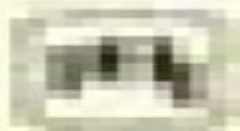




# MEMBRANE SEPARATION PROCESSES



RAMSHPAL NATH

# Membrane Separation Processes By Kaushik Nath

**Sundergopal Sridhar**



## **Membrane Separation Processes By Kaushik Nath:**

*MEMBRANE SEPARATION PROCESSES* KAUSHIK NATH, 2017-01-01 This concise and systematically organized text now in its second edition gives a clear insight into various membrane separation processes. It covers the fundamentals as well as the recent developments of different processes along with their industrial applications and the products. It includes the basic principles, operating parameters, membrane hardware, flux equation, transport mechanism, and applications of membrane based technologies. Membrane separation processes are largely rate controlled separations which require rate analysis for complete understanding. Moreover, a higher level of mathematical analysis along with the understanding of mass transfer is also required. These are amply treated in different chapters of the book to make the students comprehend the membrane separation principles with ease. This textbook is primarily designed for undergraduate students of chemical engineering, biochemical engineering, and biotechnology for the course in membrane separation processes. Besides, the book will also be useful to process engineers and researchers. **KEY FEATURES** Provides sufficient number of examples of industrial applications related to chemical, metallurgical, biochemical, and food processing industries. Focuses on important biomedical applications of membrane based technologies such as blood oxygenator, controlled drug delivery, plasmapheresis, and bioartificial organs. Includes chapter end short questions and problems to test students' comprehension of the subject. **NEW TO THIS EDITION** A new section on membrane cleaning is included. Membrane fabrication methods are supplemented with additional information. Chapter 2: Additional information on silt density index, forward osmosis, and sea water desalination. Chapter 3: Physicochemical parameters affecting nanofiltration, determination of various resistances using resistance in series model, and few more industrial applications with additional short questions. Chapter 4: Membrane cross linking methods used in pervaporation, factors affecting pervaporation, and few more applications. Chapter 9: Membrane distillation, membrane reactor with different modules, types of membranes, and reactions for membrane reactor. Chapter 13: **Membrane**

**Processes** S. Sridhar, Siddhartha Moulik, 2018-12-18 A reference for engineers, scientists, and academics who want to be abreast of the latest industrial separation treatment technique, this new volume aims at providing a holistic vision on the potential of advanced membrane processes for solving challenging separation problems in industrial applications. Separation processes are challenging steps in any process industry for isolation of products and recycling of reactants. Membrane technology has shown immense potential in separation of liquid and gaseous mixtures, effluent treatment, drinking water purification, and solvent recovery. It has found endless popularity and wide acceptance for its small footprint, higher selectivity, scalability, energy saving capability, and inherent ease of integration into other unit operations. There are many situations where the target component cannot be separated by distillation, liquid extraction, and evaporation. The different membrane processes such as pervaporation, vapor permeation, and membrane distillation could be used for solving such industrial bottlenecks. This book covers the entire array of fundamental aspects: membrane synthesis and applications in the chemical

process industries CPI It also includes various applications of pervaporation vapor permeation and membrane distillation in industrially and socially relevant problems including separation of azeotropic mixtures close boiling compounds organic organic mixtures effluent treatment along with brackish and seawater desalination and many others These processes can also be applied for extraction of small quantities of value added compounds such as flavors and fragrances and selective removal of hazardous impurities viz volatile organic compounds VOCs such as vinyl chloride benzene ethyl benzene and toluene from industrial effluents Including case studies this is a must have for any process or chemical engineer working in the industry today Also valuable as a learning tool students and professors in chemical engineering chemistry and process engineering will benefit greatly from the groundbreaking new processes and technologies described in the volume **MASS**

**TRANSFER** N. Anantharaman, K. M. Meera Sheriffa Begum, 2011-05 Mass transfer operations are of great importance in a process industry as it has a direct impact on the cost of the final product A chemical process engineer therefore should have sound knowledge of the basics of mass transfer and its applications This book is designed to equip the reader with sufficient knowledge of mass transfer operations and face the challenges ahead The objective of this textbook is to teach a budding chemical engineer the principles involved in analyzing a process and apply the desired mass transfer operation to separate the components involved It deals with operations involving diffusion interphase mass transfer humidification drying crystallization absorption distillation extraction leaching and adsorption The principles and equipment used for different mass transfer operations have been lucidly explained Designed for a two semester course this text is primarily intended for the undergraduate students of chemical pharmaceutical petrochemical engineering as well as biotechnology and industrial biotechnology It will also be useful to plant engineers and design professionals **KEY FEATURES** 1 Explains the theoretical concepts with full derivation of equations 2 Illustrates the application of theory through worked out numerical examples 3 Provides exercise problems with answers at the end of each chapter for practice Membrane Technologies and Applications Kaustubha Mohanty, Mihir K. Purkait, 2011-12-19 Compiling recent advances in membrane separations technology this highly relevant book introduces cost effective solutions for separation problems in a wide range of industries It discusses membrane use in water and wastewater treatment food and dairy industry and fuel cell applications It describes the role of membrane technologies in resource recovery pollution prevention and energy production as well as environmental monitoring and quality control A concise resource for emerging technologies this book provides the tools to implement effective production processes improve environmental protection and public health and explore new opportunities for the industry *Membrane Technology* Sundergopal Sridhar, 2018-09-03 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

**Modeling in Membranes and Membrane-Based Processes** Anirban Roy, Siddhartha Moulik, Reddi Kamesh, Aditi Mullick, 2020-04-07 The book Modeling in Membranes and Membrane Based Processes is based on the idea of developing a reference which will cover most relevant and state of the art approaches in membrane modeling This book explores almost every major aspect of modeling and the techniques applied in membrane separation studies and applications This includes first principle based models thermodynamics models computational fluid dynamics simulations molecular dynamics simulations and artificial intelligence based modeling for membrane separation processes These models have been discussed in light of various applications ranging from desalination to gas separation In addition this breakthrough new volume covers the fundamentals of polymer membrane pore formation mechanisms covering not only a wide range of modeling techniques but also has various facets of membrane based applications Thus this book can be an excellent source for a holistic perspective on membranes in general as well as a comprehensive and valuable reference work Whether a veteran engineer in the field or lab or a student in chemical or process engineering this latest volume in the Advances in Membrane Processes is a must have along with the first book in the series Membrane Processes also available from Wiley Scrivener

**Sustainable Technologies for Water and Wastewater Treatment** Noel Jacob Kaleekkal, Prasanna Kumar S Mural, Saravanamuthu Vigneswaran, Upal Ghosh, 2021-07-05 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

Membrane Separation Processes Patrick Meares, 1976

A FIRST COURSE IN BIOPROCESS ENGINEERING NATH, KAUSHIK, 2024-05-13 This concise and systematically organized text provides a fundamental overview of bioprocess engineering in a simple and straightforward manner with emphasis on its scope and applications It is built on core concepts such as thermodynamics stoichiometry reactor design transport phenomena and process control The book helps students familiarize the state of the art knowledge

in topics such as metabolic engineering enzyme kinetics biomass growth and propagation fermentation and other industrial bioprocesses

**KEY FEATURES** The book fully conforms to the model curriculum of biotechnology and bioprocess engineering as per AICTE guideline prescribed at senior undergraduate and graduate levels Contains extensive illustrative drawings graphical presentation images and tables for better understanding of the subject Covers major concepts of biochemical engineering including applications in bioprocesses fermentation technologies enzymatic processes and downstream separation processes amongst others Provides a balanced blend of microbiology biochemistry and chemical engineering knowledge base relevant to bioprocess design operation and scale up Includes chapter end review questions and problems to test students comprehension of the subject Summarises Key points at the end of each chapter as a ready reckoner for the students to recapitulate

**TARGET AUDIENCE** B Tech Biotechnology B Tech Chemical Engineering P G Diploma in Bioprocess Technology M Tech Biotechnology

Membrane Separation Processes Ahmad Fauzi Ismail, Takeshi Matsuura, 2021-10-15

Membrane Separation Processes Theories Problems and Solutions provides graduate and senior undergraduate students and membrane researchers in academia and industry with the fundamental knowledge on the topic by explaining the underlying theory that is indispensable for solving problems that occur in membrane separation processes All major membrane processes are discussed and an economic analysis is provided Separation processes such as RO UF MF RO PRO and MD are thoroughly discussed During the last two decades the scope of the R D of membrane separation processes has been significantly broadened Other sections in the book cover membrane contactor and membrane adsorption In addition hybrid systems in which two or more membrane systems are combined are now being investigated for large scale applications Written by renowned experts with extensive experience with industry education and R D who have complementary expertise In depth coverage of the most important conventional and emerging membrane processes Provides fundamental membrane theories for solving problems in separation processes without using complicated software

**Biosensors** Baljinder Kaur, Santosh Kumar, Brajesh Kumar Kaushik, 2024-12-17

Comprehensive resource covering new technologies materials strategies and recent advancements in the field of biosensing Biosensors summarizes cutting edge technologies in biosensing including gene editing known as Clustered Regularly Interspaced Short Palindromic Repeat or CRISPR quorum sensing utilizing inter and intra cell signals two dimensional 2D materials and aptamer mediated sensor designs and more with additional coverage of the latest materials strategies and advancements made in the field Chapters are categorized on the basis of various bio recognition elements that include aptamer nucleic acid enzymes antibodies bacteriophages peptides and molecular imprinted polymers Plasmonic surface enhanced Raman scattering colorimetric fluorescence electrochemical magneto and piezo electric biosensor sensing techniques are also considered The roles of various nanomaterials advancement in synthesis signal enhancement strategies and new trends for biomedical applications are also described Current challenges limitations and future prospects to developing biosensors for point of care and clinical applications are

also discussed Written by three highly qualified authors Biosensors includes information on Diverse bio receptors include nucleic acids aptamers enzymes antibodies bacteriophages molecularly imprinted polymers whole cell and techniques of immobilization Different transduction principles using bio receptors e g optical electrochemical piezo electrical and SERS to detect microorganism toxins and diseases Nanomaterials synthesis their role in biosensing pros and cons of carbon polymer metals metal oxides and quantum dots based nanomaterials in medical biosensing applications Biosensors is a comprehensive and complete resource on the subject for researchers and professionals in physics chemistry and biomedical science research communities working in the fields of plasmonics optics biosensors and nano photonics and students in related programs of study **Journal of Scientific and Industrial Research** ,2012 **Synthetic Membranes and Membrane Separation Processes** Takeshi Matsuura,2020-09-10 Synthetic Membranes and Membrane Separation Processes addresses both fundamental and practical aspects of the subject Topics discussed in the book cover major industrial membrane separation processes including reverse osmosis ultrafiltration microfiltration membrane gas and vapor separation and pervaporation Membrane materials membrane preparation membrane structure membrane transport membrane module and separation design and applications are discussed for each separation process Many problem solving examples are included to help readers understand the fundamental concepts of the theory behind the processes The book will benefit practitioners and students in chemical engineering environmental engineering and materials science **Microbial Niche Nexus Sustaining Environmental Biological Wastewater and Water-Energy-Environment Nexus** Senthilkumar Kandasamy,Maulin P Shah,Kavitha Subbiah,Naveenkumar Manickam,2025-01-15 In most of the industries industrial effluent treatment plants are playing vital roles to ensure the efficient management of industrial effluent for supporting sustainable development of our society Due to the technological development new concepts about future wastewater management are being incorporated by process industries in the whole world including recyclable resources and energy nutrient recovery from industrial effluent etc However conventional treatment methods including biotechnological methods used in treatment plants are facing a lot of difficulties due to the strict discharging norms and coming out of new fangled pollutants Recently a novel concept microbial niche nexus sustaining biological wastewater treatment was introduced which can accomplish the significant removal of toxic emerging pollutants by different microbial communities with the concern of other components like integrated and healthy ecosystem The book focuses on research related to future potential and progress of microbial niche based environmental biotechnology such as microbial enrichment microbial function system design new technological developments and its applications Besides the book reviews important interconnections between water energy and the environment as security in water and energy and the environment is associated with human beings natural resources economic and environmental sustainability In addition the book describes innovative green technologies with the aim of enhancing the present state of the art technologies in the various fields like water energy the environment and the related

potential fields of industrial wastewater treatment      **Ashland) . Patent Reports. series 5 - Membrane Separation Processes** Patent Reports / Lexington Data, Lexington Data inc, 19??      **Microbial Degradation of Synthetic Dyes in Wastewaters** Shree Nath Singh, 2014-10-16 Today synthetic dyes are used extensively in the textile dyeing paper printing color photography pharmaceuticals food and drink cosmetic and leather industries As of now over 100 000 different dyes are available with an annual production of over 700 000 metric tons These industries discharge an enormous amount of colored effluents into natural water bodies with or without treatment The textile industry alone discharges 280 000 tons of dyes every year making it the largest contributor to colored effluent discharge Although a variety of treatment technologies are available including adsorption chemical oxidation precipitation coagulation filtration electrolysis and photodegradation biological and microbiological methods employing activated sludge pure cultures microbial consortia and degradative enzymes are economically viable effective and environmentally responsible options As such this book gathers review articles from international experts working on the microbial degradation of synthetic dyes offering readers the latest information on the subject It is intended as a quick reference guide for academics scientists and industrialists around the world

**Transport Mechanisms in Membrane Separation Processes** J G a Bitter, 1991-07-31      **Membrane Processes in Separation and Purification** J.G. Crespo, Karl W. Böddeker, 2013-11-11 The chapters of this book are based upon lectures presented at the NATO Advanced Study Institute on Membrane Processes in Separation and Purification March 21 April 2 1993 Curia Portugal organized as a successor and update to a similar Institute that took place 10 years ago p M Bungay H K Lonsdale M N de Pinho Eds Synthetic Membranes Science Engineering and Applications NATO ASI Series Reidel Dordrecht 1986 The decade between the two NATO Institutes witnesses the transition from individually researched membrane processes to an applied and established membrane separation technology as is reflected by the contents of the corresponding proceeding volumes By and large the first volume presents itself as a textbook on membrane processes still valid while the present volume focuses on areas of separation need as amenable to membrane processing Biotechnology and Environmental Technology Accordingly the contributions to this volume are grouped into Membranes in Biotechnology 11 papers Membranes in Environmental Technology 6 papers and New Concepts 4 papers This is followed by one contribution each on Energy Requirements and Education i e membrane processes within an academic curriculum The book thus amounts to a state of the art of applied membrane processing and may well augment the more fundamental approach of its predecessor

*Ion-Exchange Membrane Separation Processes* H Strathmann, 2004-02-12 Today membranes and membrane processes are used as efficient tools for the separation of liquid mixtures or gases in the chemical and biomedical industry in water desalination and wastewater purification Despite the fact that various membrane processes like reverse osmosis are described in great detail in a number of books processes involving ion exchange membranes are only described in a fragmented way in scientific journals and patents even though large industrial applications like electrodialysis have been



around for over half a century Therefore this book is emphasizing on the most relevant aspects of ion exchange membranes This book provides a comprehensive overview of ion exchange membrane separation processes covering the fundamentals as well as recent developments of the different products and processes and their applications The audience for this book is heterogeneous as it includes plant managers and process engineers as well as research scientists and graduate students The separate chapters are based on different topics The first chapter describes the relevant Electromembrane processes in a general overview The second chapter explains thermodynamic and physicochemical fundamentals The third chapter gives information about ion exchange membrane preparation techniques while the fourth and fifth chapter discusses the processes as unit operations giving examples for the design of specific plants First work on the principles and applications of electrodialysis and related separation processes Presently no other comprehensive work that can serve as both reference work and text book is available Book is suited for teaching students and as source for detailed information      *Membrane Separation Processes* Jerry Meldon, 2008-03-01

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