Membrane Technologies For Water Treatment Removal Of Toxic Trace Elements With Emphasis On Arsenic Fluoride And Uranium Sustainable Water Management Treatment Efficiency And Reuse

Presenting a useful reference to the current state of membrane technology and its likely future growth, this book covers all aspects of the technology and its applications in the water industry. Drawing on the experience of international experts, Membrane Technology in Water and Wastewater Treatment encompasses many practical applications of specific membranes, including MF, UF, NF, RO and EDR, in the treatment of ground and surface water, backwash water, seawater, and industrial and domestic wastewater. Novel applications, process enhancements and the latest systems are also discussed. This book is an excellent guide to membrane technology and will be of great interest to water companies, industrialists, legislative bodies and anyone with an interest in the technology or its applications.

Best water filtration strategies for the '90s. Get the engineering savvy you need to capitalize on membrane technology for effective water filtration. Water Treatment Membrane Processes, by the American Water Works Association Research Foundation, enables you to use membrane filtration methods for purifying drinking water--and utilize new research for wastewater treatment. This richly illustrated guide shows you how to apply membrane processes in numerous water treatment applications. . .model membrane performance. . .and take charge of field evaluation and piloting. You'll see how to implement nanofiltration, ultrafiltration, microfiltration, and electrodialysis techniques--and make the most of membrane reactors, bioreactors and ion exchange membrane reactors.

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.

This book analyses the sustainability of membrane operations applied on an industrial scale, as well as that of those under investigation on lab/pilot scales, covering also the preparation of both polymeric and inorganic membranes. It presents reverse osmosis in desalination, membrane bioreactors for municipal wastewater treatment and pressure-driven industrial wastewater treatment in agrofood and textile fields as examples of industrial membrane operations. Regarding the membrane processes still on a lab/pilot scale, the analysis includes membrane operations for the recovery of valuable products from wastewater streams, for the removal of toxic compounds from water/wastewater, and for zero liquid discharge approaches in desalination. The book offers
a useful guide for scientists and engineers working in various fields, including membrane technology, separation, desalination, and wastewater treatment. Alberto Figoli and Alessandra Criscuoli are both Senior Researchers at the Institute on Membrane Technology (ITM-CNR), Italy.

This publication presents the lectures given at the course on Advanced Separation Technology for Industrial Waste Minimization: Environmental and Analytical Aspects (13-15 October, 1992, Ispra, Italy) organized jointly by the Technical University of Lisbon, University of Calabria and the Environment Institute of the Joint Research Centre of the Commission of the European Communities at Ispra. This course is integrated in a programme for education and training in Advanced Separation Technology for Industrial Waste Minimization supported by the Community Action Programme for Education and Training for Technology (COMETT II). The lecture material is based on case studies of importance to textile, tanneries, pulp and paper, metal finishing and electroplating, food, and other industries. Environmental regulations have lead industrial engineers to search for more efficient, less energy consuming and less waste producing processes. Membrane-based separation processes contributed to recover water, raw materials and energy and to achieve simultaneously pollution control. Along this book emphasis will be given to this fast growing area of process technology.

The book examines the possibility of integrating different membrane unit operations (microfiltration, ultrafiltration, nanofiltration, reverse osmosis, electrodialysis and gas separation) in the same industrial cycle or in combination with conventional separation systems. It gives careful analysis of the technical aspects, and the possible fields of industrial development. The book reviews many original solutions in water desalination, agro-food productions and wastewater treatments, highlighting the advantages achievable in terms of product quality, compactness, rationalization and optimization of productive cycles, reduction of environmental impact and energy saving. Also included are examples of membrane reactors and their integration with a fuel cell; polymeric membranes in the integrated gasification combined cycle power plants; integrating a membrane reformer into a solar system; and potential application of membrane integrated systems in the fusion reactor fuel cycle. With detailed analysis and broad coverage, the book is divided into two sections: Bio-applications and Inorganic Applications.

Membrane technologies are currently the most effective and sustainable methods utilized in diversified water filtration, wastewater treatment, as well as industrial and sustainable energy applications. This book covers essential subsections of membrane separation and bioseparation processes from the perspectives of technical innovation, novelty, and sustainability. The book offers a comprehensive overview of the latest improvements and concerns with respect to membrane fouling remediation techniques, issues of bioincompatibility for biomedical applications, and various subareas of membrane separation processes, which will be an efficient resource for engineers.

The high rate of industrialization around the world has led to an increase in the rate of anthropogenic activities which involves the release of different types of contaminants into the aquatic environment generating high environmental risks, which could affect health and socio-economic activities if not treated properly. There is no doubt that the rapid progress in improving the water quality
and management has been motivated by the latest developments in green chemistry. Over the past decade, sources of water pollutants and the conventional methods used for the treatment of industrial wastewater treatment has flourished. Water quality and its adequate availability have been a matter of concern worldwide particularly in developing countries. According to a World Health Organization (WHO) report, more than 80% of diseases are owing to the consumption of contaminated water. Heavy metals are highly toxic that are a potential threat for water, soil, and air, their consumption in higher concentrations provided hazardous outcomes. The water quality is usually measured keeping in mind chemical, physical, biological, and radiological standards. The discharge of the effluent by industries contains heavy metals, hazardous chemicals, and a high amount of organic and inorganic impurities those can contaminate the water environment, and hence, human health. Therefore, it is our primary responsibility to maintain the water quality in our respective countries. This book provides understanding, occurrence, identification, toxic effects and control of water pollutants in aquatic environment using green chemistry protocols. It focuses on water remediation properties and processes including industry-scale water remediation technologies. This book covers recent literature on remediation technologies in preventing water contamination and its treatment. Chapters in this book discuss remediation of emerging pollutants using nanomaterials, polymers, advanced oxidation processes, membranes, and microalgae bioremediation, etc. It also includes photochemical, electrochemical, piezoacoustic, and ultrasound techniques. It is a unique reference guide for graduate students, faculties, researchers and industrialists working in the area of water science, environmental science, analytical chemistry, and chemical engineering.

Contributed by multiple experts, the book covers the scientific and engineering aspects of membrane processes and systems. It aims to cover basic concepts of novel membrane processes including membrane bioreactors, microbial fuel cell, forward osmosis, electro-dialysis and membrane contactors. Maintains a pragmatic approach involving design, operation and cost analysis of pilot plants as well as scaled-up counterparts

The book covers the subject of membrane bioreactors (MBR) for wastewater treatment, dealing with municipal as well as industrial wastewaters. The book details the 3 types of MBR available and discusses the science behind the technology, their design features, operation, applications, advantages, limitations, performance, current research activities and cost. As the demand for wastewater treatment, recycling and re-use technologies increases, it is envisaged that the membrane separation bioreactor will corner the market. Contents Membrane Fundamentals Biological Fundamentals Biomass Separation Membrane Bioreactors Membrane Aeration and Extractive Bioreactors Commercial Membrane Bioreactor Systems Membrane Bioreactor Applications Case Studies

This book discusses major technological advances in the treatment and re-use of wastewater. Its focus is on both novel treatment strategies and the modifications and adaptions of conventional processes to optimize the treatment of a complex variety of pollutants, including organic matter, chemicals and micropollutants in different water resources, as well as the integration of water treatment with bioelectricity production. Written by leading researchers in the field, it will be of interest to a wide range of researchers in both industry and academia. Dyes, pigments and metals are extensively used in food, paper, carpet, rubber, plastics, cosmetics, and textile industries, in order to color and finish products. As a result, they generate a considerable amount of coloured wastewater rich in organic, inorganic, and mineral
substances which are continuously polluting the water bodies and affecting human and aquatic life. Besides these industries, urban and agricultural activities also generate effluents high in biochemical oxygen demand (BOD) and chemical oxygen demand (COD). In recent years, considerable research work has been done in this area and is underway to eliminate heavy metals particularly mercury (Hg), chromium (Cr), lead (Pb), selenium and cadmium (Cd) and synthetic dyes from polluted waters which have high toxicity and carcinogenicity. Currently a number of methods are in operation to decontaminate the polluted waters. Among several purification technologies, use of nanoparticles/composites have gained much attention as efficient purification technology due to its many advantages such as simple synthesis, special chemical and physical properties, unique photocatalytic activity and beneficial antimicrobial properties and high efficiency. The book Environmental Nanotechnology for Water Purification comprehensively covers and provides new insights on all nanoparticles, composites and advanced methods employed in water purification.

Sustainable Technologies for Water and Wastewater Treatment discusses relevant sustainable technologies for water and wastewater treatment pertaining to a nanoscale approach to water treatment and desalination, membrane-based technologies for water recovery and reuse, the energy and water nexus, degradation of organic pollutants, nascent technologies, bio and bio-inspired materials for water reclamation and integrated systems, and an overview of wastewater treatment plants. The book focuses on advanced topics including in situ generation of hydroxyl radicals, which can aid in the indiscriminate oxidation of any contaminant present in wastewater, making advanced oxidation processes commercially viable. Features: A comprehensive review of current and novel water and wastewater treatment technologies from a sustainability perspective All the sustainable technologies, such as desalination, wastewater treatment, advanced oxidation processes, hydrodynamic cavitation, membrane-based technologies, sonosorption, and electrospun fibers Discussion on reference materials for important research accomplishments in the area of water and environmental engineering Theoretical aspects covering principles and instrumentation A summary on sustainability, including life cycle assessment (LCA), energy balance and large-scale implementation of advanced techniques This book is aimed at professionals, graduate students, and researchers in civil, chemical, environmental engineering, and materials science.

The most commonly used biological wastewater treatment technologies still have serious technical-economical and sustainability-related limitations, due to their high energy requirements, poor effluent quality, and lack of energy and resource recovery processes. In this thesis, novel electrochemical membrane bioreactors (EMBRs), which take advantage of membrane separation and bioelectrochemical techniques, are developed for wastewater treatment and the simultaneous recovery of energy and resources. Above all, this innovative system holds great promise for the efficient wastewater treatment and energy recovery. It can potentially recover net energy from wastewater while at the same time harvesting high-quality effluent. The book also provides a proof-of-concept study showing that electrochemical control might offer a promising in-situ means of suppressing membrane fouling. Lastly, by integrating electrodialysis into EMBRs, phosphate separation and recovery are achieved. Hence, these new EMBR techniques provide viable alternatives for sustainable wastewater treatment and resource recovery.

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The primary objective of this book is to support the basic human need, water and its treatment are of the utmost importance. However, some rural areas are disadvantaged and have difficulty in effectively treating their water supply, which can affect the health and safety of their region. To protect and defend citizens, research must supply effective and applicable methods in securing the safety and drinkability of water. Membrane Technology for Water and Wastewater Treatment in Rural Regions is an essential publication that discusses the fabrication and characterization of membranes, processes and operations, and specific applications of membranes on water and wastewater treatment. Moreover, the book discusses selected promising aspects of membrane usage in the industry with a focus on palm oil mill industry, sewage management and treatment, and water treatment in rural areas. Featuring coverage on a broad range of topics including membrane processes, water production, and transport resistances, this book is ideally designed for engineers, chemists, environmentalists, public officials, researchers, academicians, students, and industry professionals.
The need for fresh water is increasing with the rapid growth of the world's population. In countries and regions with available water resources, it is necessary to ensure the health and safety of the water supply. However, in countries and regions with limited freshwater resources, priority is given to water supply plans and projects, among which the desalination strategy stands out. In the desalination process, membrane and thermal processes are used to obtain fresh water from salty water that is in abundant amounts in the sea. This book will outline valuable scientific contributions to the new desalination and water treatment technologies to obtain high quality water with low negative environmental impacts and cost. The editors would like to record their sincere thanks to the authors for their contributions.
Biomimetic and bioinspired membranes are the most promising type of membrane for multiple usage scenarios, including commercial separation applications as well as water and wastewater treatment technologies. In recent years, aquaporin biomimetic membranes (ABMs) for water purification have raised considerable interest. These membranes display uniquely favorable properties and outstanding performances, such as diverse interactions, varied selective transport mechanisms, superior stability, high resistance to membrane fouling, and distinct adaptability. Biomimetic membranes would make a significant contribution to alleviate water stress, environmental threats, and energy consumption.
The topic collection “Membranes and Membrane Technologies” consists of papers published by Trans Tech Publications Inc. from 2012 up to 2017 and it covers a wide range of engineering solutions in the field of properties research, development, and production of various types of membranes and their use in the technologies for the treatment of the drink water and wastewater, gas separation, bioindustry, etc. We hope this collection will be useful and interesting to a broad audience of researchers and engineers.
Advances in Membrane Technologies for Water TreatmentMaterials, Processes and ApplicationsElsevier
Membrane systems are finding increasing application worldwide in the purification of potable and industrial water, and their design
and use is set to grow considerably in years to come. This comprehensive book is written in a practical style with emphasis on process description, key unit operations, plant equipment description, equipment installation, safety and maintenance, process control, plant start-up, operation and troubleshooting. It is supplemented by case studies and useful engineering rules-of-thumb. The author is a chemical engineer with many years experience in the field and his technical knowledge and practical know-how in the water purification industry are summarised succinctly in this volume. This book... * Will ensure your system design is fit for its purpose * Informs readers of which membranes to use; why, where and when * Will help readers to trouble-shoot and improve performance * Provides case studies help understanding through real-life situations This book... * Will ensure your system design is fit for its purpose * Informs readers of which membranes to use; why, where and when * Will help readers to trouble-shoot and improve performance * Provides case studies help understanding through real-life situations The book explores basic concepts and advanced topics in the field of water technologies. It deals extensively with advances in materials, material selection, preparation, characterization and application. The relevance of water technologies in industries is considered, and a section is dedicated to describing and analyzing the technologies required for water reuse and advanced purification, including desalination. Nuclear desalination, low-carbon desalination and water purification technologies to address the adverse impacts of climate change are examined from both the adaptation and mitigation points of view. Aimed at senior undergraduate/graduate students in chemical, civil and environmental engineering, along with wastewater and desalination researchers, this book: Details advanced water treatments for varied processes. Describes membrane and desalination techniques for water reuse and advanced purification. Elaborates water technologies at both the front and back ends of the process. Discusses modern technologies for effluent treatment and water recycling. Explores the role of information technology in the water sector. Current Trends and Future Developments in Bio-Membranes: Membrane Technology for Water and Wastewater Treatment - Advances and Emerging Processes presents recent advances and a status update on the applications of membrane processes to both urban and industrial wastewater. Specific case studies of membrane technologies are described. Membrane processes have been widely studied, but their application in the wastewater sector is increasing rapidly. The book deals with the applications to the wastewater sector (e.g. MBR, NF, RO, ED) and emerging membrane technologies (e.g. MBfR, MD, FO, MFC). Specific case studies of membrane technology application and relevant wastewaters (e.g. municipal, dairy, oily refinery, etc.) are also discussed. Presents recent advances of wastewater treatment using membrane processes Outlines novel and emerging membrane technologies, e.g., membrane distillation, forward osmosis and membrane biofilm reactors Includes recent developments of more consolidated membrane processes, e.g., membrane biological reactors, nanofiltration, reverse osmosis, etc., either for water treatment or desalination Includes interesting and instructive case studies on the application of membrane technologies to various wastewater sources, e.g., municipal, dairy, olive mill, refinery, pulp and paper Membrane-Based Hybrid Processes for Wastewater Treatment analyzes and discusses the potential of membrane-based hybrid processes
for the treatment of complex industrial wastewater, the recovery of valuable compounds, and water reutilization. In addition, recent and future trends in membrane technology are highlighted. Industrial wastewater contains a large variety of compounds, such as heavy metals, salts and nutrients, which makes its treatment challenging. Thus, the use of conventional water treatment methods is not always effective. Membrane-based hybrid processes have emerged as a promising technology to treat complex industrial wastewater. Discusses the properties, mechanisms, advantages, limitations and promising solutions of different types of membrane technologies Addresses the optimization of process parameters Describes the performance of different membranes Presents the potential of Nanotechnology to improve the treatment efficiency of wastewater treatment plants (WWTPs) Covers the application of membrane and membrane-based hybrid treatment technologies for wastewater treatment Includes forward osmosis, electrodialysis, and diffusion dialysis Considers hybrid membrane systems expanded to cover zero liquid discharge, salt recovery, and removal of trace contaminants

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.

Principles of Membrane Bioreactors for Wastewater Treatment covers the basic principles of membrane bioreactor (MBR) technology, including biological treatment, membrane filtration, and MBR applications. The book discusses concrete principles, appropriate design, and operational aspects. It covers a wide variety of MBR topics, including filtration theory, membrane materials and geometry, fouling phenomena and properties, and strategies for minimizing fouling. Also covered are the practical aspects such as operation and maintenance. Case studies and examples in the book help readers understand the basic concepts and principles clearly, while problems presented help advance relevant theories more deeply. Readers will find this book a helpful resource to understand the state of the art in MBR technology. Focuses on the application of membrane technologies in removing toxic metals\metalloys from water. Particular attention is devoted to the removal of arsenic, uranium, and fluoride. These compounds are all existing in the earth's crust at levels between two and five thousands micrograms per kg (parts per million) on average and these compounds can be considered highly toxic to humans, who are exposed to them primarily from air, food and water. In order to comply with the new maximum contaminant level, numerous studies have been undertaken to improve established treatments or to develop novel treatment technologies for removing toxic metals from contaminated surface and groundwater. Among the technologies available, applicable for water treatment, membrane technology has been identified as a promising technology to remove such toxic metals from water. The book describes both pressure driven (traditional processes, such as Nanofiltration, Reverse Osmosis, Ultrafiltration,etc) and more advanced membrane processes (such as forward osmosis, membrane distillation, and membrane bio-reactors) employed in the application of interest. Key aspect of this book is to provide information on both the basics of membrane technologies and on the results depending on the type of technology employed.
This ready reference on Membrane Technologies for Water Treatment, is an invaluable source detailing sustainable, emerging processes, to provide clean, energy saving and cost effective alternatives to conventional processes. The editors are internationally renowned leaders in the field, who have put together a first-class team of authors from academia and industry to present a highly approach to the subject. The book is an instrumental tool for Process Engineers, Chemical Engineers, Process Control Technicians, Water Chemists, Environmental Chemists, Materials Scientists and Patent Lawyers.

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.

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.

Water is accepted as the most important source of life. It is assumed that life began in water and spread from there to the whole world. But water has been polluted anthropogenically since the beginning of the industrial revolution in the late 19th century. At the end of the 20th century, most water sources cannot be used for aquaculture, irrigation, and human use. Therefore, for sustainable development, we have to protect our water sources on Earth, because it's the only planet we have!

Over the past few decades the boom in the industrial sector has contributed to the release in the environment of pollutants that have no regulatory status and which may have significant impact on the health of animals and humans. These pollutants also refer as “emerging pollutants” are mostly aromatic compounds which derive from excretion of pharmaceutical, industrial effluents and municipal discharge. Some form of pollutions have also evolved, including the proliferation of acid mine drainage from oxidation or weathering of obsolete and unmanaged excavations around the world; this results mostly in the dispersion of inorganic pollutants in the environment at level surpassing the treatment capacity of conventional techniques. It is recurrent these days to find water treatment plants which no longer produce water that fits the purpose of domestic consumption based on newly established guidelines. This situation has prompted water authorities and researchers to develop tools for proper prediction and control of the dispersion of pollutants in the environment to ensure that appropriate measures are taken to prevent the occurrence of outbreaks due to sudden load of these pollutants in the water system. The chapters in this book cover a wide range of nano and bio-based techniques that have been designed for the real time detection of emerging contaminants in environmental water sources, geochemical models that are continuously improved for the prediction of inorganic contaminants migration from the mine solid wastes into ground and surface waters. Remediation strategies are also discussed and include effective techniques based on nanotechnology, advanced membrane filtration, oxidative and bio- degradation processes using various types of nanocatalysts, biocatalysts...
or supporting polymer matrices which are under advanced investigations for their implementation at large scale for the removal of recalcitrant pollutants from polluted water. This book is divided into two sections, the first section covers the occurrence of emerging pollutants in environmental water while the second section covers state of the art research on the removal of emerging pollutants from water using sustainable technologies. A total of 13 chapters addressing various topics related to the two sections are essentially based on recent development in the respective field which could have a significant impact on the enhancement of the performance of wastewater treatment plants around the world and especially in developing countries where access to clean and safe water remains a daily challenge. Over the past half century, reverse osmosis (RO) has grown from a nascent niche technology into the most versatile and effective desalination and advanced water treatment technology available. However, there remain certain challenges for improving the cost-effectiveness and sustainability of RO desalination plants in various applications. In low-pressure RO applications, both capital (CAPEX) and operating (OPEX) costs are largely influenced by product water recovery, which is typically limited by mineral scale formation. In seawater applications, recovery tends to be limited by the salinity limits on brine discharge and cost is dominated by energy demand. The combination of water scarcity and sustainability imperatives, in many locations, is driving system designs towards minimal and zero liquid discharge (M/ZLD) for inland brackish water, municipal and industrial wastewaters, and even seawater desalination. Herein, we review the basic principles of RO processes, the state-of-the-art for RO membranes, modules and system designs as well as methods for concentrating and treating brines to achieve MLD/ZLD, resource recovery and renewable energy powered desalination systems. Throughout, we provide examples of installations employing conventional and some novel approaches towards high recovery RO in a range of applications from brackish groundwater desalination to oil and gas produced water treatment and seawater desalination. Advanced membranes—from fundamentals and membrane chemistry to manufacturing and applications A hands-on reference for practicing professionals, Advanced Membrane Technology and Applications covers the fundamental principles and theories of separation and purification by membranes, the important membrane processes and systems, and major industrial applications. It goes far beyond the basics to address the formulation and industrial manufacture of membranes and applications. This practical guide: Includes coverage of all the major types of membranes: ultrafiltration; microfiltration; nanofiltration; reverse osmosis (including the recent high-flux and low-pressure membranes and anti-fouling membranes); membranes for gas separations; and membranes for fuel cell uses Addresses six major topics: membranes and applications in water and wastewater; membranes for biotechnology and chemical/biomedical applications; gas separations; membrane contractors and reactors; environmental and energy applications; and membrane materials and characterization Includes discussions of important strategic issues and the future of membrane technology With chapters contributed by leading experts in their specific areas and a practical focus, this is the definitive reference for professionals in industrial manufacturing and separations and research and development; practitioners in the manufacture and applications of membranes; scientists in water treatment, pharmaceutical, food, and fuel cell processing industries; process engineers; and others. It is also an excellent resource for researchers in industry and academia and graduate students taking courses in separations and membranes and related fields. 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.

Emerging Membrane Technology for Sustainable Water Treatment provides the latest information on the impending crisis posed by water stress and poor sanitation, a timely issue that is one of the greatest human challenges of the 21st century. The book also discusses the use of membrane technology, a serious contender that can be used to confront the crisis on a global scale, along with its specific uses as a solution to this escalating problem. Provides a unique source on membrane technology and its application for water treatment Focuses on technologies designed for the treatment of seawater and brackish water Highlights the most economically and environmentally friendly membrane technologies Lists various technologies and emphasizes their link to renewable energy, energy efficiency, nanotechnology, reuse, and recycle

Advances in Membrane Technologies for Water Treatment: Materials, Processes and Applications provides a detailed overview of advanced water treatment methods involving membranes, which are increasingly seen as effective replacements for a range of conventional water treatment methods. The text begins with reviews of novel membrane materials and advances in membrane operations, then examines the processes involved with improving membrane performance. Final chapters cover the application of membrane technologies for use in water treatment, with detailed discussions on municipal wastewater and reuse in the textile and paper industries. Provides a detailed overview of advanced water treatment methods involving membranes Coverage includes advancements in membrane materials, improvement in membrane performance, and their applications in water treatment Discusses the use of membrane technologies in the production of drinking water, desalination, wastewater treatment, and recovery

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