

Membrane cleaning methods

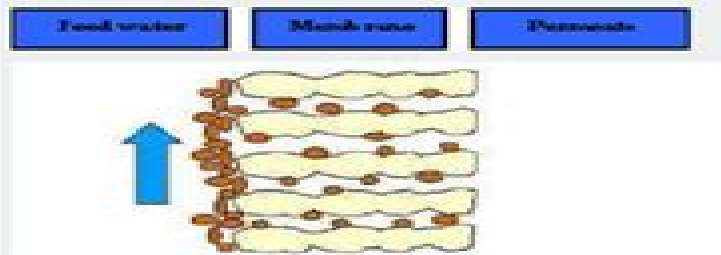
Membrane technology

There are several different membrane cleaning methods, such as forward flush, backward flush and air flush.

- When **forward flush** is applied, membranes are flushed with feed water or permeate forward. The feed water or permeate flows through the system more rapidly than during the production phase. Because of the more rapid flow and the resulting turbulence, particles that are absorbed to the membrane are released and discharged. The particles that are absorbed to membrane pores are not released. These particles can only be removed through backward flushing.
- **Backward flush** is a reversed filtration process. Permeate is flushed through the feed water side of the system under pressure, applying twice the flux that is used during filtration. When the flux has not restored itself sufficiently after back flushing, a chemical cleaning process can be applied.
- During a **chemical cleaning process**, membranes are soaked with a solution of chlorine bleach, hydrochloric acid or hydrogen peroxide. First the solution soaks into the membranes for a number of minutes and after that a forward flush or backward flush is applied, causing the contaminants to be rinsed out.
- A newer cleaning method is the so-called **air flush or air/ water flush**. This is a forward flush during which air is injected in the supplier pipe. Because air is used (while the water speed remains the same), a much more turbulent cleaning system is created.

Forward flush

When forward flush is applied in a membrane, the barrier that is responsible for dead-end management is opened. At the same time the membrane is temporarily performing cross-flow filtration, without the production of permeate. The purpose of a forward flush is the removal of a constructed layer of contaminants on the membrane through the creation of turbulence. A high hydraulic pressure gradient is in order during forward flush.



Backward flush

When backward flush is applied the pores of a membrane are flushed inside out. The pressure on the permeate side of the membrane is higher than the pressure within the membranes, causing the pores to be cleaned. A backward flush is executed under a pressure that is about 2.5 times greater than the production pressure. Permeate is always used for a backward flush, because the permeate chamber must always be free of contagion. A consequence of backward flush is a decrease in recovery of the process. Because of this, a

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Z F Cui,H S Muralidhara



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Methods in Non-Aqueous Enzymology Munishwar N. Gupta, 2013-12-01 Extending the range of enzymatic catalysis by using non aqueous media has now developed into a powerful approach in biochemistry and biotechnology One peculiar feature which distinguishes it from the conventional enzymology carried out in aqueous buffers is that the awareness of different parameters that control and influence the behaviour of enzymes in such environments has emerged rather slowly Science is about being able to repeat what somebody else has done Absence of knowledge about such well defined parameters factors has sometimes made some workers rather cautious and diffident about using this approach in their laboratories But for this non aqueous enzymology would be more widely practised It is these thoughts that made me feel that the availability of some well defined protocols for various applications involving enzymes in non aqueous environments would further catalyze the growth of this area Hence this book in which each chapter has some protocols in a specific area The protocols are preceded by brief background material The early chapters which are of general importance concern control of water activity and stabilization via immobilization Some subsequent chapters provide the protocols for transformations involving lipids and carbohydrates peptide synthesis and preparation of chiral compounds The disproportionate focus on lipases is not a coincidence this class of enzymes has been used more often than others in non aqueous enzymology

Membrane Technology Enhancement for Environmental Protection and Sustainable Industrial Growth Zhien Zhang, Wenxiang Zhang, Mohamed Mehdi Chehimi, 2020-12-14 This book presents a detailed discussion of the fundamentals and practical applications of membrane technology enhancement in a range of industrial processes energy recovery and resource recycling To date most books on the applications of membrane technology have mainly focused on gas pollution removal or industrial wastewater treatment In contrast the enhancement of various membrane processes in the areas of energy and the environment has remained largely overlooked This book highlights recent works and industrial products using membrane technology while also discussing experiments and modeling studies on the membrane enhancement process

Waste Water Treatment Technologies - Volume II Saravanamuthu Vigneswaran , 2009-09-25 Water and Wastewater Treatment Technologies theme is a component of Encyclopedia of Water Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty one Encyclopedias The Theme on Water and Wastewater Treatment Technologies deals in three volumes and covers several topics with several issues of great relevance to our world such as Urban Wastewater Treatment Characteristics of Effluent Organic Matter in Wastewater Filtration Technologies in wastewater treatment Air Stripping in Industrial Wastewater Treatment Dissolved air flotation in industrial wastewater treatment Membrane Technology for Organic Removal in Wastewater Adsorption and Biological Filtration in Wastewater Treatment Physico chemical processes for Organic removal from wastewater effluent Deep Bed Filtration Modelling Theory And Practice Specific options in biological wastewater

treatment for reclamation and reuse Biological Phosphorus Removal Processes For Wastewater Treatment Sequencing Batch Reactors Principles Design Operation And Case Studies Wastewater stabilization ponds WSP for wastewater treatment Treatment of industrial wastewater by membrane bioreactors Stormwater treatment technologies Sludge Treatment Technologies Wastewater Treatment Technology For Tanning Industry Palm Oil And Palm Waste Potential In Indonesia Recirculating Aquaculture Systems A Review Upflow anaerobic sludge blanket UASB reactor in wastewater treatment Applied Technologies In Municipal Solid Waste Landfill Leachate Treatment Water Mining Planning and Implementation Issues for a successful project Assessment methodologies for water reuse scheme and technology Nanotechnology for Wastewater Treatment These three volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts Managers and Decision makers and NGOs

Membrane Based Methods for Dye Containing Wastewater Subramanian Senthilkannan Muthu, Ali Khadir, 2021-10-13 This book highlights recent findings of membrane based dye removal methods along with the application of photocatalytic nanofiltration and ultrafiltration membrane including membrane based fibers metal organic frameworks polyethersulfone ceramic etc Among water and wastewater pollutants dyes have been normally observed and detected in various aquatic solutions including rivers and lakes Aesthetic pollution toxicity persistent and carcinogenicity are some of the adverse effects of dyes entering the ecosystem Although dyes have brought a colourful world their presence in the environment are responsible for adverse effects on the planet Diverse physical chemical and biological methods are available to treat dye contaminated water This book presents membrane separation technology that has been developed in the past decade to treat different wastewaters and owing to its effective performance has garnered the attention of academia and industry alike

Membrane filtration guidance manual, 2003 **Advances in Synthesis Gas: Methods, Technologies and Applications** Mohammad Reza Rahimpour, Mohammad Amin Makarem, Maryam Meshksar, 2022-10-18 Advances in Synthesis Gas Methods Technologies and Applications Syngas Process Modelling and Apparatus Simulation consists of numerical modeling and simulation of different processes and apparatus for producing syngas purifying it as well as synthesizing different chemical materials or generating heat and energy from syngas These apparatus and processes include but are not limited to reforming gasification partial oxidation swing technologies and membranes Introduces numerical modeling and the simulation of syngas production processes and apparatus Describes numerical models and simulation procedures utilized for syngas purification processes and equipment Discusses modelling and simulation of processes using syngas as a source for producing chemicals and power

Membrane Technology Z F Cui, H S Muralidhara, 2010-09-23 Membrane technology is a rapidly developing area with key growth accross the process sector including biotech separation and biomedical applications e g haemodialysis artificial lungs through to large scale industrial applications in the water and waste water processing and the food and drink industries As processes mature and the cost of

membranes continues to dramatically reduce so their applications and use are set to expand Process engineers need access to the latest information in this area to assist with their daily work and to help to develop and apply new and ever more efficient liquid processing solutions This book covers the latest technologies and applications with contributions from leading figures in the field Throughout the emphasis is on delivering solutions to practitioners Real world case studies and data from leading organizations including Cargill Lilly Microbach ITT mean this book delivers the latest solutions as well as a critical working reference to filtration and separation professionals Covers the latest technologies and applications in this fast moving bioprocessing sector Presents a wide range of case studies that ensure readers benefit from the hard won experience of others saving time money and effort World class author team headed up by the Chair of Chemical Engineering at Oxford University UK and the VP of Plant Operations and Process Technology at Cargill Corp the food services company and largest privately owned company in the US

Handbook of Membrane Separations Anil Kumar Pabby, Syed S.H. Rizvi, Ana Maria Sastre Requena, 2015-04-09 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

Innovative Materials and Methods for Water Treatment Marek Bryjak, Nalan Kabay, Bernabe L. Rivas, Jochen Bundschuh, 2016-02-17 Due to increasing demand for potable and irrigation water water suppliers have to use alternative resources They either have to regenerate wastewater or deal with contaminated surface water This book brings together the experiences of various experts in preparing of innovative materials that are selective for arsenic and chromium removal and in

Advances in Wastewater Treatment II Kinjal J. Shah, Vimal Gandhi, 2021-06-20 The book reviews advanced methods of wastewater treatments Included are oxidation processes for the degradation of organic molecules applications of nanomaterials and nanocomposites in membrane based processes design of adsorption columns photocatalytic degradation processes and the removal of dyes pesticides and pharmaceutical compounds Keywords Degradation of Organic Molecules Nano Filtration Ultrafiltration Microfiltration Nanomaterial based Membranes Adsorption Columns Nano Carbon Cage Photocatalytic Degradation Dyes Pesticides Pharmaceutical Compounds Advanced Oxidation Processes Complex Organic Molecules Perfluorooctanoic Acid Hydrolytic Acidification Levofloxacin Degradation Catalytic Degradation Energy Storage

Current Trends and Future Developments on (Bio-) Membranes Angelo Basile, Mario Gensini, Ivo Allegrini, Alberto Figoli, 2023-01-31 Current Trends and Future Developments on Bio Membranes Membrane Technologies in Environmental Protection and Public Health Challenges and Opportunities illustrates the application of membrane technology used in separation processes along with the advantages of membranes in comparison with other types of separation methods In addition the book illustrates new approaches for pollution monitoring and helps researchers develop new membrane systems for air or water pollution monitoring Sections focus on the application of membrane technology to new membranes hence it is

ideal for R D managers in industry and a variety of others including academic researchers and postgraduate students working in strategic treatment separation and purification processes Includes membrane purification processes relating to environmental applications and membrane based tools for air monitoring Discusses membrane water potabilization Presents a comprehensive reference on recent applications of membrane technology in environmental monitoring and pollution processes

Membranes for Water Treatment and Remediation Ashok Kumar Nadda, Priya Banerjee, Swati Sharma, Phuong Nguyen-Tri, 2023-03-03 This book provides comprehensive description of polymeric membranes in water treatment and remediation It describes both the sustainability challenges and new opportunities to use membranes for water decontamination It also discusses the environmental related issues challenges and advantages of using membrane based systems and provides comprehensive description of various polymeric membranes nanomaterials biomolecules and their integrated systems for wastewater treatment Various topics covered in this book are direct pressure driven and osmotic driven membrane processes hybrid membrane processes such as membrane bioreactors and integrating membrane separation with other processes and resource recovery oriented membrane based processes The book will be useful for students researchers and professionals working in the area of materials science and environmental chemistry

Advances in Separation Sciences Pravin G Ingole, Chaudhery Mustansar Hussain, 2024-11-30 *Advances in Separation Sciences Sustainable Processes and Technologies* discusses the different separation technologies and their applications in a variety of industrial processes The book lists the pros and cons of the various processes for specialized application and outlines selection criteria to provide readers with the knowledge they need to develop processes and technologies themselves Divided into eight parts chapters cover sustainable perspectives and developments theory and mechanisms of various separation processes advances in sample preparation techniques advances in chromatography advances in membrane technology advances in microfluidics green and sustainable separation sciences and challenges and commercialization In depth and step by step descriptions of the various processes and technologies explanations of their inclusion in modern industry and scales for both experimental and theoretical models are also included Includes new research findings and relates them to industrial applications Identifies new research needs and opportunities Includes both mechanisms and applications Provides fundamental knowledge of separation processes through theories and problems Includes challenges and solutions for the commercialization of separation processes

Hydrophobic Ceramic Membranes for CO₂ Capture Zhaohao Li, Jinjin Yang, Hongming Fu, Haiping Chen, 2024-12-03 This book focuses on developing and optimizing ceramic membranes with hydrophobic and superhydrophobic properties for CO₂ capture in membrane contactors aimed at improving CO₂ capture technology in thermal power plants and other industries It examines the preparation of ceramic membranes the mass transfer mechanisms in porous media and the specific processes involved in capturing CO₂ The book also compares the performance of commercial Al₂O₃ ceramic membranes with traditional polytetrafluoroethylene membranes and explores

ways to enhance the efficiency of CO₂ capture by addressing challenges such as membrane wetting and increased mass transfer resistance. Additionally, it introduces a cost-effective superhydrophobic ceramic membrane made from power plant waste fly ash, analyzing its performance and surface dynamics for CO₂ capture applications. It is a useful tool for researchers, academics, professionals, and graduates interested in the field of chemical engineering, environmental science, and materials science, particularly those focused on CO₂ capture technologies, membrane science, and clean energy solutions.

Membrane Engineering in the Circular Economy Adolfo Iulianelli, Alfredo Cassano, Carmela Conidi, Konstantinos Petrotos, 2022-04-12. *Membrane Engineering in the Circular Economy: Renewable Sources Valorization in Energy and Downstream Processing in Agro food Industry* describes the modification of the general concept of waste, including waste valorization as added value products that are useful for energy production and biotechnology industries. Speaking to the relevance of this new vision, the book highlights the fundamentals of membrane operations in the exploitation of renewable sources for energy production and the valorization of agro food waste at the industrial level. This book is an excellent resource for researchers, biologists, membranologists, and engineers in chemistry, biochemical engineering, food sciences, and the agro food refinery industry. It discusses membrane engineering for agro food wastes transformation into added value products, presents circular and zero waste economy principles pursued by membrane technology and applied to the agro food industry, and includes potentialities of agro food wastes for renewable and energy production via membrane operations.

HISTORY, DEVELOPMENT AND MANAGEMENT OF WATER RESOURCES - Volume II, 2010-05-15. These volumes are part of Encyclopedia of Water Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty-one Encyclopedias. The two volumes present the state of the art subject matter of various aspects of History, Development, and Management of Water Resources. These volumes are aimed at the following five major target audiences: University and College Students, Educators, Professional Practitioners, Research Personnel, and Policy and Decision Makers.

Application of Nanotechnology in Membranes for Water Treatment Alberto Figoli, Jan Hoinkis, Sacide Alsoy Altinkaya, Jochen Bundschuh, 2017-07-14. The book focuses on Application of Nanotechnology in Membranes for Water Treatment but not only provides a series of innovative solutions for water reclamation through advanced membrane technology but also serves as a medium to promote international cooperation and networking for the development of advanced membrane technology for Universal well-being and to achieve the common goal of supplying economically, environmentally, and societally sustainable freshwater and better sanitation systems. This book is unique because the chapters were authored by established researchers all around the globe based on their recent research findings. In addition, this book provides a holistic coverage of membrane development for water treatment from the membrane preparation and characterizations to the performance for specific processes and applications. Since that water scarcity has become a global risk and one of the most serious challenges for the scientific community in this century, the publication of

this book is therefore significant as it will serve as a medium for a good reference of an alternative solution in water reclamation This book will provide the readers with a thorough understanding of the different available approaches for manufacturing membranes both with innovative polymeric systems and inorganic nano materials which could give enhanced functionalities catalytic and antimicrobial activities to improve the performance of the existing membranes It will be useful for leading decision and policy makers water sector representatives and administrators policy makers from the governments business leaders business houses in water treatment and engineers scientists from both industrialized and developing countries as well

Edible Nanomaterials, 2024-11-05 *Edible Nanomaterials* Volume 107 highlights new advances in the field of medicine with this new volume presenting interesting chapters on topics including Plant derived edible nanoparticles and their therapeutic utilities Endogenous and artificial carbon dots from edible sources Synthesis applications in biomedicine and uses as fluorescent analytical probes Nano edible coatings Panoramic Exploration of Comestible Nanomaterials for enhancement of food quality and safety and their environmental impact Nanonutraceuticals Exploring the nanoencapsulation route for bioactive delivery Synthesis of Edible Nanoparticles for Food Applications and much more Additional sections explore Plants as Emerging Nano Factories A Green Approach Edible Nanomaterials for Biomedical Devices Therapeutics Agents and Regenerative Tissue Engineering Plants as Nanofactories and Synthesis Strategies of Edible Nanoparticles Advancements and Perspectives Highlights new advances in the field of medicine with this volume presenting topics surrounding Plant derived edible nanoparticles Covers applications in biomedicine and uses as fluorescent analytical probes and as Nano edible coatings Delves into Edible Nanomaterials for Biomedical Devices Therapeutics Agents and Regenerative Tissue Engineering

Membrane Processes in Separation and Purification J.G. Crespo, Karl W. Böddeker, 1994-06-30 The current vigour in separations research principally derives from the need for pioneering separations processes in an emerging technology biotechnology from new societal emphases reduction of chemical emissions into the environment as well as from opportunities for achieving dramatic improvements in the efficiency of a number of manufacturing technologies through the development of a new generation of membranes novel membrane applications Accordingly the contributions to this volume are grouped into Membranes in Biotechnology 11 papers Membranes in Environmental Technology 6 papers and New Concepts 4 papers This is followed by one contribution each on Energy Requirements and Education i e membrane processes within an academic curriculum The book thus amounts to a state of the art review of applied membrane processes Even though other texts have appeared in recent years a more documented practical book is needed with a strong interaction with the collateral disciplines of materials sciences life sciences and environmental science This book emphasizes the need for such an integrated approach to membrane processes

Waste Recycling Technologies for Nanomaterials Manufacturing Abdel Salam Hamdy Makhlouf, Gomaa A. M. Ali, 2021-05-09 This book discusses the recent advances in the wastes recycling technologies to provide low cost and alternative ways for

nanomaterials production It shows how carbon nanomaterials can be synthesized from different waste sources such as banana fibers argan *Argania spinosa* seed shells corn grains camellia *oleifera* shell sugar cane bagasse oil palm empty fruit bunches and leaves and palm kernel shells Several nanostructured metal oxides MnO_2 Co_3O_4 can be synthesized via recycling of spent batteries The recovered nanomaterials can be applied in many applications including Energy supercapacitors solar cells etc water treatments heavy metal ions and dyes removal and other applications Spent battery and agriculture waste are rich precursors for metals and carbon respectively The book also explores the various recycling techniques agriculture waste recycling batteries recycling and different applications of the recycled materials

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