enzymes, fluidized-bed drying, and more Presenting cutting-edge information on new and emerging

food engineering processes, Food Engineering Handbook: Food Process Engineering is an essential reference on the modeling, quality, safety, and technologies associated with food processing operations today.

Membrane Technology and Engineering for Water Purification

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

Handbook of Membrane Reactors

Membrane Separation Principles and Applications: From Material Selection to Mechanisms and Industrial Uses, the latest volume in the Handbooks in Separation Science series, is the first single resource to explore all aspects of this rapidly growing area of study. Membrane technology is now accepted as one of the most effective tools for separation and purification, primarily due to its simple operation. The result has been a proliferation of studies on this topic; however, the relationships between fundamental knowledge and applications are rarely discussed. This book acts as a guideline for those who are interested in exploring membranes at a more progressive level. Covering methods of pressure driving force, partial pressure driving force, concentration driving force, electrical potential driving force, hybrid processes, and more, this volume is more complete than any other known resource on membrane separations. Covers membrane material selection, membrane fabrication, membrane characterization, separation mechanisms and applications in each chapter Authored by contributors who are internationally recognized as experts in their respective fields Organized by the driving force behind

each type of membrane separation—a unique approach that more clearly links fundamental principles with their dominant applications

Membrane Technology for Water and Wastewater Treatment, Energy and Environment

THE DEFINITIVE GUIDE TO DESALINATION PLANT OPERATION AND MAINTENANCE This Water Environment Federation and Water Reuse Association publication describes state-of-the-art operation, maintenance, and troubleshooting methods for reverse osmosis brackish and seawater desalination plants for municipal water supplies. All plant components are discussed in detail, from intake and pretreatment to discharge management. Best practices for maintaining plant equipment are also provided. Real-world examples illustrating the latest technologies and their practical implementation are included throughout this authoritative resource. Desalination Engineering covers: Source water open and subsurface intakes Source water pretreatment -- chemical conditioning, dissolved air flotation clarifiers, and granular media, membrane, and cartridge filters Reverse osmosis system operation Reverse osmosis system troubleshooting Post-treatment -- lime and carbon dioxide, calcite conditioning, remineralization, and disinfection Desalination plant discharge management Equipment maintenance -- pumps, air blowers, motors, bearings, valves, mechanical seals, mechanical drives, chemical feed systems, automatic samplers

Handbook of Industrial Membrane Technology

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

Seawater Desalination

It is necessary to understand the extent of pollution in the environment in terms of the air, water, and soil in order for both humans and animals to live healthier lives. Poor waste treatment or pollution monitoring can lead to massive environmental issues, such as diminishing valuable resources, and cause a significant negative impact on society. Solutions, such as reuse of waste and sustainable waste management, must be explored to prevent these adverse effects. The Handbook of Research on Resource Management for Pollution and Waste Treatment is a collection of innovative research that examines waste and pollution treatment methods that can be adopted at local and international levels and examines appropriate resource management strategies for environmentally related issues. Featuring coverage on a wide range of topics such as soil washing, bioremediation, and runoff handling, this book is ideally designed for environmentalists, engineers, waste

management professionals, natural resource regulators, environmental policymakers, scientists, academicians, researchers, and students seeking current research on viable resource management methods for the regeneration of their immediate environment.

UF/MF Membrane Water Treatment

Industrial desalination of sea and brackish water is becoming an essential part in providing sustainable sources of fresh water for a larger number of communities around the world. Desalination is a main source of fresh water in the Gulf countries, a number of the Caribbean and Mediterranean Islands, and several municipalities in a large number of countries. As the industry expands there is a pressing need to have a clear and well-written textbook that focuses on desalination fundamentals and other industrial aspects. This book focuses on the processes widely used in industry, which include multistage flash desalination and reverse osmosis. Also, other desalination processes with attractive features and high potential are featured. It includes a large number of solved examples, which are explained in simple and careful matter that allow the reader to follow and understand the development. The data used in the development of the examples and case studies are extracted from existing desalination plants. This title also includes comparisons of model predictions against results reported in literature as well as available experimental and industrial data. Several industries include similar unit operation processes, i.e., evaporators, condensers, flashing units, membrane separation, and chemical treatment. Examples of such industries include wastewater treatment, food, petroleum, petrochemical, power generation, and pulp and paper. Process fundamentals and design procedures of such unit processes follow the same procedures given in this textbook.

Graphene-based Membranes for Mass Transport Applications

"This book provides a comprehensive description of the state of the art of ultrafiltration (UF) and microfiltration (MF) membrane technology in water and wastewater applications. The book will give practitioners a comprehensive understanding of all key facets of membranes and their application."--P. 4 of cover.

Membrane and Desalination Technologies

Membrane Technology and Engineering for Water Purification, Second Edition is written in a practical style with emphasis on: process description; key unit operations; systems design and costs; plant equipment description; equipment installation; safety and maintenance; process control; plant start-up; and operation and troubleshooting. It is supplemented by case studies and engineering rules-of-thumb. The author is a chemical engineer with extensive experience in the field, and his

technical knowledge and practical know-how in the water purification industry are summarized succinctly in this new edition. This book will inform you which membranes to use in water purification and why, where and when to use them. It will help you to troubleshoot and improve performance and provides case studies to assist understanding through real-life examples. Membrane Technology section updated to include forward osmosis, electrodialysis, and diffusion dialysis Hybrid Membrane Systems expanded to cover zero liquid discharge, salt recovery and removal of trace contaminants Includes a new section on plant design, energy, and economics

Desalination Engineering: Operation and Maintenance

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.

Reverse Osmosis

Sustainable Desalination Handbook: Plant Selection, Design and Implementation provides the comprehensive knowledge base required for efficient and sustainable process design for existing and new desalination plants around the world. This valuable resource for understanding and utilizing the most recent developments in desalination technologies and methods addresses the necessary components, including process design and implementation, operational strategies, and novel discoveries that minimize environmental impacts. In addition, the book features essential illustrations, operational details, issues and potential solutions and sustainable management strategies for present and future desalination plants. Explains plant design and process selection criteria for each desalination process Presents international regulations and permitting for intake and discharge locations, design and disposal Provides energy recovery schemes, optimization and process controls Covers renewable energy sources, such as nuclear, geothermal, solar and wind powered desalination, energy storage and optimization Includes case studies of recent desalination projects and process design

The Boundary Flux Handbook

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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.

Sustainable Desalination Handbook

The Boundary Flux Handbook summarizes over 100 chemical compounds (single compounds, in mixed solution) and different feed streams from industry (complex streams exiting the agricultural, biological, pharmaceutical, food, dye, textile, and other industries) and the respective critical and threshold fluxes (or boundary flux), together with data on rejection and permeabilities. It gives the reader valuable data to quickly estimate membrane performances in respect to productivity, selectivity, and longevity, and aids in estimating capital and operating costs of membrane processes during the plant design operations. The book is valuable for scientific researchers and chemical engineers working with membrane technology as a reference for lab work, membrane process design, and control. For each specific feedstock, only the best performing membranes are listed. At least one commercial membrane module and a maximum of four different choices are reported, in order to assure easy integration of the proposed membranes into the systems by contacting the relevant commercial partner, and to define the best choice of the pretreatment steps, permitting quick membrane process optimization or revamping operations. This text summarizes over 100 chemical compounds, different feed streams from industry, and the respective critical and threshold fluxes. It gives the reader valuable data to quickly estimate membrane performances in respect to productivity, selectivity and longevity. For each studied feedstock, only the best performing membrane(s) are listed, including one commercial and a maximum of four different choices, to assure the possibility to easily integrate the proposed membranes into the systems by contacting the relevant commercial partner.

Membrane Technology and Applications

Pretreatment for Reverse Osmosis Desalination is a comprehensive reference on all existing and emerging seawater pretreatment technologies used for desalination. The book focuses on reverse osmosis membrane desalination, which at present is the most widely applied technology for the production of fresh drinking water from highly saline water sources (brackish water and seawater). Each chapter contains examples illustrating various pretreatment technologies and their practical implementation. Provides in-depth overview of the key theoretical concepts associated with desalination pre-treatment Gives insight into the latest trends in membrane separation technology Incorporates analytical methods and guidelines for monitoring pretreatment systems

Desalination Engineering: Planning and Design

Examining the current literature, research, and relevant case studies, presented by a team of international experts, the Urban Water Reuse Handbook discusses the pros and cons of water reuse and explores new and alternative methods for obtaining a sustainable water supply. The book defines water reuse guidelines, describes the historical and current

Emerging Technologies for Sustainable Desalination Handbook

Sustainable Desalination Handbook: Plant Selection, Design and Implementation provides the comprehensive knowledge base required for efficient and sustainable process design for existing and new desalination plants around the world. This valuable resource for understanding and utilizing the most recent developments in desalination technologies and methods addresses the necessary components, including process design and implementation, operational strategies, and novel discoveries that minimize environmental impacts. In addition, the book features essential illustrations, operational details, issues and potential solutions and sustainable management strategies for present and future desalination plants. Explains plant design and process selection criteria for each desalination process Presents international regulations and permitting for intake and discharge locations, design and disposal Provides energy recovery schemes, optimization and process controls Covers renewable energy sources, such as nuclear, geothermal, solar and wind powered desalination, energy storage and optimization Includes case studies of recent desalination projects and process design

Membrane Handbook

Renewable Energy Powered Desalination Handbook: Applications and Thermodynamics offers a practical handbook on the use of renewable technologies to produce freshwater using sustainable methods. Sections cover the different renewable technologies currently used in the field, including solar, wind, geothermal and nuclear desalination. This coverage is followed by an equally important clear and rigorous discussion of energy recovery and the thermodynamics of desalination processes. While seawater desalination can provide a climate-independent source of drinking water, the process is energy-intensive and environmentally damaging. This book provides readers with the latest methods, processes, and technologies available for utilizing renewable energy applications as a valuable technology. Desalination based on the use of renewable energy sources can provide a sustainable way to produce fresh water. It is expected to become economically attractive as the costs of renewable technologies continue to decline and the prices of fossil fuels continue to increase. Covers renewable energy sources, such as nuclear, geothermal, solar and wind powered desalination and energy storage and optimization Includes energy recovery schemes, optimization and process controls Elaborates on the principles of thermodynamics and second law efficiencies to improve process performance, including solar desalination Explains global applicability of solar,

wind, geothermal and nuclear energy sources with case studies Discusses renewable energy-desalinated water optimization schemes for island communities

Desalination Technology

“ the best handbook on membrane technology, which is currently on the market ” -Membrane News (on the previous edition) Building on the success of the previous edition, Membrane Technology and Applications Third Edition provides a comprehensive overview of separation membranes, their manufacture and their applications. Beginning with a series of general chapters on membrane preparation, transport theory and concentration polarization, the book then surveys several major areas of membrane application in separate chapters. Written in a readily accessible style, each chapter covers its membrane subject thoroughly, from historical and theoretical backgrounds through to current and potential applications. Topics include reverse osmosis, ultrafiltration, pervaporation, microfiltration, gas separation and coupled and facilitated transport; chapters on electrodialysis and medical applications round out the coverage. NEW TO THE THIRD EDITION New sections on the use of membranes in the chlor-alkali industry, membrane distillation, pressure retarded osmosis and constant flux-variable pressure ultrafiltration Zeolite and ceramic membranes, submerged membrane modules, and fuel cell membranes Substantially enhanced chapters on ultrafiltration, pervaporation and membrane contactors Updates to every chapter to reflect the developments in the field

The CRC Handbook of Mechanical Engineering, Second Edition

The use of seawater desalination is an increasingly sought after alternative for new drinking water supplies in coastal areas, particularly as desalination becomes more economical. This new manual of practice parlays lessons learned from recent studies and global seawater desalination projects into guidance for desalination facilities that are reliable, economical, and environmentally sound. This new manual is specifically designed to help water utility managers and design engineers understand desalination—the technologies, the infrastructure, and the costs—to make informed decisions from planning through treatment plant construction. It explains environmental and ecological impacts of desalination plants, seawater intakes, and the disposal of concentrate discharges back into the ocean. Chapters describe the minerals and other constituents that determine source water quality and, therefore, treatment approaches.

Urban Water Reuse Handbook

An in-depth guide to reverse osmosis desalination This Water Environment Federation and WaterReuse Association publication provides comprehensive information on the planning and engineering of brackish and seawater desalination

projects for municipal water supplies. After a brief overview of widely used desalination technologies, Desalination Engineering focuses on reverse osmosis desalination. The book discusses basic principles, planning and environmental review of projects, design and selection of key desalination plant components, desalinated water posttreatment, and concentrate management. Guidelines on sizing and cost estimation of desalination plant facilities are also included in this practical resource. **COVERAGE INCLUDES:** Source water quality characterization Fundamentals of reverse osmosis desalination Planning considerations Environmental review and permitting Intakes for source water collection Intake pump stations Source water screening and conditioning Sand removal, sedimentation, and dissolved air flotation Pretreatment by granular media filtration Pretreatment by membrane filtration Comparison of granular media and membrane pretreatment Reverse osmosis separation Post-treatment of desalinated water Desalination plant discharge management Desalination project cost estimates

Handbook of Environmental Engineering: Membrane and desalination technologies

This handbook emphasizes the use of synthetic membranes for separations involving industrial or municipal process streams. The ten chapters are authored by some of the world's leading experts in the field of membrane science and technology. Discussions on theory, engineering aspects, membrane preparation and typical and projected applications of the various membrane processes are included.

Membrane Handbook

In this essential new volume, Volume 13: Membrane and Desalination Technologies, a panel of expert researchers provide a wealth of information on membrane and desalination technologies. An advanced chemical and environmental engineering textbook as well as a comprehensive reference book, this volume is of high value to advanced graduate and undergraduate students, researchers, scientists, and designers of water and wastewater treatment systems. This is an essential part of the Handbook of Environmental Engineering series, an incredible collection of methodologies that study the effects of pollution and waste in their three basic forms: gas, solid, and liquid. Chapters adopt the series format, employing methods of practical design and calculation illustrated by numerical examples, including pertinent cost data whenever possible, and exploring in great detail the fundamental principles of the field. Volume 13: Membrane and Desalination Technologies is an essential guide for researchers, highlighting the latest developments in principles of membrane technology, membrane systems planning and design, industrial and municipal waste treatments, desalination requirements, wastewater reclamation, biofiltration, and more.

Physicochemical Treatment Processes

Membrane Characterization provides a valuable source of information on how membranes are characterized, an extremely limited field that is confined to only brief descriptions in various technical papers available online. For the first time, readers will be able to understand the importance of membrane characterization, the techniques required, and the fundamental theory behind them. This book focuses on characterization techniques that are normally used for membranes prepared from polymeric, ceramic, and composite materials. Features specific details on many membrane characterization techniques for various membrane materials of industrial and academic interest Contains examples of international best practice techniques for the evaluation of several membrane parameters, including pore size, charge, and fouling Discusses various membrane models more suitable to a specific application Provides examples of ab initio calculations for the design, optimization, and scale-up of processes based on characterization data

Pretreatment for Reverse Osmosis Desalination

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

Membrane Separation Principles and Applications

Desalination Technology: Health and Environmental Impacts covers the latest developments in desalination, examining the environmental and public health-related impacts of these technologies. Written by international experts, the text presents specifications for assessing water quality, technical issues associated with desalination technologies, and the chemical aspects of desalinated water and its microbiology. The book also discusses environmental protection issues that assist in the optimization of proposed and existing desalination facilities to ensure that nations and consumers enjoy the benefits of the expanded access to desalinated water. This includes coverage of health and environmental issues such as energy conservation and sustainability as well as protection of delicate coastal ecosystems and groundwater from contamination by surface disposal of concentrates—challenges that must be addressed during the design, construction, and operation of a desalination facility. Development of new and improved desalination technologies, including major cost reduction trends, have significantly broadened the opportunities to access large quantities of safe water in many parts of the world. And while there are many books available on desalination, this book's unusual approach blends technical coverage of the latest technologies with coverage of the environmental and public health-related impacts of these technologies, setting it apart from other resources. It provides technical guidance based on the practical expertise of a balanced group of international scientists and engineers.

Renewable Energy Powered Desalination Handbook

The past 30 years have seen the emergence of a growing desire worldwide to take positive actions to restore and protect the environment from the degrading effects of all forms of pollution: air, noise, solid waste, and water. Because pollution is a direct or indirect consequence of waste, the seemingly idealistic demand for “zero discharge” can be construed as an unrealistic demand for zero waste. However, as long as waste exists, we can only attempt to abate the subsequent pollution by converting it to a less noxious form. Three major questions usually arise when a particular type of pollution has been identified: (1) How serious is the pollution? (2) Is the technology to abate it available? and (3) Do the costs of abatement justify the degree of abatement achieved? The principal intention of the Handbook of Environmental Engineering series is to help readers formulate answers to the last two questions. The traditional approach of applying tried-and-true solutions to specific pollution problems has been a major contributing factor to the success of environmental engineering, and has accounted in large measure for the establishment of a “methodology of pollution control.” However, realization of the ever-increasing complexity and interrelated nature of current environmental problems makes it imperative that intelligent planning of pollution abatement systems be undertaken.

Emerging Technologies for Sustainable Desalination Handbook

During the past 20 years, the field of mechanical engineering has undergone enormous changes. These changes have been driven by many factors, including: the development of computer technology worldwide competition in industry improvements in the flow of information satellite communication real time monitoring increased energy efficiency robotics automatic control increased sensitivity to environmental impacts of human activities advances in design and manufacturing methods These developments have put more stress on mechanical engineering education, making it increasingly difficult to cover all the topics that a professional engineer will need in his or her career. As a result of these developments, there has been a growing need for a handbook that can serve the professional community by providing relevant background and current information in the field of mechanical engineering. The CRC Handbook of Mechanical Engineering serves the needs of the professional engineer as a resource of information into the next century.

Handbook of Industrial Membranes

There is great interest in the novel mass-transport properties of graphene-based membrane materials, especially for environmental applications such as wastewater treatment and reuse, gas separation and water desalination. Graphene-based Membranes for Mass Transport Applications is a comprehensive overview of the research in this area. Starting with current state-of-the-art membrane-based filtration and separation technologies, the book then explores the structure,

composition and general properties of graphene-based membranes including nanoporous graphene and graphene oxide followed by the selective mass transport properties of the membranes. The final chapters look at their specific use in barrier applications, purification and separation applications and water desalination. Edited by leading researchers, the book provides an introduction and reference to physicists, chemists, material scientists, chemical engineers and students who are entering or already working in the field of graphene-based membrane materials.

Advanced Physicochemical Treatment Processes

For the Nonengineering Professional Perfect for anyone without a background in science or engineering who wants to take a closer look at how water is processed and treated, Reverse Osmosis: A Guide for the Nonengineering Professional relates reverse osmosis in its most basic form and addresses growing concerns about the quality of tap water. What is reverse osmosis? Not to be confused with filtration—which involves straining or size exclusion—reverse osmosis involves a diffusive mechanism and separation process that is dependent on solute concentration, pressure, and the water flux rate. This book describes all of the basic processes involved in reverse osmosis operations. Presented in a conversational style—using jargon-free language—it discusses in detail the drinking water purification, wastewater reuse, desalination processes, and other freshwater applications used to ensure the safe consumption of water. The book also places special emphasis on pharmaceuticals and personal care product (PPCP) contaminants, which are not typically removed from wastewater by conventional treatment processes, however, they can be removed by processes using sophisticated membrane filtration. The author provides a basic understanding of membrane technology, and explains the membrane treatment process. He details how the processes fit together within a drinking water or wastewater treatment system and presents concepts that make up water and wastewater treatment processes as a whole. He also highlights advances in reverse osmosis technology and discusses relevant applications. Presents a comprehensive coverage of reverse osmosis Discusses fundamental processes and equipment used in reverse osmosis Provides technical terminology in simplified form Reverse Osmosis: A Guide for the Nonengineering Professional explains how reverse osmosis is used in drinking water purification and provides readers with step-by-step instruction on the pretreatment, treatment, and post-treatment technology used in the purification of drinking water.

Fundamentals of Salt Water Desalination

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, merialized membrane processes, and gives a state-of-the-art review of new membrane pro environmental, water treatment, pharmaceutical, medical, food, dairy, beverage, paper, tex cess concepts under development. It is intended tile, and

electronic industries. The existing ap to be a single source of underlying principles, membranes, membrane modules, process de plications include: (1) dialysis for the purifica tion of human blood (the artificial kidney), (2) sign, applications, and cost estimates. It is also electro dialysis for the desalination of brackish a first attempt to bridge the gap between the water to produce potable 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 pro from this handbook. It can be used as educa tein 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 pro synthetic membranes, it will serve as a single cesses generally have low capital investment, as source of reference for the entire field.

Membrane Technology and Applications

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, merialized membrane processes, and gives a state-of-the-art review of new membrane pro environmental, water treatment, pharmaceutic al, medical, food, dairy, beverage, paper, tex cess concepts under development. It is intended tile, and electronic industries. The existing ap to be a single source of underlying principles, membranes, membrane modules, process de plications include: (1) dialysis for the purifica tion of human blood (the artificial kidney), (2) sign, applications, and cost estimates. It is also electro dialysis for the desalination of brackish a first attempt to bridge the gap between the water to produce potable 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 pro from this handbook. It can be used as educa tein 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 pro synthetic membranes, it will serve as a single cesses generally have low capital investment, as source of reference for the entire field.

Handbook of Membrane Separations

This handbook emphasizes the use of sythetic membranes for separations involving industrial or municipal process streams. Discussions on theory, engineering aspects, membrane preparation, and typical and projected applications of the various membrane processes are included.

Reverse Osmosis

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.

Sustainable Desalination Handbook

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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