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聚焦研究前沿

深化自主创新



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2014年11月



前 言

该专题的宗旨是为教学科研提供学科热点和前沿情报等学术资讯，由浙江工业大学图书馆信息咨询部整理编制。数据来源为我校购买的各类数字资源，通过分析整理，编写了人文社会科学领域相关的最新热点论文、最新研究前沿等信息，以期开展科学研究、申报课题基金项目等学术活动提供帮助。

本期为海水淡化专辑，我们整理了从汤森路透（Thomson Reuters）Web of Science 数据库中摘选了化学工程类期刊上刊载的2014年以海水淡化为主题的论文，以及ESI数据库收录期刊所刊载的以海水淡化为主题的高被引论文。

ESI针对22个专业领域，通过论文数、论文被引频次、论文篇均被引频次、高被引论文、热点论文和前沿论文等6大指标，从各个角度对国家/地区科研水平、机构学术声誉、科学家学术影响力以及期刊学术水平进行全面衡量。

高被引论文（Highly Cited Paper(last 10 years)），即刊载于ESI收录期刊中最近10年间各研究领域中被引频次排名位于全球前1%的论文。这些论文是由汤森路透公司统计的10年内被频繁引用，引用次数位居同领域前列的论文。

本专题所列内容涉及的有关图示说明：

4 Citations: 17

HOT PAPER **RESEARCH FRONT** **WEB OF SCIENCE**

Title: UPDATE 1 OF: SYNTHESIS AND FUNCTIONALIZATION OF INDOLES THROUGH PALLADIUM-CATALYZED REACTIONS

Authors: CACCHI S, FABRIZI G

Source: CHEMREV


111: PR215-PR283 2011

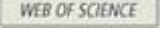
Addresses: Univ Rome, Dipartimento Chim & Technol Farmaco, Ple A Moro 5, I-00185 Rome, Italy
Univ Rome, Dipartimento Chim & Technol Farmaco, I-00185 Rome, Italy

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本期数据来自 ESI 基本科学指标数据库（Essential Science Indicators）。

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检索词:

海水淡化: "seawater desalination" or desalination or "sea water desalination"

海水淡化 ESI 高被引论文

第 1 条, 共 85 条

标题: Off-design performance analysis of a solar-powered organic Rankine cycle

作者: Wang, JF (Wang, Jiangfeng); Yan, ZQ (Yan, Zhequan); Zhao, P (Zhao, Pan); Dai, YP (Dai, Yiping)

来源出版物: ENERGY CONVERSION AND MANAGEMENT 卷: 80 页: 150-157 DOI: 10.1016/j.enconman.2014.01.032 出版年: APR 2014

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摘要: Performance evaluation of a thermodynamic system under off-design conditions is very important for reliable and cost-effective operation. In this study, an off-design model of an organic Rankine cycle driven by solar energy is established with compound parabolic collector (CPC) to collect the solar radiation and thermal storage unit to achieve the continuous operation of the overall system. The system off-design behavior is examined under the change in environment temperature, as well as thermal oil mass flow rates of vapor generator and CPC. In addition, the off-design performance of the system is analyzed over a whole day and in different months. The results indicate that a decrease in environment temperature, or the increases in thermal oil mass flow rates of vapor generator and CPC could improve the off-design performance. The system obtains the maximum average exergy efficiency in December and the maximum net power output in June or in September. Both the net power output and the average exergy efficiency reach minimum values in August. (C) 2014 Elsevier Ltd. All rights reserved.

作者关键词: Solar energy; Organic Rankine cycle; Off-design performance

KeyWords Plus: REVERSE-OSMOSIS DESALINATION; CONDENSATION HEAT-TRANSFER; REFRIGERANT R-134A; PRESSURE-DROP; OPTIMIZATION; DRIVEN; ENERGY; SYSTEM; COLLECTORS; EXCHANGER

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第 2 条, 共 85 条

标题: A novel thin film composite forward osmosis membrane prepared from PSf-TiO₂ nanocomposite substrate for water desalination

作者: Emadzadeh, D (Emadzadeh, D.); Lau, WJ (Lau, W. J.); Matsuura, T (Matsuura, T.); Rahbari-Sisakht, M (Rahbari-Sisakht, M.); Ismail, AF (Ismail, A. F.)

来源出版物: CHEMICAL ENGINEERING JOURNAL 卷: 237 页: 70-80 DOI: 10.1016/j.cej.2013.09.081 出版年: FEB 1 2014

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摘要: In this work, polysulfone (PSf)-titanium dioxide (TiO₂) nanocomposite substrates were prepared by incorporating different amounts of TiO₂ nanoparticles (ranging from zero to 1 wt%) into PSf matrix. The nanocomposite substrates so prepared were then characterized with respect to hydrophilicity, overall porosity, surface roughness and cross-sectional morphology. It was found that both hydrophilicity and porosity of the substrate were increased upon addition of TiO₂. In addition, long finger-like structures were developed by increasing the TiO₂ loading, leading to water permeability enhancement. In order to fabricate thin film nanocomposite (TFN) membranes for forward osmosis (FO) application, a thin polyamide layer was formed by interfacial polymerization of 1,3-phenyldiamine and 1,3,5-benzenetricarbonyl trichloride on the top surface of PSf-TiO₂ nanocomposite substrates. Under the conditions for FO performance evaluation (10 mM NaCl concentration in feed solution, 0.5 and 2.0 M NaCl concentration in draw solution, and both active layer facing the feed solution (AL-FS) and active layer facing the draw solution (AL-DS) orientations), the TFN membrane prepared using PSf substrate embedded with 0.5 wt% TiO₂ nanoparticles (denoted as TFN0.5) exhibited the most promising results by showing high water permeability and low reverse solute flux. In comparison with control TFC membrane, the water flux of TFN0.5 membrane was improved by 86-93%, depending on the membrane orientation and draw solution concentration. The increase in water permeability can be attributed to decrease in structural parameter which resulted in decreased internal concentration polarization (ICP). Although further increase in TiO₂ nanoparticles loading to 0.75 and 1 wt% could result in higher water permeability, their FO performances were compromised by a significant increase in reverse solute flux. Based on the results obtained in this work, it can be concluded that adding an appropriate amount of TiO₂ nanoparticles into PSf substrate could potentially improve the performance of TFC membrane during FO applications. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Thin film nanocomposite membrane; Forward osmosis; TiO₂ nanoparticles; Substrate; Water desalination

KeyWords Plus: PRESSURE-RETARDED OSMOSIS; ENHANCED PERFORMANCE; TIO2 NANOPARTICLES; HYBRID MEMBRANES; REVERSE-OSMOSIS; CARBOXYLIC-ACID; FLUX BEHAVIOR; RO MEMBRANES; POLYAMIDE; LAYER

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标题: Effects of flow cell design on charge percolation and storage in the carbon slurry electrodes of electrochemical flow capacitors

作者: Dennison, CR (Dennison, C. R.); Beidaghi, M (Beidaghi, M.); Hatzell, KB (Hatzell, K. B.); Campos, JW (Campos, J. W.); Gogotsi, Y (Gogotsi, Y.); Kumbur, EC (Kumbur, E. C.)

来源出版物: JOURNAL OF POWER SOURCES 卷: 247 页: 489-496 DOI: 10.1016/j.jpowsour.2013.08.101 出版年: FEB 1 2014

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摘要: The electrochemical flow capacitor (EFC) is an electrical energy storage concept recently introduced for grid-scale energy storage applications. The EFC utilizes flowable carbon-based electrodes as the active material in a flow battery type architecture for capacitive storage and recovery of energy. Charged slurry can be stored in external reservoirs until it is needed, enabling scalable energy storage to satisfy a variety of large-scale applications. Here, the capacitance and conductivity of EFC slurry electrodes were measured as a function of flow rate (from 0 to 10 ml min⁻¹) and flow cell channel depth (electrode 'thickness', ranging from 0.5 to 3 mm). The effect of salt concentration in the electrolyte was also explored. The interfacial resistance associated with the current collector/slurry interface was found to constitute a large portion of the total cell resistance. Bulk slurry conductivity was found to vary significantly with changes in electrolyte concentration, flow rate and channel depth. Very respectable capacitance values of up to similar to 30 F ml⁻¹ (150 F g⁻¹) were obtained during intermittent flow operation. However, significant underutilization of the slurry due to increased ohmic losses at larger channel depths was observed, as evidenced by a rapid decay in capacitance with increasing channel depth. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Carbon slurry; Electrochemical flow capacitor; Energy storage; Flow battery; Flowable electrode; Supercapacitor

KeyWords Plus: ENERGY-STORAGE; BATTERY; DEIONIZATION; DESALINATION; TRANSPORT; MEMBRANE; MODEL

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第 4 条, 共 85 条

标题: Selective Trans-Membrane Transport of Alkali and Alkaline Earth Cations through Graphene Oxide Membranes Based on Cation- π Interactions

作者: Sun, PZ (Sun, Pengzhan); Zheng, F (Zheng, Feng); Zhu, M (Zhu, Miao); Song, ZG (Song, Zhigong); Wang, KL (Wang, Kunlin); Zhong, ML (Zhong, Minlin); Wu, DH (Wu, Dehai); Little, RB (Little, Reginald B.); Xu, ZP (Xu, Zhiping); Zhu, HW (Zhu, Hongwei)

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摘要: Graphene and graphene oxide (G-O) have been demonstrated to be excellent filters for various gases and liquids, showing potential applications in areas such as molecular sieving and water desalination. In this paper, the selective trans-membrane transport properties of alkali and alkaline earth cations through a membrane composed of stacked and overlapped G-O sheets ("G-O membrane") are investigated. The thermodynamics of the ion transport process reveal that the competition between the generated thermal motions and the interactions of cations with the G-O sheets results in the different penetration behaviors to temperature variations for the considered cations (K^+ , Mg^{2+} , Ca^{2+} and Ba^{2+}). The interactions between the studied metal atoms and graphene are quantified by first-principles calculations based on the plane-wave-basis-set density functional theory (DFT) approach. The mechanism of the selective ion trans-membrane transportation is discussed further and found to be consistent with the concept of cation- π interactions involved in biological systems. The balance between cation- π interactions of the cations considered with the sp^2 clusters of G-O membranes and the desolvation effect of the ions is responsible for the selectivity of G-O membranes toward the penetration of different ions. These results help us better understand the ion transport process through G-O membranes, from which the possibility of modeling the ion transport behavior of cellular membrane using G-O can be discussed further. The selectivity toward different ions also makes G-O membrane a promising candidate in areas of membrane separations.

PubMed ID: 24401025

作者关键词: selective permeation; cation- π interaction; graphene oxide; alkali and alkaline earth cations; thermodynamics; first-principles calculations

KeyWords Plus: EXFOLIATED GRAPHITE; BENZENE; WATER; FILMS

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第 5 条, 共 85 条

标题: Direct prediction of the desalination performance of porous carbon electrodes for capacitive deionization

作者: Porada, S (Porada, S.); Borchardt, L (Borchardt, L.); Oschatz, M (Oschatz, M.); Bryjak, M (Bryjak, M.); Atchison, JS (Atchison, J. S.); Keesman, KJ (Keesman, K. J.); Kaskel, S (Kaskel, S.); Biesheuvel, PM (Biesheuvel, P. M.); Presser, V (Presser, V.)

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摘要: Desalination by capacitive deionization (CDI) is an emerging technology for the energy-and cost-efficient removal of ions from water by electrosorption in charged porous carbon electrodes. A variety of carbon materials, including activated carbons, templated carbons, carbon aerogels, and carbon nanotubes, have been studied as electrode materials for CDI. Using carbide-derived carbons (CDCs) with precisely tailored pore size distributions (PSD) of micro-and mesopores, we studied experimentally and theoretically the effect of pore architecture on salt electrosorption capacity and salt removal rate. Of the reported CDC-materials, ordered mesoporous silicon carbide-derived carbon (OM SiC-CDC), with a bimodal distribution of pore sizes at 1 and 4 nm, shows the highest salt electrosorption capacity per unit mass, namely 15.0 mg of NaCl per 1 g of porous carbon in both electrodes at a cell voltage of 1.2 V (12.8 mg per 1 g of total electrode mass). We present a method to quantify the influence of each pore size increment on desalination performance in CDI by correlating the PSD with desalination performance. We obtain a high correlation when assuming the ion adsorption capacity to increase sharply for pore sizes below one nanometer, in line with previous observations for CDI and for electrical double layer capacitors, but in contrast to the commonly held view about CDI that mesopores are required to avoid electrical double layer overlap. To quantify the dynamics of CDI, we develop a two-dimensional porous electrode modified Donnan model. For two of the tested materials, both containing a fair degree of mesopores (while the total electrode porosity is similar to 95 vol%), the model describes data for the accumulation rate of charge (current) and salt accumulation very well, and also accurately reproduces the effect of an increase in electrode thickness. However, for TiC-CDC with hardly any mesopores, and with a lower total porosity, the current is underestimated. Calculation results show that a material with higher electrode porosity is not necessarily responding faster, as more porosity also implies longer transport pathways across the electrode. Our work highlights that a direct prediction of CDI performance both for equilibrium and dynamics can be achieved based on the PSD and knowledge of the geometrical structure of the electrodes.

KeyWords Plus: CARBIDE-DERIVED CARBON; REDUCED GRAPHENE OXIDE; PORE-SIZE; ACTIVATED CARBON; WATER DESALINATION; COMPOSITE ELECTRODES; SALINITY



DIFFERENCE; CHARGE EFFICIENCY; SELECTIVE REMOVAL; ENERGY-STORAGE

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第 6 条, 共 85 条

标题: Review on the science and technology of water desalination by capacitive deionization

作者: Porada, S (Porada, S.); Zhao, R (Zhao, R.); van der Wal, A (van der Wal, A.); Presser, V (Presser, V.); Biesheuvel, PM (Biesheuvel, P. M.)

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摘要: Porous carbon electrodes have significant potential for energy-efficient water desalination using a promising technology called Capacitive Deionization (CDI). In CDI, salt ions are removed from brackish water upon applying an electrical voltage difference between two porous electrodes,



in which the ions will be temporarily immobilized. These electrodes are made of porous carbons optimized for salt storage capacity and ion and electron transport. We review the science and technology of CDI and describe the range of possible electrode materials and the various approaches to the testing of materials and devices. We summarize the range of options for CDI-designs and possible operational modes, and describe the various theoretical conceptual approaches to understand the phenomenon of CDI. (C) 2013 Elsevier Ltd. All rights reserved.

KeyWords Plus: ACTIVATED CARBON CLOTH; ELECTRICAL DOUBLE-LAYER; CONTROLLED ION EXCHANGE; CARBIDE-DERIVED CARBON; POROUS-ELECTRODES; CHARGE EFFICIENCY; BRACKISH-WATER; COMPOSITE ELECTRODES; AEROGEL ELECTRODES; AQUEOUS-SOLUTIONS

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第 7 条, 共 85 条

标题: A review of working fluid and expander selections for organic Rankine cycle

作者: Bao, JJ (Bao, Junjiang); Zhao, L (Zhao, Li)

来源出版物: RENEWABLE & SUSTAINABLE ENERGY REVIEWS 卷: 24 页: 325-342 DOI: 10.1016/j.rser.2013.03.040 出版年: AUG 2013

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摘要: How to effectively utilize low and medium temperature energy is one of the solutions to alleviate the energy shortage and environmental pollution problems. In the past twenty years,



because of its feasibility and reliability, organic Rankine cycle has received widespread attentions and researches. In this paper, it reviews the selections of working fluids and expanders for organic Rankine cycle, including an analysis of the influence of working fluids' category and their thermodynamic and physical properties on the organic Rankine cycle's performance, a summary of pure and mixed working fluids' screening researches for organic Rankine cycle, a comparison of pure and mixture working fluids' applications and a discussion of all types of expansion machines' operating characteristics, which would be beneficial to select the optimal working fluid and suitable expansion machine for an effective organic Rankine cycle system. (C) 2013 Elsevier Ltd. All rights reserved.

作者关键词: Organic Rankine cycle; Organic working fluids; Expanders; Mixed working fluids

KeyWords Plus: WASTE HEAT-RECOVERY; REVERSE-OSMOSIS DESALINATION; LOW-GRADE HEAT; FOOD-PROCESSING APPLICATION; MULTI-VANE EXPANDERS; MICRO-CHP SYSTEMS; LOW-TEMPERATURE; POWER-GENERATION; SCROLL EXPANDER; ZEOTROPIC MIXTURES

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第 8 条, 共 85 条

标题: Energy Recovery in Membrane Capacitive Deionization

作者: Dlugolecki, P (Dlugolecki, Piotr); van der Wal, A (van der Wal, Albert)

来源出版物: ENVIRONMENTAL SCIENCE & TECHNOLOGY 卷: 47 期: 9 页: 4904-4910 DOI: 10.1021/es3053202 出版年: MAY 7 2013

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摘要: Membrane capacitive deionization (MCDI) is a water desalination technology based on applying a cell voltage between two oppositely placed porous carbon electrodes. In front of each electrode, an ion-exchange membrane is positioned, and between them, a spacer is situated, which transports the water to be desalinated. In this work, we demonstrate for the first time that up to 83% of the energy used for charging the electrodes during desalination can be recovered in the regeneration step. This can be achieved by charging and discharging the electrodes in a controlled manner by using constant current conditions. By implementing energy recovery as an integral part of the MCDI operation, the overall energy consumption can be as low as 0.26 (kW.h)/m³ of produced water to reduce the salinity by 10 mM, which means that MCDI is more energy efficient for treatment of brackish water, than reverse osmosis. Nevertheless, the measured energy consumption is much higher than the thermodynamically calculated values for desalinating the water, and therefore, a further improvement in thermodynamic efficiency will be needed in the future.

PubMed ID: 23477563

KeyWords Plus: ION-EXCHANGE MEMBRANE; SUPERCAPACITOR FLOW CELL; REVERSE ELECTRODIALYSIS; SALINITY GRADIENTS; WATER DESALINATION; POWER-GENERATION; BOUNDARY-LAYER; ELECTRODES; SALT; PURIFICATION

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第 9 条, 共 85 条

标题: Desalination via a new membrane capacitive deionization process utilizing flow-electrodes

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摘要: A capacitive deionization process utilizing flow-electrodes (FCDI) was designed and evaluated for use in seawater desalination. The FCDI cell exhibited excellent removal efficiency (95%) with respect to an aqueous NaCl solution (salt concentration: 32.1 g L⁻¹), demonstrating that the FCDI process could effectively overcome the limitations of typical CDI processes.

KeyWords Plus: MICROBIAL FUEL-CELLS; AQUEOUS-SOLUTIONS; ENERGY-STORAGE; CARBON AEROGEL; WATER; ELECTROSORPTION; IONS

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第 10 条, 共 85 条

标题: Constructal law of design and evolution: Physics, biology, technology, and society

作者: Bejan, A (Bejan, Adrian); Lorente, S (Lorente, Sylvie)

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摘要: This is a review of the theoretical and applied progress made based on the Constructal law of design and evolution in nature, with emphasis on the last decade. The Constructal law is the law of physics that accounts for the natural tendency of all flow systems (animate and inanimate) to change into configurations that offer progressively greater flow access over time. The progress made with the Constructal law covers the broadest range of science, from heat and fluid flow and geophysics, to



animal design, technology evolution, and social organization (economics, government). This review presents the state of this fast growing field, and draws attention to newly opened directions for original research. The Constructal law places the concepts of life, design, and evolution in physics. (C) 2013 American Institute of Physics.

KeyWords Plus: DEHUMIDIFICATION DESALINATION UNIT; SHAPED MICROCHANNEL NETWORKS; VASCULARIZED COOLING PLATES; FLUID-FLOW CHARACTERISTICS; CONVECTION HEAT-TRANSFER; LAYERED SKIN-STRUCTURE; SYLVIE LORENTE; ADRIAN BEJAN; NATURAL-CONVECTION; FORCED-CONVECTION

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第 11 条, 共 85 条

标题: Enabling Graphene Oxide Nanosheets as Water Separation Membranes

作者: Hu, M (Hu, Meng); Mi, BX (Mi, Baoxia)

来源出版物: ENVIRONMENTAL SCIENCE & TECHNOLOGY 卷: 47 期: 8 页: 3715-3723 DOI: 10.1021/es400571g 出版年: APR 16 2013

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摘要: We report a novel procedure to synthesize a new type of water separation membrane using graphene oxide (GO) nanosheets such that water can flow through the nanochannels between GO layers while unwanted solutes are rejected by size exclusion and charge effects. The GO membrane was made via layer-by-layer deposition of GO nanosheets, which were cross-linked by 1,3,5-benzenetricarbonyl trichloride, on a polydopamine-coated polysulfone support. The cross-linking not only provided the stacked GO nanosheets with the necessary stability to overcome their inherent dispensability in water environment but also fine-tuned the charges, functionality, and spacing of the GO nanosheets. We then tested the membranes synthesized with different numbers of GO layers to demonstrate their interesting water separation performance. It was found that the GO membrane flux ranged between 80 and 276 LMH/MPa, roughly 4-10 times higher than that of most commercial nanofiltration membranes. Although the GO membrane in the present development stage had a relatively low rejection (6-46%) of monovalent and divalent salts, it exhibited a moderate rejection (46-66%) of Methylene blue and a high rejection (93-95%) of Rhodamine-WT. We conclude the paper by emphasizing that the facile synthesis of a GO membrane exploiting the ideal properties of inexpensive GO materials offers a myriad of opportunities to modify its physicochemical properties, potentially making the GO membrane a next-generation, cost-effective, and sustainable alternative to the long-existing thin-film composite polyamide membranes for water separation applications.

PubMed ID: 23488812

KeyWords Plus: AQUEOUS-SOLUTION; RO MEMBRANES; ACTIVE COMPOUNDS; OSMOSIS; SHEETS; LAYER; DESALINATION; ADSORPTION; COMPOSITE; REJECTION

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第 12 条, 共 85 条

标题: Optimization of salt adsorption rate in membrane capacitive deionization

作者: Zhao, R (Zhao, R.); Satpradit, O (Satpradit, O.); Rijnaarts, HHM (Rijnaarts, H. H. M.); Biesheuvel, PM (Biesheuvel, P. M.); van der Wal, A (van der Wal, A.)

来源出版物: WATER RESEARCH 卷: 47 期: 5 页: 1941-1952 DOI: 10.1016/j.watres.2013.01.025 出版年: APR 1 2013

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摘要: Membrane capacitive deionization (MCDI) is a water desalination technique based on applying a cell voltage between two oppositely placed porous electrodes sandwiching a spacer channel that transports the water to be desalinated. In MCDI, ion-exchange membranes are positioned in front of each porous electrode to prevent co-ions from leaving the electrode region during ion adsorption, thereby enhancing the salt adsorption capacity. MCDI can be operated at constant cell voltage (CV), or at a constant electrical current (CC).

In this paper, we present both experimental and theoretical results for desalination capacity and rate in MCDI (both in the CV- and the CC-mode) as function of adsorption/desorption time, salt feed concentration, electrical current, and cell voltage. We demonstrate how by varying each parameter individually, it is possible to systematically optimize the parameter settings of a given system to achieve the highest average salt adsorption rate and water recovery. (C) 2013 Elsevier Ltd. All rights reserved.

PubMed ID: 23395310

作者关键词: Membrane capacitive deionization; Ion exchange membrane; Desalination; Water recovery; Salt adsorption rate; Porous electrode model; Constant current operation; Constant voltage operation

KeyWords Plus: ION-EXCHANGE MEMBRANES; POROUS-ELECTRODES; WATER DESALINATION; BRACKISH-WATER; TRANSPORT-PROPERTIES; CARBON; ELECTROCHEMISTRY; PERFORMANCE; EFFICIENCY; ANIONS

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第 13 条, 共 85 条

标题: A sulfonated polyphenylenesulfone (sPPSU) as the supporting substrate in thin film composite (TFC) membranes with enhanced performance for forward osmosis (FO)

作者: Widjojo, N (Widjojo, Natalia); Chung, TS (Chung, Tai-Shung); Weber, M (Weber, Martin); Maletzko, C (Maletzko, Christian); Warzelhan, V (Warzelhan, Volker)

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摘要: The new sulfonated polyphenylenesulfone (sPPSU) materials synthesized via direct route with various content of sulfonated units, i.e., 2.5 and 5 mol% 3,3'-di-sodiumdisulfate-4,4'-dichlorodiphenyl sulfone (sDCDPS) monomer, have been effectively implemented as supporting layers of the thin film composite (TFC) membranes for forward osmosis (FO) applications. Not only does the hydrophilic nature of membrane substrates essentially facilitate the water transport across the membrane during the FO process, but also possibly provide anti-fouling characteristics as well as induce the formation of fully sponge-like structures. Compared to TFC-FO membranes made of hydrophobic non-sulfonated PPSU supporting layers, those made of hydrophilic sPPSU supporting layers comprising 2.5 mol% sDCDPS can achieve a 4.4-fold increment on water flux up to 54 LMH with 8.8 gMH salt reverse flux under the pressure retarded osmosis (PRO) mode using 2 M NaCl as draw solution. Surprisingly, the newly developed TFC-FO membranes show a much smaller difference in water flux between PRO and FO modes compared to previous works, indicating much lower ICP, particularly at low draw solution concentrations, i.e. 0.5-2 M NaCl. When tested for seawater desalination using 3.5 wt% NaCl as the feed and 2 M NaCl as the draw solution, the aforementioned membrane show a water flux up to 22 LMH under the PRO mode, which is the highest ever reported. Furthermore, the structural parameter indicating the internal concentration polarization (ICP) can be remarkably decreased with an increase in sulphonated material contents in membrane substrates. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Thin film composite (TFC) membranes; Directly sulfonated polymer; Forward osmosis; Interfacial polymerization; Sponge-like structure; Hydrophilic substrate

KeyWords Plus: HOLLOW-FIBER MEMBRANES; PRESSURE-RETARDED OSMOSIS; INTERNAL CONCENTRATION POLARIZATION; WATER FLUX; LAYER; ENERGY; DESALINATION; TRANSPORT; POLYMER; DRIVEN

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第 14 条, 共 85 条

标题: Advances in Membrane Distillation for Water Desalination and Purification Applications

作者: Camacho, LM (Camacho, Lucy Mar); Dumeé, L (Dumeé, Ludovic); Zhang, JH (Zhang, Jianhua); Li, JD (Li, Jun-de); Duke, M (Duke, Mikel); Gomez, J (Gomez, Juan); Gray, S (Gray, Stephen)

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摘要: Membrane distillation is a process that utilizes differences in vapor pressure to permeate water through a macro-porous membrane and reject other non-volatile constituents present in the influent water. This review considers the fundamental heat and mass transfer processes in membrane distillation, recent advances in membrane technology, module configurations, and the applications and economics of membrane distillation, and identifies areas that may lead to technological improvements in membrane distillation as well as the application characteristics required for commercial deployment.

作者关键词: membrane distillation; heat transfer; mass transfer; module configurations; water desalination and purification

KeyWords Plus: AIR-GAP MEMBRANE; HOLLOW-FIBER MEMBRANES; SURFACE MODIFYING MACROMOLECULES; HYDROPHOBIC CERAMIC MEMBRANES; HUMAN PLASMA ULTRAFILTRATE; AQUEOUS ALCOHOL-SOLUTIONS; SPACER-FILLED CHANNELS; BUCKY-PAPER MEMBRANES; FLAT-SHEET MEMBRANES; SPIRAL WOUND MODULES

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第 15 条, 共 85 条

标题: Standard Methodology for Evaluating Membrane Performance in Osmotically Driven Membrane Processes

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摘要: Osmotically driven membrane processes (ODMPs) such as forward osmosis (FO) and pressure retarded osmosis (PRO) are extensively investigated for utilization in a broad range of applications. In ODMPs, the operating conditions and membrane properties play more critical roles in mass transport and process performance than in pressure-driven membrane processes. Search of the literature reveals that ODMP membranes, especially newly developed ones, are tested under different temperatures, draw solution compositions and concentrations, flow rates, and pressures. In order to compare different membranes, it is important to develop standard protocols for testing of membranes for ODMPs. In this article we present a standard methodology for testing of ODMP membranes based on experience gained and operating conditions used in FO and PRO studies in recent years. A round-robin testing of two commercial membranes in seven independent laboratories revealed that water flux and membrane permeability coefficients were similar when participants performed the experiments and calculations using the same protocols. The thin film composite polyamide membrane exhibited higher water and salt permeability than the asymmetric cellulose-based membrane, but results with the high permeability thin-film composite membrane were more scattered. While salt rejection results in RO mode were relatively similar, salt permeability coefficients for both membranes in FO mode were more varied. Results suggest that high permeability ODMP membranes should be tested at lower hydraulic pressure in RO mode and that RO testing be conducted with the same membrane sample used for testing in FO mode. (C) 2012 Elsevier B.V. All rights reserved.

作者关键词: Osmotically driven membrane process (ODMP); Forward osmosis (FO); Pressure retarded osmosis (PRO); Osmotic dilution (ODN); Desalination; Water reclamation

KeyWords Plus: INTERNAL CONCENTRATION POLARIZATION; THIN-FILM COMPOSITE; PRESSURE-RETARDED OSMOSIS; HOLLOW-FIBER MEMBRANES; DRAW SOLUTE PERMEATION; SUPPORT LAYER; WATER FLUX; POWER-GENERATION; SELECTIVE LAYER; BEHAVIOR

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第 16 条, 共 85 条

标题: Intelligent demand side energy management system for autonomous polygeneration microgrids

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摘要: Autonomous polygeneration microgrids is a novel approach in addressing the needs of remote areas. These needs can include power, fuel for transportation in the form of hydrogen, potable water through desalination and space heating and cooling. This approach has been investigated technically and economically and has proved viable. Further research has taken place in the supervisory management of this topology using computational intelligence techniques like fuzzy logic, which has optimized the concept minimizing the sizes of the installed components. The optimal design of the system can meet, though, only the design principles and needs. In reality experience has shown that most autonomous power systems operate out of specifications very shortly after installation or after a couple of years new needs arise and it is not possible economic wise for the people to extend it. In these cases the microgrid would struggle to cover the increased needs and in the end fail, causing blackouts. A solution to this is partial load shedding in an intelligent manner. This paper presents a multi agent system for intelligent demand side management of the polygeneration microgrid topology which also includes grey prediction algorithms for better management. This approach can also be used for designing the optimal polygeneration microgrid for a given amount of an investment. The results show that the proposed intelligent demand side management system can address its design principles successfully and guaranty the most effective operation even in conditions near and over the limits of the design specification of the autonomous polygeneration microgrid. (C) 2012 Elsevier Ltd. All rights reserved.

作者关键词: Polygeneration; Microgrids; Smartgrids; Demand side management; Multi agent system; Grey predictor

KeyWords Plus: CONTROLLER

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第 17 条, 共 85 条

标题: Effect of water and air flow on concentric tubular solar water desalting system

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摘要: This work reports an innovative design of tubular solar still with a rectangular basin for water desalination with flowing water and air over the cover. The daily distillate output of the system is increased by lowering the temperature of water flowing over it (top cover cooling arrangement). The

fresh water production performance of this new still is observed in Sri Ramakrishna Mission Vidyalaya College of Arts and Science, Coimbatore (11 degrees North, 77 degrees East), India. The water production rate with no cooling flow was 2050 ml/day (410 ml/trough). However, with cooling air flow, production increased to 3050 ml/day, and with cooling water flow, it further increased to 5000 ml/day. Despite the increased cost of the water cooling system, the increased output resulted in the cost of distilled water being cut in roughly half. Diurnal variations of a few important parameters are observed during field experiments such as water temperature, cover temperature, air temperature, ambient temperature and distillate output. (C) 2012 Elsevier Ltd. All rights reserved.

作者关键词: Tubular solar still; Fresh water; Distillate output

KeyWords Plus: WASTE HOT WATER; GLASS COVER; DISTILLATION SYSTEM; DESALINATION SYSTEMS; INTERMITTENT FLOW; STILL; PERFORMANCE; ABSORBER; DESIGN; CPC

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第 18 条, 共 85 条

标题: Giant osmotic energy conversion measured in a single transmembrane boron nitride nanotube

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摘要: New models of fluid transport are expected to emerge from the confinement of liquids at the nanoscale(1,2), with potential applications in ultrafiltration, desalination and energy conversion(3). Nevertheless, advancing our fundamental understanding of fluid transport on the smallest scales requires mass and ion dynamics to be ultimately characterized across an individual channel to avoid averaging over many pores. A major challenge for nanofluidics thus lies in building distinct and well-controlled nanochannels, amenable to the systematic exploration of their properties. Here we describe the fabrication and use of a hierarchical nanofluidic device made of a boron nitride nanotube that pierces an ultrathin membrane and connects two fluid reservoirs. Such a transmembrane geometry allows the detailed study of fluidic transport through a single nanotube under diverse forces, including electric fields, pressure drops and chemical gradients. Using this device, we discover very large, osmotically induced electric currents generated by salinity gradients, exceeding by two orders of magnitude their pressure-driven counterpart. We show that this result originates in the anomalously high surface charge carried by the nanotube's internal surface in water at large pH, which we independently quantify in conductance measurements. The nano-assembly route using nanostructures as building blocks opens the way to studying fluid, ionic and molecule transport on the nanoscale, and may lead to biomimetic functionalities. Our results furthermore suggest that boron nitride nanotubes could be used as membranes for osmotic power harvesting under salinity gradients.

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KeyWords Plus: CARBON NANOTUBES; REVERSE ELECTRODIALYSIS;



POWER-GENERATION; WATER TRANSPORT; FLOW; MEMBRANES

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标题: Structure and Electrochemical Performance of Carbide-Derived Carbon Nanopowders

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摘要: Microporous carbon materials are widely used in gas storage, sorbents, supercapacitor electrodes, water desalination, and catalyst supports. While these microporous carbons usually have a particle size in the 1100 m range, here the synthesis of porous carbide-derived carbon (CDC) with particle diameters around 30 nm by extraction of titanium from nanometer-sized titanium carbide (TiC) powder at temperatures of 200 degrees C and above is reported. Nanometer-sized CDCs prepared at 200400 degrees C show a disordered structure and the presence of CN sp1 bonds. Above 400 degrees C, the CN bond disappears with the structure transition to disordered carbon similar to that observed after synthesis from carbide micropowders. Compared to CDCs produced from micrometer-sized TiC, nano-CDC has a broader pore size distribution due to interparticle porosity and a large contribution from the surface layers. The material shows excellent electrochemical performance due to its easily accessible pores and a large specific surface area.

作者关键词: titanium carbide; carbide-derived carbon; supercapacitors; nanopowders

KeyWords Plus: PORE-SIZE; SUPERCAPACITOR PERFORMANCE; NANOPOROUS MATERIALS; PARTICLE-SIZE; TIO2 ANATASE; CAPACITANCE; ELECTRODE; STORAGE; NANOPARTICLES; NANOMATERIALS

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第 20 条, 共 85 条

标题: A new method for fabrication of graphene/polyaniline nanocomplex modified microbial fuel cell anodes

作者: Hou, JX (Hou, Junxian); Liu, ZL (Liu, Zhongliang); Zhang, PY (Zhang, Peiyuan)

来源出版物: JOURNAL OF POWER SOURCES 卷: 224 页: 139-144 DOI: 10.1016/j.jpowsour.2012.09.091 出版年: FEB 15 2013

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摘要: A novel microbial fuel cell (MFC) anode is fabricated by electrochemically reducing graphene oxide (ERGNO) first and coating polyaniline (PANI) nano-fibers afterward on the surface of carbon cloth (CC). ERGNO/CC is prepared using an electrochemical synthesis method reducing graphene oxide by cyclic voltammetry (CV) in phosphate buffer solution (PBS, pH = 6.9). Combining the advantages of PANI and ERGNO, PANI-ERGNO/CC yields a maximum power density of 1390 mW m⁻² when used as the MFC anode, which is 3 times larger than that of the MFC with the CC anode. The electrodes are characterized by scanning electron microscopy (SEM) and Raman spectroscopy. The electrochemical activities have been investigated by CV and electrochemical impedance spectroscopy (EIS). The great improvement is attributed to the fact that graphene not only serves as a highly conductive support material, but also provides large surface for PANI. High conductivity and large specific surface area greatly improve the charge transfer efficiency and the bacterial biofilm loading. In this work, a practical and promising synthesis method is developed to fabricate high-performance MFC anodes. (C) 2012 Elsevier B.V. All rights reserved.

作者关键词: Microbial fuel cell; Electrode modification; Electrochemically reducing graphene oxide; Graphene nano-sheets; Polyaniline nano-fibers

KeyWords Plus: DIRECT ELECTROCHEMICAL REDUCTION; GRAPHENE OXIDE; SUPERCAPACITOR ELECTRODES; IMPEDANCE SPECTROSCOPY; VOLTAMMETRIC DETECTION; SOLAR-CELLS; COMPOSITE; DESALINATION; SHEETS; FILMS

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第 21 条, 共 85 条

标题: Technical review and evaluation of the economics of water desalination: Current and future challenges for better water supply sustainability

作者: Ghaffour, N (Ghaffour, Noreddine); Missimer, TM (Missimer, Thomas M.); Amy, GL (Amy, Gary L.)

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摘要: Desalination capacity has rapidly increased in the last decade because of the increase in water demand and a significant reduction in desalination cost as a result of significant technological advances, especially in the reverse osmosis process. The cost of desalinated seawater has fallen below US\$0.50/m³ for a large scale seawater reverse osmosis plant at a specific location and conditions while in other locations the cost is 50% higher (US\$1.00/m³) for a similar facility. In addition to capital and operating costs, other parameters such as local incentives or subsidies may also contribute to the large difference in desalted water cost between regions and facilities. Plant suppliers and consultants have their own cost calculation methodologies, but they are confidential and provide water costs with different accuracies. The few existing costing methodologies and software packages such as WTCost (c) and DEEP provide an estimated cost with different accuracies and their applications are limited to specific conditions. Most of the available cost estimation tools are of the black box type, which provide few details concerning the parameters and methodologies applied for local conditions. Many desalination plants built recently have greater desalinated water delivery costs caused by special circumstances, such as plant remediation or upgrades, local variation in energy costs, and site-specific issues in raw materials costs (e.g., tariffs and transportation). Therefore, the availability of a more transparent and unique methodology for estimating the cost will help in selecting an appropriate desalination technology suitable for specific locations with consideration of all the parameters influencing the cost. A techno-economic evaluation and review of the costing aspects and the main parameters influencing the total water cost produced by different desalination technologies are herein presented in detail. Some recent developments, such as the increase of unit capacity, improvements in process design and materials, and the use of hybrid systems have contributed to cost reduction as well as reduction in energy consumption. The development of new and emerging low-energy desalination technologies, such as adsorption desalination, will have an impact on cost variation estimation in the future. (C) 2012 Elsevier B.V. All rights reserved.

作者关键词: Desalination cost; Desalination technologies development; Energy consumption; Economics; Costing methodologies

KeyWords Plus: CAPACITY-BUILDING STRATEGIES; SEAWATER DESALINATION; REVERSE-OSMOSIS; ENERGY; TECHNOLOGY; PLANTS; SYSTEMS; COSTS; MSF; DISTILLATION

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第 22 条, 共 85 条

标题: Effect of polydopamine deposition conditions on fouling resistance, physical properties, and permeation properties of reverse osmosis membranes in oil/water separation

作者: Kasemset, S (Kasemset, Sirirat); Lee, A (Lee, Albert); Miller, DJ (Miller, Daniel J.); Freeman, BD (Freeman, Benny D.); Sharma, MM (Sharma, Mukul M.)

来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 425 页: 208-216 DOI: 10.1016/j.memsci.2012.08.049 出版年: JAN 1 2013

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摘要: A commercial polyamide reverse osmosis (RO) membrane was surface-modified with polydopamine deposited from buffered, aqueous dopamine solution at ambient conditions. The influence of various modification conditions (i.e., dopamine solution concentration, polydopamine deposition time, and initial pH of Tris-HCl buffer) on pure water flux, flux during filtration of an oil/water emulsion, and NaCl rejection was investigated. Dead-end filtration results showed decreased pure water flux with increasing dopamine solution concentration and polydopamine deposition time. Membranes modified at a pH of 5 exhibited no change in pure water flux or flux during fouling experiments compared to the native membranes, suggesting that polydopamine was not deposited under such acidic coating conditions. All polydopamine-modified membranes, except those coated at a pH of 5, had higher fluxes when filtering an oil/water emulsion than that of unmodified membranes. NaCl rejection values in all membranes were within the manufacturer's specification. The increased flux when filtering an oil/water emulsion was not sensitive to dopamine concentration, coating time greater than 60 min, or alkaline buffer pH value. Short deposition times slightly reduced the fouling resistance of coated membranes, and membranes modified at acidic pH values showed no improvement in fouling. (C) 2012 Elsevier B.V. All rights reserved.

作者关键词: Polydopamine; Fouling resistance; Reverse osmosis; Surface modification; Oil fouling

KeyWords Plus: SURFACE MODIFICATION; MULTIFUNCTIONAL COATINGS; WATER-PURIFICATION; DESALINATION; POLY(DOPAMINE); PERFORMANCE

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第 23 条, 共 85 条

标题: Energy consumption and constant current operation in membrane capacitive deionization

作者: Zhao, R (Zhao, R.); Biesheuvel, PM (Biesheuvel, P. M.); van der Wal, A (van der Wal, A.)

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摘要: Membrane capacitive deionization (MCDI) is a water desalination technology based on applying a cell voltage between two oppositely placed porous electrodes sandwiching a spacer channel that transports the water to be desalinated. In the salt removal step, ions are adsorbed at the carbon-water interface within the micropores inside the porous electrodes. After the electrodes reach a certain adsorption capacity, the cell voltage is reduced or even reversed, which leads to ion release from the electrodes and a concentrated salt solution in the spacer channel, which is flushed out, after which the cycle can start over again. Ion-exchange membranes are positioned in front of each porous electrode, which has the advantage of preventing the co-ions from leaving the electrode region during ion adsorption, while also allowing for ion desorption at reversed voltage. Both effects significantly increase the salt removal capacity of the system per cycle. The classical operational mode of MCDI at a constant cell voltage results in an effluent stream of desalinated water of which the salt concentration varies with time. In this paper, we propose a different operational mode for MCDI, whereby desalination is driven by a constant electrical current, which leads to a constant salt concentration in the desalinated stream over long periods of time. Furthermore, we show how the salt concentration of the desalinated stream can be accurately adjusted to a certain setpoint, by either varying the electrical current level and/or the water flow rate. Finally, we present an extensive dataset for the energy requirements of MCDI, both for operation at constant voltage and at constant current, and in both cases also for the related technology in which membranes are not included (CDI). We find consistently that in MCDI the energy consumption per mole of salt removed is lower than that in CDI. Within the range 10-200 mM ionic strength of the water to be treated, we find for MCDI a constant energy consumption of similar to 22 kJ per ion removed. Results in this work are an essential tool to evaluate the economic viability of MCDI for the treatment of saltwater.

KeyWords Plus: WATER DESALINATION; POROUS-ELECTRODES; SEAWATER DESALINATION; CARBON ELECTRODES; CHARGE EFFICIENCY; BRACKISH-WATER; TECHNOLOGY; ELECTROCHEMISTRY; ELECTROSORPTION; IMPROVEMENT

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标题: Water Desalination across Nanoporous Graphene

作者: Cohen-Tanugi, D (Cohen-Tanugi, David); Grossman, JC (Grossman, Jeffrey C.)

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摘要: We show that nanometer-scale pores in single-layer freestanding graphene can effectively filter NaCl salt from water. Using classical molecular dynamics, we report the desalination performance of such membranes as a function of pore size, chemical functionalization, and applied pressure. Our results indicate that the membrane's ability to prevent the salt passage depends critically on pore diameter with adequately sized pores allowing for water flow while blocking ions. Further, an investigation into the role of chemical functional groups bonded to the edges of graphene pores suggests that commonly occurring hydroxyl groups can roughly double the water flux thanks to their hydrophilic character. The increase in water flux comes at the expense of less consistent salt rejection performance, which we attribute to the ability of hydroxyl functional groups to substitute for water molecules in the hydration shell of the ions. Overall, our results indicate that the water permeability of this material is several orders of magnitude higher than conventional reverse osmosis membranes, and that nanoporous graphene may have a valuable role to play for water purification.

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作者关键词: Desalination; graphene; molecular dynamics; materials; nanofluidics

KeyWords Plus: CARBON NANOTUBE PORES; MOLECULAR-DYNAMICS; POLARIZATION; SEPARATION; SIMULATION; INTERFACE; MEMBRANES; SHEETS; IONS

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标题: CO₂-triggered switchable solvents, surfactants, and other materials

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摘要: Waste CO₂ at atmospheric pressure can be used to trigger dramatic changes in the properties of certain switchable materials. Compared to other triggers such as light, acids and oxidants, CO₂ has the advantages that it is inexpensive, nonhazardous, non-accumulating in the system, easily removed, and it does not require the material to be transparent. Known CO₂-triggered switchable materials now include solvents, surfactants, solutes, catalysts, particles, polymers, and gels. These have also been described as "smart" materials or, for some of the switchable solvents, "reversible ionic liquids". The added flexibility of switchable materials represents a new strategy for minimizing energy and material consumption in process and product design.

KeyWords Plus: REVERSIBLE IONIC LIQUIDS; RECYCLABLE VOLATILE SALTS; AQUEOUS 2-PHASE SYSTEMS; AMMONIA-CARBON DIOXIDE; ROOM-TEMPERATURE; SUPRAMOLECULAR CHEMISTRY; EMULSION POLYMERIZATION; FERROCENYL SURFACTANT; OSMOSIS DESALINATION; LATENT GELATORS

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第 26 条, 共 85 条

标题: A study of the capacitive deionisation performance under various operational conditions

作者: Mossad, M (Mossad, Mohamed); Zou, LD (Zou, Linda)

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摘要: Capacitive deionisation (CDI) has many advantages over other desalination technologies due



to its low energy consumption, less environmental pollution and low fouling potential. The objectives of this study are to investigate the effect of operational conditions on the CDI electrosorption efficiency and energy consumption, to identify ion selectivity in multi-ionic solutions and to probe the effect of dissolved reactive silica on the treatment efficiency. A series of laboratory scale experiments were conducted using a CDI unit with activated carbon electrodes. The electrosorption removal efficiency was inversely related to solution temperature, initial total dissolved salts (TDS) concentration and the applied flow rate. CDI energy consumption (kWh/m³) is directly related to the TDS concentration and inversely related to the flow rate. The kinetics analysis indicated that the electrosorption followed pseudo-first-order kinetics model. Ion selectivity on activated carbon electrodes followed the order of Fe³⁺ > Ca²⁺ > Mg²⁺ > Na⁺ for cations and SO₄²⁻ > Br⁻ > Cl⁻ > F⁻ > NO₃⁻ for anions. It was found that the dissolved silica was not removed by CDI; no silica fouling was found. The deterioration of activated carbon electrodes was not observed at any time during experiment. (C) 2012 Elsevier B.V. All rights reserved.

PubMed ID: 22402342

作者关键词: Electrosorption; Capacitive deionisation; Activated carbon; Ion selectivity

KeyWords Plus: CARBON NANOTUBES; DEIONIZATION TECHNOLOGY; FILM ELECTRODES; BRACKISH-WATER; DESALINATION; ELECTROSORPTION; EFFICIENCY; MEMBRANES; AEROGEL; IONS

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第 27 条, 共 85 条

标题: A review of draw solutes in forward osmosis process and their use in modern applications

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摘要: Forward osmosis (FO) is one of the emerging membrane technologies which has gained renewed interest recently as a low energy desalination process. The central to FO process is the draw solution (DS) and the membrane because both play a substantial role on its performance. Hence, the selection of an appropriate DS is crucial for the process efficiency. Many DS have been tested so far for a wide range of modern applications and this paper aims to review the various aspects of the DS

in the process performance and provides valuable information regarding the selection criteria of suitable DS. Several general DS properties such as the osmotic pressure and the water solubility can affect the process performance. Other intrinsic properties to specific novel DS such as the emerging magnetic nanoparticles (MNPs) can also have an impact on the process efficiency and have to be evaluated. Separation and recovery of the DS are one of the major challenges facing the development of FO process. The recovery process should not be energy intensive, otherwise the FO process cannot be comparable with other pressure-driven processes. Thermolytic solutions such as ammonia carbonates are considered as the promising DS for desalination applications; however, their recovery process efficiency relies on the availability of low-grade heat. MNPs are emerging and effective DS for desalination and can be readily recovered by a magnetic field or conventional membrane processes. However, the aggregation of MNPs due to their magnetic properties has been issued. The vast numbers of studies on the use of NaCl as DS for the treatment of impaired water open up the possibilities of using seawater or reverse osmosis brine streams as suitable DS for such purpose. Fertilisers were also suggested as DS for seawater and wastewater treatment when the diluted DS can be used directly for irrigation. The development of an adequate and efficient DS coupled with a low-cost energy recovery system is crucial to the performance of the process and to achieve success for the large scale of FO.

作者关键词: Forward osmosis; Draw solutions; Desalination; Wastewater reuse

KeyWords Plus: PRESSURE-RETARDED OSMOSIS; INTERNAL CONCENTRATION POLARIZATION; AMMONIA-CARBON DIOXIDE; SEAWATER DESALINATION; CONCENTRATED BRINES; PROCESS PERFORMANCE; REVERSE-OSMOSIS; DRINKING-WATER; SEA-WATER; MEMBRANE

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第 28 条, 共 85 条

标题: Recent developments in forward osmosis: Opportunities and challenges

作者: Zhao, SF (Zhao, Shuaifei); Zou, L (Zou, Linda); Tang, CYY (Tang, Chuyang Y.); Mulcahy, D (Mulcahy, Dennis)

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摘要: Recently, forward osmosis (FO) has attracted growing attention in many potential applications such as power generation, desalination, wastewater treatment and food processing. However, there are still several critical challenges, including concentration polarization, membrane fouling, reverse solute diffusion and the need for new membrane development and draw solute design in FO. These challenges are also the current research focus on FO. This paper aims to review the recent developments in FO, focusing on the opportunities and challenges. It begins with discussing the



advantages of the FO process over pressure-driven membrane processes. These potential advantages lie in FO's low energy consumption, low fouling propensity, reduced or easy cleaning, low costs, high salt rejection and high water flux. Next, the recent applications of FO, as the outcomes of the above advantages, are described. The key part of this review is a detailed discussion of five critical challenges faced by FO and their relationships. Finally, the future of FO is viewed. This review provides a clear outline for FO-concerned researchers on the recent developments in FO. (C) 2012 Elsevier B. V. All rights reserved.

作者关键词: Forward osmosis; Power generation; Desalination; Wastewater treatment; Concentration polarization

KeyWords Plus: PRESSURE-RETARDED OSMOSIS; INTERNAL CONCENTRATION POLARIZATION; HOLLOW-FIBER MEMBRANES; CROSS-FLOW MICROFILTRATION; THIN-FILM COMPOSITE; AMMONIA-CARBON DIOXIDE; OSMOTIC DRUG-DELIVERY; RESPONSE-SURFACE METHODOLOGY; POLYELECTROLYTE NANOFILTRATION MEMBRANES; WASTE-WATER RECLAMATION

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第 29 条, 共 85 条

标题: Exploration of polyelectrolytes as draw solutes in forward osmosis processes

作者: Ge, QC (Ge, Qingchun); Su, JC (Su, Jincai); Amy, GL (Amy, Gary L.); Chung, TS (Chung, Tai-Shung)

来源出版物: WATER RESEARCH 卷: 46 期: 4 页: 1318-1326 DOI: 10.1016/j.watres.2011.12.043 出版年: MAR 15 2012

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摘要: The development of the forward osmosis (FO) process has been constrained by the slow development of appropriate draw solutions. Two significant concerns related to draw solutions are the draw solute leakage and intensive energy requirement in recycling draw solutes after the FO process. FO would be much attractive if there is no draw solute leakage and the recycle of draw solutes is easy and economic. In this study, polyelectrolytes of a series of polyacrylic acid sodium salts (PAA-Na), were explored as draw solutes in the FO process. The characteristics of high solubility in water and flexibility in structural configuration ensure the suitability of PAA-Na as draw solutes and their relative ease in recycle through pressure-driven membrane processes. The high water flux with insignificant salt leakage in the FO process and the high salt rejection in recycle processes reveal the superiority of PAA-Na to conventional ionic salts, such as NaCl, when comparing their FO performance via the same membranes. The repeatable performance of PAA-Na after recycle indicates the absence of any aggregation problems. The overall performance demonstrates that polyelectrolytes of PAA-Na series are promising as draw solutes, and the new concept of using polyelectrolytes as draw solutes in FO processes is applicable. (C) 2011 Elsevier

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作者关键词: Forward osmosis; Polyelectrolyte; Water treatment; Desalination; Draw solution

KeyWords Plus: AMMONIA-CARBON DIOXIDE; NANOFILTRATION MEMBRANES; DESALINATION PROCESS; CELLULOSE-ACETATE; WATER; PERFORMANCE; NANOPARTICLES; REJECTION

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第 30 条, 共 85 条

标题: Water Desalination Using Capacitive Deionization with Microporous Carbon Electrodes

作者: Porada, S (Porada, S.); Weinstein, L (Weinstein, L.); Dash, R (Dash, R.); van der Wal, A (van der Wal, A.); Bryjak, M (Bryjak, M.); Gogotsi, Y (Gogotsi, Y.); Biesheuvel, PM (Biesheuvel, P. M.)

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摘要: Capacitive deionization (CDI) is a water desalination technology in which salt ions are removed from brackish water by flowing through a spacer channel with porous electrodes on each side. Upon applying a voltage difference between the two electrodes, cations move to and are accumulated in electrostatic double layers inside the negatively charged cathode and the anions are removed by the positively charged anode. One of the key parameters for commercial realization of CDI is the salt adsorption capacity of the electrodes. State-of-the-art electrode materials are based on porous activated carbon particles or carbon aerogels. Here we report the use for CDI of carbide-derived carbon (CDC), a porous material with well-defined and tunable pore sizes in the sub-nanometer range. When comparing electrodes made with CDC with electrodes based on activated carbon, we find a significantly higher salt adsorption capacity in the relevant cell voltage window of 1.2-1.4 V. The measured adsorption capacity for four materials tested negatively correlates with known metrics for pore structure of the carbon powders such as total pore volume and BET-area, but is positively correlated with the volume of pores of sizes <1 nm, suggesting the relevance of these sub-nanometer pores for ion adsorption. The charge efficiency, being the ratio of equilibrium salt adsorption over charge, does not depend much on the type of material, indicating that materials that have been identified for high charge storage capacity can also be highly suitable for CDI. This work shows the potential of materials with well-defined sub-nanometer pore sizes for energy-efficient water desalination.

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作者关键词: capacitive deionization; carbide-derived carbons; water desalination; electrostatic double layer theory; porous electrodes; millifluidics

KeyWords Plus: CARBIDE-DERIVED CARBON; ACTIVATED CARBON; BRACKISH-WATER; SEAWATER DESALINATION; AEROGEL ELECTRODES; CHARGE EFFICIENCY; AQUEOUS-SOLUTIONS; ELECTROSORPTION; TECHNOLOGY; ADSORPTION

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第 31 条, 共 85 条

标题: Development of antifouling reverse osmosis membranes for water treatment: A review

作者: Kang, GD (Kang, Guo-dong); Cao, YM (Cao, Yi-ming)

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摘要: With the rapidly increasing demands on water resources, fresh water shortage has become an important issue affecting the economic and social development in many countries. As one of the main technologies for producing fresh water from saline water and other wastewater sources, reverse osmosis (RO) has been widely used so far. However, a major challenge facing widespread application of RO technology is membrane fouling, which results in reduced production capacity and increased operation costs. Therefore, many researches have been focused on enhancing the RO

membrane resistance to fouling. This paper presents a review of developing antifouling RO membranes in recent years, including the selection of new starting monomers, improvement of interfacial polymerization process, surface modification of conventional RO membrane by physical and chemical methods as well as the hybrid organic/inorganic RO membrane. The review of research progress in this article may provide an insight for the development of antifouling RO membranes and extend the applications of RO technology in water treatment in the future. (C) 2011 Elsevier Ltd. All rights reserved.

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作者关键词: Reverse osmosis; Membrane fouling; Antifouling property; Surface modification

KeyWords Plus: POLYPROPYLENE MICROPOROUS MEMBRANE; FILM-COMPOSITE MEMBRANES; OF-THE-ART; SURFACE MODIFICATION; SEAWATER DESALINATION; PHYSIOCHEMICAL PROPERTIES; NANOFILTRATION MEMBRANES; POLY(ETHYLENE GLYCOL); GRAFT-POLYMERIZATION; ICIC-MPD

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标题: Membrane distillation: A comprehensive review

作者: Alkudhiri, A (Alkudhiri, Abdullah); Darwish, N (Darwish, Naif); Hilal, N (Hilal, Nidal)

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摘要: Membrane Distillation (MD) is a thermally-driven separation process, in which only vapour molecules transfer through a microporous hydrophobic membrane. The driving force in the MD process is the vapour pressure difference induced by the temperature difference across the hydrophobic membrane. This process has various applications, such as desalination, wastewater treatment and in the food industry.

This review addresses membrane characteristics, membrane-related heat and mass transfer concepts, fouling and the effects of operating condition. State of the art research results in these different areas will be presented and discussed. (C) 2011 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Membrane distillation; AGMD; Membrane

KeyWords Plus: HYDROPHOBIC POROUS MEMBRANES; AQUEOUS ALCOHOL-SOLUTIONS; PORE-SIZE DISTRIBUTION; FACTORS AFFECTING FLUX; MASS-TRANSFER; MICROPOROUS MEMBRANES; WASTE-WATER; SEAWATER DESALINATION; CONCENTRATION POLARIZATION; TRANSPORT RESISTANCES

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标题: Forward osmosis processes: Yesterday, today and tomorrow

作者: Chung, TS (Chung, Tai-Shung); Zhang, S (Zhang, Sui); Wang, KY (Wang, Kai Yu); Su, JC (Su, Jincai); Ling, MM (Ling, Ming Ming)

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摘要: The purpose of this short communication is to share our perspectives on future R & D for FO processes in order to develop effective and sustainable technologies for water, energy and pharmaceutical production. (C) 2010 Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis; Osmotic power; Desalination; Osmotic membrane bioreactor; Energy and water

KeyWords Plus: PRESSURE-RETARDED OSMOSIS; HOLLOW-FIBER MEMBRANES; INTERNAL CONCENTRATION POLARIZATION; OSMOTIC POWER; PROCESS PERFORMANCE; LIQUID FOODS; WATER FLUX; SEA-WATER; NANOFILTRATION; ENERGY

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第 34 条, 共 85 条

标题: The optimal evaporation temperature and working fluids for subcritical organic Rankine cycle

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摘要: A theoretical formula is proposed to calculate the OET (optimal evaporation temperature) of subcritical ORC (organic Rankine cycle) based on thermodynamic theory when the net power output is selected as the objective function. The OETs of 22 working fluids including wet, isentropic and dry fluids are determined under the given conditions. In order to compare the accuracy of these results, the quadratic approximation method in EES (Engineering Equation Solver) is used to optimize the net power output and the OETs are obtained by numerical simulation. The results show that the OETs calculated by the theoretical formula are consistent with the numerical simulation results. In addition, the average computational accuracy of OETs from the theoretical formula is higher than that from the simplified formula recommended by the related literature. The larger net power output will be produced when the critical temperature of working fluid approaches to the temperature of the waste heat source. According to the maximum net power output, suitable working pressure, total heat transfer capacity and expander SP (size parameter), R114, R245fa, R123, R601a, n-pentane, R141b and R113 are suited as working fluids for subcritical ORC under the given conditions in this paper. (C) 2011 Elsevier Ltd. All rights reserved.

作者关键词: Organic Rankine cycle; Optimal evaporation temperature; Working fluid; Waste heat recovery

KeyWords Plus: WASTE HEAT-RECOVERY; LOW-GRADE HEAT; PARAMETRIC OPTIMIZATION; PERFORMANCE ANALYSIS; SYSTEM; ORC; SELECTION; POWER; VAPORIZATION; DESALINATION

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第 35 条, 共 85 条

标题: State of the art and review on the treatment technologies of water reverse osmosis concentrates

作者: Perez-Gonzalez, A (Perez-Gonzalez, A.); Urtiaga, AM (Urtiaga, A. M.); Ibanez, R (Ibanez,

R.); Ortiz, I (Ortiz, I.)

来源出版物: WATER RESEARCH 卷: 46 期: 2 页: 267-283 DOI: 10.1016/j.watres.2011.10.046 出版年: FEB 1 2012

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摘要: The growing demand for fresh water is partially satisfied by desalination plants that increasingly use membrane technologies and among them reverse osmosis to produce purified water. Operating with water recoveries from 35% to 85% RO plants generate huge volumes of concentrates containing all the retained compounds that are commonly discharged to water bodies and constitute a potentially serious threat to marine ecosystems; therefore there is an urgent need for environmentally friendly management options of RO brines.

This paper gives an overview on the potential treatments to overcome the environmental problems associated to the direct discharge of RO concentrates. The treatment options have been classified according to the source of RO concentrates and the maturity of the technologies. For the sake of clarity three different sources of RO concentrates are differentiated i) desalination plants, ii) tertiary processes in WWTP, and iii) mining industries.

Starting with traditional treatments such as evaporation and crystallization other technologies that have emerged in last years to reduce the volume of the concentrate before disposal and with the objective of achieving zero liquid discharge and recovery of valuable compounds from these effluents are also reviewed. Most of these emerging technologies have been developed at laboratory or pilot plant scale (see Table 1). With regard to RO concentrates from WWTP, the manuscript addresses recent studies that are mainly focused on reducing the organic pollutant load through the application of innovative advanced oxidation technologies. Finally, works that report the treatment of RO concentrates from industrial sources are analyzed as well. (C) 2011 Elsevier Ltd. All rights reserved.

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作者关键词: Reverse osmosis concentrates; Volume reduction; Pollutant load reduction; Salt recovery; Nutrient recovery

KeyWords Plus: AIDED INTENSIFIED EVAPORATION; VACUUM MEMBRANE DISTILLATION; ZERO-LIQUID DISCHARGE; DESALINATION PLANT; ENVIRONMENTAL-IMPACT; BRINE DISPOSAL; RO CONCENTRATE; HIGH-RECOVERY; BIOLOGICAL DENITRIFICATION; SURFACE-WATER

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第 36 条, 共 85 条

标题: A combined thermodynamic cycle used for waste heat recovery of internal combustion engine



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来源出版物: ENERGY 卷: 36 期: 12 页: 6821-6829 DOI: 10.1016/j.energy.2011.10.014 出版年: DEC 2011

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摘要: In this paper, we present a steady-state experiment, energy balance and exergy analysis of exhaust gas in order to improve the recovery of the waste heat of an internal combustion engine (ICE). Considering the different characteristics of the waste heat of exhaust gas, cooling water, and lubricant, a combined thermodynamic cycle for waste heat recovery of ICE is proposed. This combined thermodynamic cycle consists of two cycles: the organic Rankine cycle (ORC), for recovering the waste heat of lubricant and high-temperature exhaust gas, and the Kalina cycle, for recovering the waste heat of low-temperature cooling water. Based on Peng-Robinson (PR) equation of state (EOS), the thermodynamic parameters in the high-temperature ORC were calculated and determined via an in-house computer program. Suitable working fluids used in high-temperature ORC are proposed and the performance of this combined thermodynamic cycle is analyzed. Compared with the traditional cycle configuration, more waste heat can be recovered by the combined cycle introduced in this paper. (C) 2011 Elsevier Ltd. All rights reserved.

作者关键词: Internal combustion engine; Energy balance; Waste heat recovery; Combined thermodynamic cycle; Thermodynamic performance

KeyWords Plus: ORGANIC RANKINE-CYCLE; RO DESALINATION; PERFORMANCE; DESIGN; SYSTEM; FLUIDS; ORC

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第 37 条, 共 85 条

标题: Low-grade heat conversion into power using organic Rankine cycles - A review of various applications

作者: Tchanche, BF (Tchanche, Bertrand F.); Lambrinos, G (Lambrinos, Gr.); Frangoudakis, A (Frangoudakis, A.); Papadakis, G (Papadakis, G.)

来源出版物: RENEWABLE & SUSTAINABLE ENERGY REVIEWS 卷: 15 期: 8 页: 3963-3979 DOI: 10.1016/j.rser.2011.07.024 出版年: OCT 2011

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摘要: An organic Rankine cycle (ORC) machine is similar to a conventional steam cycle energy

conversion system, but uses an organic fluid such as refrigerants and hydrocarbons instead of water. In recent years, research was intensified on this device as it is being progressively adopted as premier technology to convert low-temperature heat resources into power. Available heat resources are: solar energy, geothermal energy, biomass products, surface seawater, and waste heat from various thermal processes. This paper presents existing applications and analyzes their maturity. Binary geothermal and binary biomass CHP are already mature. Provided the interest to recover waste heat rejected by thermal devices and industrial processes continue to grow, and favorable legislative conditions are adopted, waste heat recovery organic Rankine cycle systems in the near future will experience a rapid growth. Solar modular power plants are being intensely investigated at smaller scale for cogeneration applications in buildings but larger plants are also expected in tropical or Sahel regions with constant and low solar radiation intensity. OTEC power plants operating mainly on offshore installations at very low temperature have been advertised as total resource systems and interest on this technology is growing in large isolated islands. (C) 2011 Elsevier Ltd. All rights reserved.

作者关键词: Modular solar thermal power; Biomass CHP; Geothermal; Waste heat recovery; OTEC; Organic Rankine cycles

KeyWords Plus: REVERSE-OSMOSIS DESALINATION; SOLAR COLLECTOR/CHP SYSTEM; OF-THE-ART; WORKING FLUIDS; WASTE HEAT; ELECTRICITY-GENERATION; ZEOTROPIC MIXTURES; CEMENT INDUSTRY; ROTARY KILN; TEMPERATURE

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第 38 条, 共 85 条

标题: The Future of Seawater Desalination: Energy, Technology, and the Environment

作者: Elimelech, M (Elimelech, Menachem); Phillip, WA (Phillip, William A.)

来源出版物: SCIENCE 卷: 333 期: 6043 页: 712-717 DOI: 10.1126/science.1200488 出版年: AUG 5 2011

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摘要: In recent years, numerous large-scale seawater desalination plants have been built in water-stressed countries to augment available water resources, and construction of new desalination plants is expected to increase in the near future. Despite major advancements in desalination technologies, seawater desalination is still more energy intensive compared to conventional technologies for the treatment of fresh water. There are also concerns about the potential environmental impacts of large-scale seawater desalination plants. Here, we review the possible reductions in energy demand by state-of-the-art seawater desalination technologies, the potential role of advanced materials and innovative technologies in improving performance, and the sustainability of desalination as a technological solution to global water shortages.

PubMed ID: 21817042

KeyWords Plus: REVERSE-OSMOSIS MEMBRANE; CARBON NANOTUBE MEMBRANES; WATER DESALINATION; THERMODYNAMIC RESTRICTION; RO; PURIFICATION; POLYAMIDE; PROTEIN; DESIGN; DERIVATIVES

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第 39 条, 共 85 条

标题: Membranes and theoretical modeling of membrane distillation: A review

作者: Khayet, M (Khayet, Mohamed)

来源出版物: ADVANCES IN COLLOID AND INTERFACE SCIENCE 卷: 164 期: 1-2 特刊: SI 页: 56-88 DOI: 10.1016/j.cis.2010.09.005 出版年: MAY 11 2011

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摘要: Membrane distillation (MD) is one of the non-isothermal membrane separation processes used in various applications such desalination, environmental/waste cleanup, food, etc. It is known since 1963 and is still being developed at laboratory stage for different purposes and not fully implemented in industry. An abrupt increase in the number of papers on MD membrane engineering (i.e. design, fabrication and testing in MD) is seen since only 6 years ago. The present paper offers a comprehensive MD state-of-the-art review covering a wide range of commercial membranes, MD membrane engineering, their MD performance, transport mechanisms, experimental and theoretical modeling of different MD configurations as well as recent developments in MD. Improved MD membranes with specific morphology, micro- and nanostructures are highly demanded. Membranes with different pore sizes, porosities, thicknesses and materials as well as novel structures are required in order to carry out systematic MD studies for better understanding mass transport in different MD configurations, thereby improving the MD performance and looking for MD industrialization. (C) 2010 Elsevier B.V. All rights reserved.

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作者关键词: Membrane distillation; Membranes; Theoretical models

KeyWords Plus: HOLLOW-FIBER MEMBRANES; AIR-GAP MEMBRANE; SURFACE-MODIFYING MACROMOLECULES; HYDROPHOBIC POROUS MEMBRANES; HYDROPHOBIC/HYDROPHILIC COMPOSITE MEMBRANES; MONTE-CARLO-SIMULATION; PORE-SIZE DISTRIBUTION; NONISOTHERMAL WATER TRANSPORT; FLAT-SHEET MEMBRANES; DIRECT-CONTACT MD

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第 40 条, 共 85 条

标题: A review of reverse osmosis membrane materials for desalination-Development to date and future potential

作者: Lee, KP (Lee, Kali Peng); Arnot, TC (Arnot, Tom C.); Mattia, D (Mattia, Davide)

来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 370 期: 1-2 页: 1-22 DOI: 10.1016/j.memsci.2010.12.036 出版年: MAR 15 2011

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摘要: Reverse osmosis (RO) is currently the most important desalination technology and it is experiencing significant growth. The objective of this paper is to review the historical and current development of RO membrane materials which are the key determinants of separation performance and water productivity, and hence to define performance targets for those who are developing new RO membrane materials. The chemistry, synthesis mechanism(s) and desalination performance of various RO membranes are discussed from the point of view of membrane materials science. The review starts with the first generation of asymmetric polymeric membranes and finishes with current proposals for nano-structured membrane materials. The paper provides an overview of RO performance in relation to membrane materials and methods of synthesis.

To date polymeric membranes have dominated the RO desalination industry. From the late 1950s to the 1980s the research effort focussed on the search for optimum polymeric membrane materials. In subsequent decades the performance of RO membranes has been optimised via control of membrane formation reactions, and the use of poly-condensation catalysts and additives. The performance of state-of-the-art RO membranes has been highlighted. Nevertheless, the advances in membrane permselectivity in the past decade has been relatively slow, and membrane fouling remains a severe problem.

The emergence of nano-technology in membrane materials science could offer an attractive alternative to polymeric materials. Hence nano-structured membranes are discussed in this review including zeolite membranes, thin film nano-composite membranes, carbon nano-tube membranes, and biomimetic membranes. It is proposed that these novel materials represent the most likely opportunities for enhanced RO desalination performance in the future, but that a number of challenges remain with regard to their practical implementation. (C) 2010 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Reverse osmosis (RO); Membrane material; Membrane performance; Nano-materials

KeyWords Plus: CARBON NANOTUBE MEMBRANES; FILM COMPOSITE MEMBRANE; POLYAMIDE MOLECULAR-STRUCTURE; ATOMIC-FORCE MICROSCOPY; CARBIDE-DERIVED CARBON; RIGID STAR AMPHIPHILES; NANOFILTRATION MEMBRANES; SEAWATER DESALINATION; INTERFACIAL POLYMERIZATION; ZEOLITE MEMBRANES

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第 41 条, 共 85 条

标题: Advanced carbon aerogels for energy applications

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摘要: Carbon aerogels are a unique class of high-surface-area materials derived by sol-gel chemistry. Their high mass-specific surface area and electrical conductivity, environmental compatibility and chemical inertness make them very promising materials for many energy related applications, specifically in view of recent developments in controlling their morphology. In this perspective we will review the synthesis of monolithic resorcinol-formaldehyde based carbon aerogels with hierarchical porosities for energy applications, including carbon nanotube and graphene composite carbon aerogels, as well as their functionalization by surface engineering. Applications that we will discuss include hydrogen and electrical energy storage, desalination and catalysis.

KeyWords Plus: ATOMIC LAYER DEPOSITION; HYDROGEN STORAGE PROPERTIES; FUEL-CELL-ELECTRODES; POROUS CARBON; CAPACITIVE DEIONIZATION; AMMONIA BORANE; ELECTROCHEMICAL CAPACITORS; ELECTRICAL-CONDUCTIVITY; PLATINUM NANOPARTICLES; SUPPORTED CATALYSTS

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第 42 条, 共 85 条

标题: A procedure to select working fluids for Solar Organic Rankine Cycles (ORCs)

作者: Rayegan, R (Rayegan, R.); Tao, YX (Tao, Y. X.)

来源出版物: RENEWABLE ENERGY 卷: 36 期: 2 页: 659-670 DOI: 10.1016/j.renene.2010.07.010 出版年: FEB 2011

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摘要: The selection of working fluid and working conditions of the Organic Rankine Cycle (ORC) has a great effect on the system operation, and its energy efficiency and impact on the environment. The main purpose of this study is to develop a procedure to compare capabilities of working fluids when they are employed in solar Rankine cycles with similar working conditions. The Refprop 8.0 database with 117 organic fluids has been considered as the reference in this study. A procedure to compare ORC working fluids based on their molecular components, temperature entropy diagram and fluid effects on the thermal efficiency, net power generated, vapor expansion ratio, and exergy efficiency of the Rankine cycle has been proposed. Fluids with the best cycle performance have been recognized in two different temperature levels within two different categories of fluids: refrigerants and non-refrigerants. Based on categories of solar collectors, 11 fluids have been suggested to be employed in solar ORCs that use low or medium temperature solar collectors. Collector efficiency improvement and use of the regenerative ORC instead of the basic cycle reduce irreversibility of a

solar ORC. Calculation results show that for selected fluids, the theoretical limits for irreversibility reduction and exergy efficiency enhancement through collector efficiency improvement are 35% and 5% respectively, when the collector efficiency increases from 70% to 100%. The effect of regeneration on the exergy efficiency of the cycle is fluid dependent while the effect of collector efficiency improvement on the exergy efficiency of the cycle is nearly independent of fluid type. At the two temperature levels studied, higher molecular complexity results in more effective regenerative cycles except for Cyclohydrocarbons. Published by Elsevier Ltd.

作者关键词: Solar energy; Organic Rankine cycle; Working fluid; Exergy; Regeneration

KeyWords Plus: REVERSE-OSMOSIS DESALINATION

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第 43 条, 共 85 条

标题: A supercritical Rankine cycle using zeotropic mixture working fluids for the conversion of low-grade heat into power

作者: Chen, HJ (Chen, Huijuan); Goswami, DY (Goswami, D. Yogi); Rahman, MM (Rahman, Muhammad M.); Stefanakos, EK (Stefanakos, Elias K.)

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摘要: A supercritical Rankine cycle using zeotropic mixture working fluids for the conversion of low-grade heat into power is proposed and analyzed in this paper. Unlike a conventional organic Rankine cycle, a supercritical Rankine cycle does not go through the two-phase region during the heating process. By adopting zeotropic mixtures as the working fluids, the condensation process also happens non-isothermally. Both of these features create a potential for reducing the irreversibilities and improving the system efficiency. A comparative study between an organic Rankine cycle and the proposed supercritical Rankine cycle shows that the proposed cycle can achieve thermal efficiencies of 10.8-13.4% with the cycle high temperature of 393 K-473 K as compared to 9.7-10.1% for the organic Rankine cycle, which is an improvement of 10-30% over the organic Rankine cycle. When including the heating and condensation processes in the system, the system exergy efficiency is 38.6% for the proposed supercritical Rankine cycle as compared to 24.1% for the organic Rankine cycle. (C) 2010 Elsevier Ltd. All rights reserved.

作者关键词: Supercritical Rankine cycle; Zeotropic mixture; Organic Rankine cycle; Low-grade heat

KeyWords Plus: REVERSE-OSMOSIS DESALINATION; ENERGY RECOVERY-SYSTEMS; WASTE HEAT; CARBON-DIOXIDE; SOLAR-ENERGY; GENERATION; ORC; FEASIBILITY; INDUSTRY

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第 44 条, 共 85 条

标题: Electrodialysis, a mature technology with a multitude of new applications

作者: Strathmann, H (Strathmann, H.)

来源出版物: DESALINATION 卷: 264 期: 3 特刊: SI 页: 268-288 DOI: 10.1016/j.desal.2010.04.069 出版年: DEC 31 2010

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摘要: Electrodialysis is a mature process which is applied since more than 50 years on a large industrial scale for the production of potable water from brackish water sources. But more recently electrodialysis in combination with bipolar membranes or with ion-exchange resins has found a large number of new interesting applications in the chemical process industry in the food and drug industry as well as in waste water treatment and the production of high quality industrial water.

In this paper the principle of electrodialysis is described and its advantages and limitations in various applications are pointed out. More recent developments in electrodialysis as well as in related processes such as electrodialytic water dissociation or continuous electrodeionization are discussed and their present and potential future applications are indicated. Research needs for a sustainable growth of electrodialysis and related processes are pointed out. (C) 2010 Elsevier B V. All rights reserved.

作者关键词: Electrodialysis; Continuous electrodeionization; Reverse electrodialysis; Electrodialytic water dissociation; Capacitive deionization

KeyWords Plus: ANION-EXCHANGE MEMBRANES; HIGH-PURITY WATER; BIPOLAR MEMBRANES; CONTINUOUS ELECTRODEIONIZATION; CONCENTRATION POLARIZATION; FUEL-CELLS; PERMSELECTIVITY; DESALINATION; TRANSPORT; ACID

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第 45 条, 共 85 条

标题: Advances in heat pump systems: A review

作者: Chua, KJ (Chua, K. J.); Chou, SK (Chou, S. K.); Yang, WM (Yang, W. M.)

来源出版物: APPLIED ENERGY 卷: 87 期: 12 页: 3611-3624 DOI: 10.1016/j.apenergy.2010.06.014 出版年: DEC 2010

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摘要: Heat pump systems offer economical alternatives of recovering heat from different sources for use in various industrial, commercial and residential applications. As the cost of energy continues to rise, it becomes imperative to save energy and improve overall energy efficiency. In this light, the heat pump becomes a key component in an energy recovery system with great potential for energy saving. Improving heat pump performance, reliability, and its environmental impact has been an



ongoing concern. Recent progresses in heat pump systems have centred upon advanced cycle designs for both heat- and work-actuated systems, improved cycle components (including choice of working fluid), and exploiting utilisation in a wider range of applications. For the heat pump to be an economical proposition, continuous efforts need to be devoted to improving its performance and reliability while discovering novel applications. Some recent research efforts have markedly improved the energy efficiency of heat pump. For example, the incorporation of a heat-driven ejector to the heat pump has improved system efficiency by more than 20%. Additionally, the development of better compressor technology has the potential to reduce energy consumption of heat pump systems by as much as 80%. The evolution of new hybrid systems has also enabled the heat pump to perform efficiently with wider applications. For example, incorporating a desiccant to a heat pump cycle allowed better humidity and temperature controls with achievable COP as high as 6. This review paper provides an update on recent developments in heat pump systems, and is intended to be a "one-stop" archive of known practical heat pump solutions. The paper, broadly divided into three main sections, begins with a review of the various methods of enhancing the performance of heat pumps. This is followed by a review of the major hybrid heat pump systems suitable for application with various heat sources. Lastly, the paper presents novel applications of heat pump systems used in select industries. (C) 2010 Elsevier Ltd. All rights reserved.

作者关键词: Heat pump technologies; Vapour compression cycle; Heat recovery; Energy efficiency; Hybrid heat pump systems; Applications and solutions

KeyWords Plus: VAPOR COMPRESSION REFRIGERATION; SCROLL COMPRESSOR; PERFORMANCE ENHANCEMENT; 2-PHASE EJECTOR; WORKING FLUIDS; CYCLE; ENERGY; OPTIMIZATION; DESALINATION; SIMULATION

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第 46 条, 共 85 条

标题: Analysis and optimization of the low-temperature solar organic Rankine cycle (ORC)

作者: Delgado-Torres, AM (Delgado-Torres, Agustin M.); Garcia-Rodriguez, L (Garcia-Rodriguez, Lourdes)

来源出版物: ENERGY CONVERSION AND MANAGEMENT 卷: 51 期: 12 页: 2846-2856 DOI: 10.1016/j.enconman.2010.06.022 出版年: DEC 2010

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摘要: Solar thermal driven reverse osmosis desalination is a promising renewable energy-driven desalination technology. A joint use of the solar thermal powered organic Rankine cycle (ORC) and the desalination technology of less energy consumption, reverse osmosis (RO), makes this combination interesting in some scarce water resource scenarios. However, prior to any practical experience with any new process, a comprehensive and rigorous theoretical study must be done in order to assess the performance of the new technology or combination of existing technologies. The main objective of the present paper is the expansion of the theoretical analysis done by the authors in previous works to the case in which the thermal energy required by a solar ORC is supplied by means of stationary solar collectors. Twelve substances are considered as working fluids of the ORC and four different models of stationary solar collectors (flat plate collectors, compound parabolic collectors and evacuated tube collectors) are also taken into account. Operating conditions of the solar ORC that minimizes the aperture area needed per unit of mechanical power output of the solar cycle are determined for every working fluid and every solar collector. The former is done considering a direct vapour generation configuration of the solar cycle and also the configuration with water as heat transfer fluid flowing inside the solar collector. This work is part of the theoretical analysis of the solar thermal driven seawater and brackish water reverse osmosis desalination technology. Nevertheless, the supplied information can be also used for the assessment of different



applications of the solar ORC. In that case, results presented in this paper can be useful in techno-economic analysis, selection of working fluids of the Rankine cycle, sizing of systems and assessment of solar power cycle configuration. (C) 2010 Elsevier Ltd. All rights reserved.

作者关键词: Solar organic Rankine cycle; Solar ORC; Solar reverse osmosis; Solar desalination

KeyWords Plus: REVERSE-OSMOSIS DESALINATION; WASTE HEAT-RECOVERY; THERMODYNAMIC PROPERTIES; FLUID SELECTION; WORKING FLUIDS; SYSTEM; STATE; POWER; EQUATIONS; WATER

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第 47 条, 共 85 条

标题: A review of thermodynamic cycles and working fluids for the conversion of low-grade heat

作者: Chen, HJ (Chen, Huijuan); Goswami, DY (Goswami, D. Yogi); Stefanakos, EK (Stefanakos, Elias K.)

来源出版物: RENEWABLE & SUSTAINABLE ENERGY REVIEWS 卷: 14 期: 9 页: 3059-3067 DOI: 10.1016/j.rser.2010.07.006 出版年: DEC 2010

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摘要: This paper presents a review of the organic Rankine cycle and supercritical Rankine cycle for the conversion of low-grade heat into electrical power, as well as selection criteria of potential working fluids, screening of 35 working fluids for the two cycles and analyses of the influence of fluid properties on cycle performance. The thermodynamic and physical properties, stability, environmental impacts, safety and compatibility, and availability and cost are among the important considerations when selecting a working fluid. The paper discusses the types of working fluids, influence of latent heat, density and specific heat, and the effectiveness of superheating. A discussion of the 35 screened working fluids is also presented. (C) 2010 Elsevier Ltd. All rights reserved.

作者关键词: Organic Rankine cycle; Supercritical Rankine cycle; Organic working fluid; Low-grade heat source

KeyWords Plus: ORGANIC-RANKINE-CYCLE; REVERSE-OSMOSIS DESALINATION; SUPERCRITICAL CARBON-DIOXIDE; SURFACE PRESSURE DISTRIBUTIONS; ENERGY RECOVERY-SYSTEMS; WASTE HEAT; SOLAR-ENERGY; PERFORMANCE ANALYSIS; POWER-GENERATION; NUCLEATING STEAM

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第 48 条, 共 85 条

标题: Novel Graphene-Like Electrodes for Capacitive Deionization

作者: Li, HB (Li, Haibo); Zou, LD (Zou, Linda); Pan, LK (Pan, Likun); Sun, Z (Sun, Zhuo)

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摘要: Capacitive deionization (CDI) is a novel technology that has been developed for removal of charged ionic species from salty water, such as salt ions. The basic concept of CDI, as well as electrosorption, is to force charged ions toward oppositely polarized electrodes through imposing a direct electric field to form a strong electrical double layer and hold the ions. Once the electric field disappears, the ions are instantly released back to the bulk solution. CDI is an alternative low-energy consumption desalination technology. Graphene-like nanoflakes (GNFs) with relatively high specific surface area have been prepared and used as electrodes for capacitive deionization. The GNFs were synthesized by a modified Hummers' method using hydrazine for reduction. They were characterized by atomic force microscopy, N₂ adsorption at 77 K and electrochemical workstation. It was found that the ratio of nitric acid and sulfuric acid plays a vital role in determining the specific surface area of GNFs. Its electrosorption performance was much better than commercial activated carbon (AC), suggesting a great potential in capacitive deionisation application. Further, the electrosorptive performance of GNFs electrodes with different bias potentials, flow rates and ionic strengths were measured and the electrosorption isotherm and kinetics were investigated. The results showed that GNFs prepared by this process had the specific surface area of 222.01 m²/g. The specific electrosorptive capacity of the GNFs was 23.18 μmol/g for sodium ions (Na⁺) when the initial concentration was at 25 mg/L, which was higher than that of previously reported data using graphene and AC under the same experimental condition. In addition, the equilibrium electrosorption capacity was determined as 73.47 μmol/g at 2.0 V by fitting data through the Langmuir isotherm, and the rate constant was found to be 1.01 min⁻¹ by fitting data through pseudofirst-order adsorption. The results suggested that the chemically synthesized GNFs can be used as effective electrode materials in CDI process for brackish water desalination.

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KeyWords Plus: AQUEOUS DISPERSIONS; DESALINATION; ROUTE

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第 49 条, 共 85 条

标题: Parabolic-trough solar collectors and their applications

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来源出版物: RENEWABLE & SUSTAINABLE ENERGY REVIEWS 卷: 14 期: 7 页: 1695-1721 DOI: 10.1016/j.rser.2010.03.012 出版年: SEP 2010

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摘要: This paper presents an overview of the parabolic-trough collectors that have been built and marketed during the past century, as well as the prototypes currently under development. It also presents a survey of systems which could incorporate this type of concentrating solar system to supply thermal energy up to 400 degrees C, especially steam power cycles for electricity generation, including examples of each application. (C) 2010 Elsevier Ltd. All rights reserved.

作者关键词: Solar energy; Solar collector; Concentrated Solar Power plant; Industrial process heat; Heat water production; Solar cooling

KeyWords Plus: DIRECT STEAM-GENERATION; PHOTOCATALYTIC WATER DECONTAMINATION; ORGANIC RANKINE-CYCLE; DESALINATION SYSTEM; POWER-PLANTS; DISS PROJECT; ELECTRICITY PRODUCTION; ASSISTED DESALINATION; ECONOMIC-ANALYSIS; PERFORMANCE

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来源出版物页码计数: 27

第 50 条, 共 85 条

标题: Water Purification by Membranes: The Role of Polymer Science

作者: Geise, GM (Geise, Geoffrey M.); Lee, HS (Lee, Hae-Seung); Miller, DJ (Miller, Daniel J.); Freeman, BD (Freeman, Benny D.); Mcgrath, JE (Mcgrath, James E.); Paul, DR (Paul, Donald R.)

来源出版物: JOURNAL OF POLYMER SCIENCE PART B-POLYMER PHYSICS 卷: 48 期: 15 页: 1685-1718 DOI: 10.1002/polb.22037 出版年: AUG 1 2010

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摘要: Two of the greatest challenges facing the 21st century involve providing sustainable supplies of clean water and energy, two highly interrelated resources, at affordable costs. Membrane technology is expected to continue to dominate the water purification technologies owing to its energy efficiency. However, there is a need for improved membranes that have higher flux, are more selective, are less prone to various types of fouling, and are more resistant to the chemical environment, especially chlorine, of these processes. This article summarizes the nature of the global water problem and reviews the state of the art of membrane technology. Existing deficiencies of current membranes and the opportunities to resolve them with innovative polymer chemistry and

physics are identified. Extensive background is provided to help the reader understand the fundamental issues involved. (C) 2010 Wiley Periodicals, Inc. J Polym Sci Part B: Polym Phys 48: 1685-1718, 2010

作者关键词: charge transport; desalination; ionomers; membranes; separation techniques; water purification

KeyWords Plus: REVERSE-OSMOSIS MEMBRANES; CELLULOSE-ACETATE MEMBRANES; PRESSURE-RETARDED OSMOSIS; ION-EXCHANGE MEMBRANES; AMMONIA-CARBON DIOXIDE; POLYSULFONE ULTRAFILTRATION MEMBRANES; INTERNAL CONCENTRATION POLARIZATION; ELECTROOSMOTIC TRANSPORT BEHAVIOR; PHOTOINDUCED GRAFT-POLYMERIZATION; PHARMACEUTICALLY ACTIVE COMPOUNDS

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标题: Reverse Draw Solute Permeation in Forward Osmosis: Modeling and Experiments

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摘要: Osmotically driven membrane processes are an emerging set of technologies that show promise in water and wastewater treatment, desalination, and power generation. The effective operation of these systems requires that the reverse flux of draw solute from the draw solution into the feed solution be minimized. A model was developed that describes the reverse permeation of draw solution across an asymmetric membrane in forward osmosis operation. Experiments were carried out to validate the model predictions with a highly soluble salt (NaCl) as a draw solution and a cellulose acetate membrane designed for forward osmosis. Using independently determined membrane transport coefficients, strong agreement between the model predictions and experimental results was observed. Further analysis shows that the reverse flux selectivity, the ratio of the forward water flux to the reverse solute flux, is a key parameter in the design of osmotically driven membrane processes. The model predictions and experiments demonstrate that this parameter is independent of the draw solution concentration and the structure of the membrane support layer. The value of the reverse flux selectivity is determined solely by the selectivity of the membrane active layer.

PubMed ID: 20527762

KeyWords Plus: INTERNAL CONCENTRATION POLARIZATION; AMMONIA-CARBON DIOXIDE; FLUX BEHAVIOR; MEMBRANES; DESALINATION; WATER; PERFORMANCE; TRANSPORT; DIFFUSION; HYBRID

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第 52 条, 共 85 条

标题: Characterization of novel forward osmosis hollow fiber membranes

作者: Wang, R (Wang, Rong); Shi, L (Shi, Lei); Tang, CYY (Tang, Chuyang Y.); Chou, SR (Chou, Shuren); Qiu, C (Qiu, Changquan); Fane, AG (Fane, Anthony G.)

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摘要: Forward osmosis (FO) has received intensive studies recently for a range of potential applications such as wastewater treatment, water purification and seawater desalination. One of the major challenges to be overcome is the lack of an optimized FO membrane that can produce a high water flux comparable to commercial RO membranes. Two types of thin-film composite FO hollow fibers with an ultra-thin polyamide-based RO-like skin layer (300-600 nm) on either the outer surface (#A-FO) or inner surface (#B-FO) of a porous hollow fiber substrate have been successfully fabricated. These novel composite FO hollow fibers have been characterized by a series of standard protocols and benchmarked against commercially available FO flat sheet membranes and reported NF hollow fibers used for the FO process.

The characterization reveals that the FO hollow fiber membranes possess a large lumen. The substrates are highly porous with a narrow pore size distribution. The active layers present excellent intrinsic separation properties with a hydrophilic rejection layer and good mechanical strength. The #B-FO hollow fiber membrane can achieve a high FO water flux of 32.2 L/m² h using a 0.5 M NaCl draw solution in the active rejection layer facing draw solution (AL-facing-DS) configuration at 23 degrees C. The corresponding salt flux is only 3.7 g/m² h. To the best of our knowledge, the performance of the #B-FO hollow fiber is superior to all FO membranes reported in the open literature. The current study suggests that the optimal FO membrane structure would possess a very small portion of sponge-like layer in a thin and highly porous substrate, which suggests a way for further improvement. (C) 2010 Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis; Hollow fiber; Thin film composite; Internal concentration polarization; Structural parameter

KeyWords Plus: INTERNAL CONCENTRATION POLARIZATION; PHYSIOCHEMICAL PROPERTIES; SEPARATION PERFORMANCE; MECHANICAL-PROPERTIES; WATER FLUX; LAYER; FABRICATION; MORPHOLOGY; RO

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第 53 条, 共 85 条

标题: High Performance Thin-Film Composite Forward Osmosis Membrane

作者: Yip, NY (Yip, Ngai Yin); Tiraferri, A (Tiraferri, Alberto); Phillip, WA (Phillip, William A.); Schiffman, JD (Schiffman, Jessica D.); Elimelech, M (Elimelech, Menachem)

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摘要: Recent studies show that osmotically driven membrane processes may be a viable technology for desalination, water and wastewater treatment, and power generation. However, the absence of a membrane designed for such processes is a significant obstacle hindering further advancements of this technology. This work presents the development of a high performance thin-film composite membrane for forward osmosis applications. The membrane consists of a selective polyamide active layer formed by interfacial polymerization on top of a polysulfone support layer fabricated by phase separation onto a thin (40 μ m) polyester nonwoven fabric. By careful selection of the polysulfone casting solution (i.e., polymer concentration and solvent composition) and tailoring the casting process, we produced a support layer with a mix of finger-like and spongelike morphologies that give significantly enhanced membrane performance. The structure and performance of the new thin-film composite forward osmosis membrane are compared with those of commercial membranes. Using a 1.5 M NaCl draw solution and a pure water feed, the fabricated membranes produced water fluxes exceeding 18 L m^{(2-)h(-1)}, while consistently maintaining observed salt rejection greater than 97%. The high water flux of the fabricated thin-film composite forward osmosis membranes was directly related to the thickness, porosity, tortuosity, and pore structure of the polysulfone support layer. Furthermore, membrane performance did not degrade after prolonged exposure to an ammonium bicarbonate draw solution.

PubMed ID: 20408540

KeyWords Plus: WASTE-WATER RECLAMATION; AMMONIA-CARBON DIOXIDE; REVERSE-OSMOSIS; CONTACTOR PROCESSES; DESALINATION; FLUX; IMPACTS

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第 54 条, 共 85 条

标题: Coupled effects of internal concentration polarization and fouling on flux behavior of forward osmosis membranes during humic acid filtration

作者: Tang, CYY (Tang, Chuyang Y.); She, QH (She, Qianhong); Lay, WCL (Lay, Winson C. L.); Wang, R (Wang, Rong); Fane, AG (Fane, Anthony G.)

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摘要: Forward osmosis (FO) is attracting increasing interest for its potential applications in water and wastewater treatment and desalination. One of the major drawbacks of FO is internal concentration polarization (ICP), which significantly limits the FO flux efficiency. In addition, FO membrane flux can be adversely affected by membrane fouling. The effects of ICP and fouling on FO flux behavior were systematically investigated in the current study. Both theoretical model and experimental results demonstrated that the FO flux was highly non-linear with respect to the apparent driving force (the concentration difference between the draw solution and the feed water) as a result of ICP. ICP played a dominant role on FO flux behavior at greater draw solution concentrations and/or greater membrane fluxes due to the exponential dependence of ICP on flux level. Compared to the active layer facing draw solution (AL-facing-DS) configuration, more severe ICP was observed when the membrane active layer faced the feed water (AL-facing-FW) as a result of dilutive ICP in the FO support layer. Interestingly, the AL-facing-FW configuration showed remarkable flux stability against both dilution of the bulk draw solution and membrane fouling. In this configuration, any attempt to reduce membrane flux was compensated by a reduced level of ICP. The net result was only a marginal flux reduction. In addition, foulant deposition was insignificant in this configuration. Thus, the AL-facing-FW configuration enjoyed inherently stable flux, however, at the expense of severer initial ICP. In contrast, the AL-facing-DS configuration suffered severe flux reduction as porous membrane support faced the humic acid containing feed water. The flux loss in this configuration was likely due to the combined effects of (1) the internal clogging of the FO support structure as well as (2) the resulting enhanced ICP in the support layer. The latter was caused by reduced porosity and reduced mass transfer coefficient of the support. The pore clogging enhanced ICP mechanism probably played a dominant role in FO flux reduction at higher flux levels. To the authors' best knowledge, this is the first study to systematically demonstrate the coupled effects of ICP and fouling on the FO flux behavior. (C) 2010 Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis (FO); Internal concentration polarization (ICP); Fouling; Pore plugging enhanced internal concentration polarization; Membrane orientation

KeyWords Plus: ENHANCED CONCENTRATION POLARIZATION; STREAMING POTENTIAL MEASUREMENTS; PRESSURE-RETARDED OSMOSIS; REVERSE-OSMOSIS; NANOFILTRATION MEMBRANES; PROCESS PERFORMANCE; PERFLUOROCTANE SULFONATE; PHYSIOCHEMICAL PROPERTIES; PHYSICAL ASPECTS; WASTE-WATER

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第 55 条, 共 85 条

标题: Capacitive deionization as an electrochemical means of saving energy and delivering clean water. Comparison to present desalination practices: Will it compete?

作者: Anderson, MA (Anderson, Marc A.); Cudero, AL (Cudero, Ana L.); Palma, J (Palma, Jesus)

来源出版物: ELECTROCHIMICA ACTA 卷: 55 期: 12 页: 3845-3856 DOI: 10.1016/j.electacta.2010.02.012 出版年: APR 30 2010

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摘要: Potable water as well as water for agriculture and industry is critical to human habitation on this planet. We have been squandering and polluting this precious resource and are now in need of finding cost competitive newer technologies for reclaiming this valuable life-sustaining liquid. Capacitive deionization (CDI) is an electrochemical water treatment process that holds the promise of not only being a commercially viable alternative for treating water but for saving energy as well. CDI works by sequestering ions, or other charged species, in the electrical double layer of ultracapacitors. While removing these ions, one actually stores capacitive energy. If one recovers this energy efficiently, this process likely consumes less power than any competing technology. This paper reviews current methods for treating water in comparison to the state of art of the CDC process. (C) 2010 Elsevier Ltd. All rights reserved.

作者关键词: Electrodialysis; Capacitive deionization; Double layer capacitance; Zeta potential; Asymmetric electrodes

KeyWords Plus: CARBON AEROGEL ELECTRODES; ELECTRICAL DOUBLE-LAYER; COMPOSITE FILM ELECTRODES; ACTIVATED CARBON; BRACKISH-WATER; GRAPHITE-ELECTRODES; AQUEOUS-SOLUTIONS; NA CL SOLUTION; WASTE-WATERS; ELECTROSORPTION

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第 56 条, 共 85 条

标题: Thermophysical properties of seawater: a review of existing correlations and data

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来源出版物: DESALINATION AND WATER TREATMENT 卷: 16 期: 1-3 页: 354-380 DOI: 10.5004/dwt.2010.1079 出版年: APR 2010

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摘要: Correlations and data for the thermophysical properties of seawater are reviewed. Properties examined include density, specific heat capacity, thermal conductivity, dynamic viscosity, surface tension, vapor pressure, boiling point elevation, latent heat of vaporization, specific enthalpy, specific entropy and osmotic coefficient. These properties include those needed for design of thermal and membrane desalination processes. Results are presented in terms of regression equations as functions of temperature and salinity. The available correlations for each property are summarized with their range of validity and accuracy. Best-fitted new correlations are obtained from available data for density, dynamic viscosity, surface tension, boiling point elevation, specific enthalpy, specific entropy and osmotic coefficient after appropriate conversion of temperature and salinity scales to the most recent standards. In addition, a model for latent heat of vaporization is suggested. Comparisons are carried out among these correlations, and recommendations are provided for each property, particularly over the ranges of temperature and salinity common in thermal and/or reverse osmosis seawater desalination applications.

作者关键词: Seawater; Thermophysical properties; Density; Specific heat; Thermal conductivity; Viscosity; Surface tension; Vapor pressure; Boiling point elevation; Latent heat; Enthalpy; Entropy; Osmotic coefficient

KeyWords Plus: SEA-WATER SOLUTIONS; INTERNATIONAL TEMPERATURE SCALE; 25 DEGREES C; SALT-SOLUTIONS; HEAT-CAPACITY; THERMODYNAMIC PROPERTIES; PHYSICAL PROPERTIES; THERMAL-CONDUCTIVITY; SALINITY SCALE; ONE-ATMOSPHERE

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标题: Direct seawater desalination by ion concentration polarization

作者: Kim, SJ (Kim, Sung Jae); Ko, SH (Ko, Sung Hee); Kang, KH (Kang, Kwan Hyong); Han, J (Han, Jongyoon)

来源出版物: NATURE NANOTECHNOLOGY 卷: 5 期: 4 页: 297-301 DOI: 10.1038/nnano.2010.34 出版年: APR 2010

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摘要: A shortage of fresh water is one of the acute challenges facing the world today. An energy-efficient approach to converting sea water into fresh water could be of substantial benefit, but current desalination methods require high power consumption and operating costs or large-scale infrastructures, which make them difficult to implement in resource-limited settings or in disaster scenarios. Here, we report a process for converting sea water (salinity similar to 500 mM or similar to 30,000 mg l⁻¹) to fresh water (salinity <10 mM or < 600 mg l⁻¹) in which a continuous stream of sea water is divided into desalted and concentrated streams by ion concentration polarization, a phenomenon that occurs when an ion current is passed through ion-selective membranes. During operation, both salts and larger particles (cells, viruses and microorganisms) are pushed away from the membrane (a nanochannel or nanoporous membrane), which significantly reduces the possibility of membrane fouling and salt accumulation, thus avoiding two problems that plague other membrane filtration methods. To implement this approach, a simple microfluidic device was fabricated and shown to be capable of continuous desalination of sea water (similar to 99% salt rejection at 50% recovery rate) at a power consumption of less than 3.5 Wh l⁻¹, which is comparable to current state-of-the-art systems. Rather than competing with larger desalination plants, the method could be used to make small-or medium-scale systems, with the possibility of battery-powered operation.

PubMed ID: 20305644

KeyWords Plus: SEA-WATER; MEMBRANES

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第 58 条, 共 85 条

标题: Organic fouling of forward osmosis membranes: Fouling reversibility and cleaning without chemical reagents

作者: Mi, BX (Mi, Baoxia); Elimelech, M (Elimelech, Menachem)

来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 348 期: 1-2 页: 337-345 DOI: 10.1016/j.memsci.2009.11.021 出版年: FEB 15 2010

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摘要: The recently resurgent forward osmosis (FO) membrane process has the potential to become a sustainable alternative to conventional membrane processes. However, the fouling and cleaning behavior of FO membranes remains largely unknown. There is a need to fully understand the fouling

phenomena in FO in order to take advantage of this emerging technology. In this study, we used alginate as a model organic foulant to examine FO membrane fouling and cleaning behavior with the ultimate goal of determining the underlying FO fouling/cleaning mechanisms. Results showed that alginate fouling in FO is almost fully reversible, with more than 98% recovery of permeate water flux possible after a simple water rinse without any chemical cleaning reagents. We also studied the role of applied hydraulic pressure in membrane fouling and cleaning by performing fouling tests in FO (without hydraulic pressure) and RO (with hydraulic pressure) modes. Flux recovery in the FO mode was much higher than that in the RO mode under similar cleaning conditions, although the rate of membrane flux decline was similar in the two modes. The fouling reversibility of FO was attributed to the less compact organic fouling layer formed in FO mode due to the lack of hydraulic pressure. Our results suggest that operating in FO mode may offer an unprecedented advantage in reducing or even eliminating the need for chemical cleaning. AFM force measurements were used to elucidate the impact of membrane materials (cellulose acetate versus polyamide) on membrane fouling and cleaning behavior. Adhesion force data revealed that a small percentage of relatively adhesive sites on the membrane surface play an important role in increasing membrane fouling potential and decreasing cleaning efficiency. This finding implies that using average adhesion force to predict membrane fouling potential is inadequate. Extensive long-range adhesion forces are observed for the polyamide membrane in the presence of alginate and calcium ions. The long-range interactions are attributed to calcium bridging of alginate molecules between the AFM probe and the adhesive sites on the polyamide membrane surface. (C) 2009 Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis; Reverse osmosis; Organic fouling; Fouling reversibility; Cleaning; Membrane heterogeneity; Intermolecular adhesion force; Long-range interaction

KeyWords Plus: ATOMIC-FORCE MICROSCOPY; WASTE-WATER RECLAMATION; AMMONIA-CARBON DIOXIDE; REVERSE-OSMOSIS; NANOFILTRATION MEMBRANES; CONTACTOR PROCESSES; PHYSICAL ASPECTS; POWER-GENERATION; DESALINATION; SURFACES

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第 59 条, 共 85 条

标题: A New Method for Water Desalination Using Microbial Desalination Cells

作者: Cao, XX (Cao, Xiaoxin); Huang, X (Huang, Xia); Liang, P (Liang, Peng); Xiao, K (Xiao, Kang); Zhou, YJ (Zhou, Yingjun); Zhang, XY (Zhang, Xiaoyuan); Logan, BE (Logan, Bruce E.)

来源出版物: ENVIRONMENTAL SCIENCE & TECHNOLOGY 卷: 43 期: 18 页: 7148-7152 DOI: 10.1021/es901950j 出版年: SEP 15 2009

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摘要: Current water desalination techniques are energy intensive and some use membranes operated at high pressures. It is shown here that water desalination can be accomplished without electrical energy input or high water pressure by using a source of organic matter as the fuel to desalinate



water. A microbial fuel cell was modified by placing two membranes between the anode and cathode, creating a middle chamber for water desalination between the membranes. An anion exchange membrane was placed adjacent to the anode, and a cation exchange membrane was positioned next to the cathode. When current was produced by bacteria on the anode, ionic species in the middle chamber were transferred into the two electrode chambers, desalinating the water in the middle chamber. Proof-of-concept experiments for this approach, using what we call a microbial desalination cell (MDC), was demonstrated using water at different initial salt concentrations (5, 20, and 35 g/L) with acetate used as the substrate for the bacteria. The MDC produced a maximum of 2 W/m² (31 W/m³) while at the same time removing about 90% of the salt in a single desalination cycle. As the salt was removed from the middle chamber the ohmic resistance of the MDC (measured using electrochemical impedance spectroscopy) increased from 25 Omega to 970 Omega at the end of the cycle. This increased resistance was reflected by a continuous decrease in the voltage produced over the cycle. These results demonstrate for the first time the possibility for a new method for water desalination and power production that uses only a source of biodegradable organic matter and bacteria.

PubMed ID: 19806756

KeyWords Plus: BIOLOGICAL FUEL-CELLS; ELECTRICITY-GENERATION; EXCHANGE MEMBRANES; ELECTROLYSIS CELLS; POWER-GENERATION; ORGANIC-MATTER; CATHODE; REDUCTION; CATION; CONFIGURATION

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第 60 条, 共 85 条

标题: Solute Coupled Diffusion in Osmotically Driven Membrane Processes

作者: Hancock, NT (Hancock, Nathan T.); Cath, TY (Cath, Tzahi Y.)

来源出版物: ENVIRONMENTAL SCIENCE & TECHNOLOGY 卷: 43 期: 17 页: 6769-6775 DOI: 10.1021/es901132x 出版年: SEP 1 2009

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摘要: Forward osmosis (FO) is an emerging water treatment technology with potential applications in desalination and wastewater reclamation. In FO, water is extracted from a feed solution using the high osmotic pressure of a hypertonic solution that flows on the opposite side of a semipermeable membrane; however, solutes diffuse simultaneously through the membrane in both directions and may jeopardize the process. In this study, we have comprehensively explored the effects of different operating conditions on the forward diffusion of solutes commonly found in brackish water and seawater, and reverse diffusion of common draw solution solutes. Results show that reverse transport

of solutes through commercially available FO membranes range between 80 mg to nearly 3,000 mg per liter of water produced. Divalent feed solutes have low permeation rates (less than 1 mmol/m²-hr) while monovalent ions and uncharged solutes exhibit higher permeation. Findings have significant implications on the performance and sustainability of the FO process.

PubMed ID: 19764248

KeyWords Plus: AMMONIA-CARBON DIOXIDE; REVERSE-OSMOSIS; CONTACTOR PROCESSES; DESALINATION; PERFORMANCE; PRESSURE; ELECTROLYTES; PERMEABILITY; REUSE; IONS

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第 61 条, 共 85 条

标题: Fluid selection for a low-temperature solar organic Rankine cycle

作者: Tchanche, BF (Tchanche, Bertrand Fankam); Papadakis, G (Papadakis, George); Lambrinos, G (Lambrinos, Gregory); Frangoudakis, A (Frangoudakis, Antonios)

来源出版物: APPLIED THERMAL ENGINEERING 卷: 29 期: 11-12 页: 2468-2476 DOI: 10.1016/j.applthermaleng.2008.12.025 出版年: AUG 2009

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摘要: Theoretical performances as well as thermodynamic and environmental properties of few fluids have been comparatively assessed for use in low-temperature solar organic Rankine cycle systems. Efficiencies, volume flow rate, mass flow rate, pressure ratio, toxicity, flammability, ODP and GWP were used for comparison. of 20 fluids investigated, R134a appears as the most suitable for small scale solar applications. R152a, R600a, R600 and R290 offer attractive performances but need safety precautions, owing to their flammability. (C) 2008 Elsevier Ltd. All rights reserved.

作者关键词: Small scale solar applications; Working fluids; Organic Rankine cycle

KeyWords Plus: REVERSE-OSMOSIS DESALINATION; WASTE HEAT-RECOVERY; WORKING FLUIDS; DRY FLUIDS; SYSTEM; DESIGN; POWER; OPTIMIZATION; PROTOTYPE; ORC

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第 62 条, 共 85 条

标题: Energetic and economic investigation of Organic Rankine Cycle applications

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来源出版物: APPLIED THERMAL ENGINEERING 卷: 29 期: 8-9 页: 1809-1817 DOI: 10.1016/j.applthermaleng.2008.08.016 出版年: JUN 2009

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摘要: The use of organic working fluids for the realization of the so called Organic Rankine Cycle (ORC) has been proven to be a promising solution for decentralized combined heat and power production (CHP). The process allows the use of low temperature heat sources, offering an advantageous efficiency in small-scale applications. This is the reason why the number of geothermal and biomass fired power plants based on this technology have been increased within the last years. The favourable characteristics of ORC make them suitable for being integrated in applications like solar desalination with reverse osmosis system, waste heat recovery from biogas digestion plants or micro-CHP systems. In this paper, the state of the art of ORC applications will be presented together with innovative systems which have been simulated in a process simulation environment using experimental data. The results of the simulation like efficiencies, water production rates or achievable electricity production cost will be presented and discussed.(C) 2008 Elsevier Ltd. All rights reserved.

作者关键词: Organic Rankine Cycle (ORC); Combined heat and power production (CHP); Reverse osmosis; Biogas; Waste heat recovery

KeyWords Plus: PLANT; MSF

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第 63 条, 共 85 条

标题: Assessing the Environmental Impacts of Freshwater Consumption in LCA

作者: Pfister, S (Pfister, Stephan); Koehler, A (Koehler, Annette); Hellweg, S (Hellweg, Stefanie)

来源出版物: ENVIRONMENTAL SCIENCE & TECHNOLOGY 卷: 43 期: 11 页: 4098-4104 DOI: 10.1021/es802423e 出版年: JUN 1 2009

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摘要: A method for assessing the environmental impacts of freshwater consumption was developed. This method considers damages to three areas of protection: human health, ecosystem quality, and resources. The method can be used within most existing life-cycle impact assessment (LCIA) methods. The relative importance of water consumption was analyzed by integrating the method into the Eco-indicator-99 LCIA method. The relative impact of water consumption in LCIA was analyzed with a case study on worldwide cotton production. The importance of regionalized characterization factors for water use was also examined in the case study. In and regions, water consumption may dominate the aggregated life-cycle impacts of cotton-textile production. Therefore, the consideration of water consumption is crucial in life-cycle assessment (LCA) studies that include water-intensive products, such as agricultural goods. A regionalized assessment is necessary, since the impacts of water use vary greatly as a function of location. The presented method is useful for environmental decision-support in the production of water-intensive products as well as for environmentally responsible value-chain management.

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KeyWords Plus: FOOD SECURITY; RESOURCES; DESALINATION; DATABASE



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标题: Reverse osmosis desalination: Water sources, technology, and today's challenges

作者: Greenlee, LF (Greenlee, Lauren F.); Lawler, DF (Lawler, Desmond F.); Freeman, BD (Freeman, Benny D.); Marrot, B (Marrot, Benoit); Moulin, P (Moulin, Philippe)

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摘要: Reverse osmosis membrane technology has developed over the past 40 years to a 44% share in world desalting production capacity, and an 80% share in the total number of desalination plants installed worldwide. The use of membrane desalination has increased as materials have improved and costs have decreased. Today, reverse osmosis membranes are the leading technology for new desalination installations, and they are applied to a variety of salt water resources using tailored pretreatment and membrane system design. Two distinct branches of reverse osmosis desalination have emerged: seawater reverse osmosis and brackish water reverse osmosis. Differences between the two water sources, including foulants, salinity, waste brine (concentrate) disposal options, and plant location, have created significant differences in process development, implementation, and key technical problems. Pretreatment options are similar for both types of reverse osmosis and depend on the specific components of the water source. Both brackish water and seawater reverse osmosis (RO) will continue to be used worldwide; new technology in energy recovery and renewable energy, as well as innovative plant design, will allow greater use of desalination for inland and rural communities, while providing more affordable water for large coastal cities. A wide variety of research and general information on RO desalination is available; however, a direct comparison of seawater and brackish water RO systems is necessary to highlight similarities and differences in process development. This article brings to light key parameters of an RO process and process modifications due to feed water characteristics. (C) 2009 Elsevier Ltd. All rights reserved.

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作者关键词: Desalination; Reverse osmosis; Brackish water; Seawater; Drinking water; Membranes
KeyWords Plus: OF-THE-ART; BRACKISH GROUNDWATER TREATMENT; AGRICULTURAL DRAINAGE WATER; RO MEMBRANE DESALINATION; SMALL-SCALE DESALINATION; RESEARCH-AND-DEVELOPMENT; MODIFIED FOULING INDEX; SEAWATER DESALINATION; CONCENTRATION POLARIZATION; NANOFILTRATION MEMBRANES

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第 65 条, 共 85 条

标题: Assessing freshwater use impacts in LCA: Part I-inventory modelling and characterisation factors for the main impact pathways

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摘要: Freshwater is a basic resource for humans; however, its link to human health is seldom related to lack of physical access to sufficient freshwater, but rather to poor distribution and access to safe water supplies. On the other hand, freshwater availability for aquatic ecosystems is often reduced due to competition with human uses, potentially leading to impacts on ecosystem quality. This paper summarises how this specific resource use can be dealt with in life cycle analysis (LCA).

The main quantifiable impact pathways linking freshwater use to the available supply are identified, leading to definition of the flows requiring quantification in the life cycle inventory (LCI).

The LCI needs to distinguish between and quantify evaporative and non-evaporative uses of 'blue' and 'green' water, along with land use changes leading to changes in the availability of freshwater. Suitable indicators are suggested for the two main impact pathways [namely freshwater ecosystem impact (FEI) and freshwater depletion (FD)], and operational characterisation factors are provided for a range of countries and situations. For FEI, indicators relating current freshwater use to the available freshwater resources (with and without specific consideration of water ecosystem requirements) are suggested. For FD, the parameters required for evaluation of the commonly used abiotic depletion potentials are explored.

An important value judgement when dealing with water use impacts is the omission or consideration of non-evaporative uses of water as impacting ecosystems. We suggest considering only evaporative uses as a default procedure, although more precautionary approaches (e.g. an 'Egalitarian' approach) may also include non-evaporative uses. Variation in seasonal river flows is not captured in the approach suggested for FEI, even though abstractions during droughts may have dramatic consequences for ecosystems; this has been considered beyond the scope of LCA.

The approach suggested here improves the representation of impacts associated with freshwater use in LCA. The information required by the approach is generally available to LCA practitioners

The widespread use of the approach suggested here will require some development (and consensus) by LCI database developers. Linking the suggested midpoint indicators for FEI to a damage approach will require further analysis of the relationship between FEI indicators and ecosystem health.

作者关键词: Ecosystem; Evaporative use; FD; FEI; Freshwater ecosystem impact; LCA; LCI; LCIA; Virtual water; Water footprint; Water resource

KeyWords Plus: LIFE-CYCLE ASSESSMENT; ENVIRONMENTAL PROFILE; OSMOSIS

DESALINATION; RESOURCE; MANAGEMENT; SYSTEMS; CONSUMPTION;
FRAMEWORK; COTTON

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标题: Capacitive delonization (CDI) for desalination and water treatment - past, present and future (a review)

作者: Oren, Y (Oren, Yoram)

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摘要: Capacitive deionization (CDI) has attracted the interest of the Community investigating water treatment technologies since the mid-1960s. The technology is based on the recognition that high-surface-area electrodes, when electrically charged, can quantitatively adsorb ionic components from water, thereby resulting in desalination. The article reviews the theoretical and technological background of CDI, the history of its development, and past and Present attempts towards scaling Up and commercialization. It also provides a critical review of the advantages and limitations of the technology. In addition, further research approaches necessary to render CDI a mature and competitive technology for the treatment of brackish and Surface waters are outlined.

作者关键词: capacitive deionization (CDI); capacitive deionization technology (CDT); electronic water purification (EWP); electrosorption

KeyWords Plus: CARBON AEROGEL ELECTRODES; ELECTRICAL DOUBLE-LAYER; GRAPHITE-ELECTRODES; ACTIVATED CARBON; FELT ELECTRODES; NAACL SOLUTION; ELECTROSORPTION; DEIONIZATION; ADSORPTION; CLOTH

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第 67 条, 共 85 条



标题: Chemical and physical aspects of organic fouling of forward osmosis membranes

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摘要: The growing attention to forward osmosis (FO) membrane processes from various disciplines raises the demand for systematic research on FO membrane fouling. This study investigates the role of various physical and chemical interactions, such as intermolecular adhesion forces, calcium binding, initial permeate flux, and membrane orientation, in organic fouling of forward osmosis membranes. Alginate, bovine serum albumin (BSA), and Aldrich humic acid (AHA) were chosen as model organic foulants. Atomic force microscopy (AFM) was used to quantify the intermolecular adhesion forces between the foulant and the clean or fouled membrane in order to better understand the fouling mechanisms. A strong correlation between organic fouling and intermolecular adhesion was observed, indicating that foulant-foulant interaction plays an important role in determining the rate and extent of organic fouling. The fouling data showed that FO fouling is governed by the coupled influence of chemical and hydrodynamic interactions. Calcium binding, permeation drag, and hydrodynamic shear force are the major factors governing the development of a fouling layer on the membrane surface. However, the dominating factors controlling membrane fouling vary from foulant to foulant. With stronger intermolecular adhesion forces, hydrodynamic conditions for favorable foulant deposition leading to cake formation are more readily attained. Before a compact cake layer is formed, the fouling rate is affected by both the intermolecular adhesion forces and hydrodynamic conditions. However, once the cake layer forms, all three foulants have very similar flux decline rates, and further changes in hydrodynamic conditions do not influence fouling behavior. (C) 2008 Elsevier B.V. All rights reserved.

作者关键词: forward osmosis; osmosis; organic fouling; alginate; humic acid; bovine serum albumin; intermolecular adhesion force; foulant-foulant interaction; pressure retarded osmosis

KeyWords Plus: AMMONIA-CARBON DIOXIDE; INTERNAL CONCENTRATION POLARIZATION; WASTE-WATER RECLAMATION; NANOFILTRATION MEMBRANES; REVERSE-OSMOSIS; CONTACTOR PROCESSES; POWER-GENERATION; DESALINATION; PERFORMANCE; MECHANISMS

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第 68 条, 共 85 条

标题: Membrane fouling and process performance of forward osmosis membranes on activated sludge

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来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 319 期: 1-2 页: 158-168 DOI: 10.1016/j.memsci.2008.03.048 出版年: JUL 1 2008

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摘要: An innovative osmotic membrane bioreactor (OMBR) is currently under development, based on forward osmosis (FO) driven by an osmotic pressure difference. For the OMBR to be both technically and economically viable, the performance of the FO membranes has to be sufficiently high, while membrane fouling and draw solution leakage has to be low. The effect of temperature, membrane type, membrane orientation, type and concentration of draw solution was investigated to



optimize FO membrane performance using deionised water. Membrane fouling and draw solution leakage was investigated in this work by laboratory scale FO experiments using an activated sludge solution from a membrane bioreactor (MBR).

The best FO performance with an activated sludge solution was found with a FO-type membrane $J = 6.21/m^2 h$ at 20 ± 2 degrees C with 0.5 M NaCl corresponding to $\pi = 24$ bar). Draw solutions from salts consisting of monovalent ions (NaCl and NaNO₃) performed better than salts consisting of bivalent ions (MgSO₄ and ZnSO₄), while the flux of the FO membrane were non-linearly related to the concentration of the draw solution. Internal concentration polarization did hamper the FO performance as a result of the thickness and structure of the porous substructure of the investigated membranes.

Both reversible and irreversible membrane fouling were not found during the FO experiments using activated sludge solutions. Furthermore no substantial draw solution leakage was found for the FO membranes at various draw solution concentrations for different draw solutions. (C) 2008 Elsevier B.V. All rights reserved.

作者关键词: forward osmosis; membrane bioreactor; wastewater treatment; concentration polarization; internal concentration polarization

KeyWords Plus: WASTE-WATER TREATMENT; INTERNAL CONCENTRATION POLARIZATION; AMMONIA-CARBON DIOXIDE; DESALINATION; BIOREACTOR; TRANSPORT; MECHANISMS; NF

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第 69 条, 共 85 条

标题: Superwetting nanowire membranes for selective absorption

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来源出版物: NATURE NANOTECHNOLOGY 卷: 3 期: 6 页: 332-336 DOI: 10.1038/nnano.2008.136 出版年: JUN 2008

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摘要: The construction of nanoporous membranes is of great technological importance for various applications, including catalyst supports, filters for biomolecule purification, environmental remediation and seawater desalination(1-3). A major challenge is the scalable fabrication of membranes with the desirable combination of good thermal stability, high selectivity and excellent recyclability. Here we present a self-assembly method for constructing thermally stable, freestanding nanowire membranes that exhibit controlled wetting behaviour ranging from superhydrophilic to superhydrophobic. These membranes can selectively absorb oils up to 20 times the material's weight in preference to water, through a combination of superhydrophobicity and capillary action. Moreover, the nanowires that form the membrane structure can be re-suspended in solutions and subsequently re-form the original paper-like morphology over many cycles. Our results suggest an innovative material that should find practical applications in the removal of organics, particularly in the field of oil spill cleanup.

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KeyWords Plus: SURFACES; TRANSPARENT; WETTABILITY; LOTUS; FILMS

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第 70 条, 共 85 条

标题: A key review on exergetic analysis and assessment of renewable energy resources for a sustainable future

作者: Hepbasli, A (Hepbasli, Arif)

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摘要: Energy resources and their utilization intimately relate to sustainable development. In attaining sustainable development, increasing the energy efficiencies of processes utilizing sustainable energy resources plays an important role. The utilization of renewable energy offers a wide range of exceptional benefits. There is also a link between exergy and sustainable development. A sustainable energy system may be regarded as a cost-efficient, reliable, and environmentally friendly energy system that effectively utilizes local resources and networks. Exergy analysis has been widely used in the design, simulation and performance evaluation of energy systems.

The present study comprehensively reviews exergetic analysis and performance evaluation of a wide range of renewable energy resources (RERs) for the first time to the best of the author's knowledge. In this regard, general relations (i.e., energy, exergy, entropy and exergy balance equations along with exergy efficiency, exergetic improvement potential rate and some thermodynamic parameters, such as fuel depletion ratio, relative irreversibility, productivity lack and exergetic factor) used in the analysis are presented first. Next, exergetically analyzed and evaluated RERs include (a) solar energy systems; (a1) solar collector applications such as solar water heating systems, solar space heating and cooling, solar refrigeration, solar cookers, industrial process heat, solar desalination systems and solar thermal power plants), (a2) photovoltaics (PVs) and (a3) hybrid (PV/thermal) solar collectors, (b) wind energy systems, (c) geothermal energy systems, (c1) direct utilization (district heating, geothermal or ground-source heat pumps, greenhouses and drying) and (c2) indirect utilization (geothermal power plants), (d) biomass, (e) other renewable energy systems, and (f) country based RERs. Studies conducted on these RERs are then compared with the previously ones in tabulated forms, while the Grassmann (or exergy flow) diagrams, which are a very useful representation of exergy flows and losses, for some RERs are given. Finally, the conclusions are presented. It is expected that this comprehensive study will be very beneficial to everyone involved or interested in the exergetic design, simulation, analysis and performance assessment of RERs. (c) 2006 Elsevier Ltd. All rights reserved.

作者关键词: analysis; biomass; drying; efficiency; exergy; geothermal; geothermal power plants; heat pumps; hybrid systems; photovoltaic; renewable energy; solar; sustainability; wind

KeyWords Plus: DISTRICT-HEATING SYSTEM; GEOTHERMAL POWER-PLANT; 2ND LAW ANALYSIS; MAXIMUM CONVERSION EFFICIENCY; DRYING PROCESS; PERFORMANCE EVALUATION; THERMODYNAMIC ANALYSIS; SECTORAL ENERGY; SOLAR-RADIATION; SAUDI-ARABIA

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标题: Impacts of reaction and curing conditions on polyamide composite reverse osmosis membrane properties

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摘要: Here we report on the impacts of organic solvent properties, reaction conditions, and curing conditions on polyamide composite reverse osmosis membrane separation performance, film structure, and interfacial properties. We provide direct experimental evidence that: (1) MPD diffusivity in the organic phase governs MPD-TMC thin film water permeability, (2) MPD diffusivity and solubility influence MPD-TMC thin film crosslinking in competing ways, (3) water permeability correlates most strongly with MPD-TMC film structure (i.e., crosslinking), and (4) salt rejection correlates most strongly with MPD-TMC film thickness and morphology. Overall, higher flux membranes with food salt rejection appear to comprise thinner, more heavily crosslinked film structures. Such high performance RO membranes are obtained by (1) selecting high surface tension, low viscosity solvents, (2) controlling protonation of MPD and hydrolysis of TMC during interfacial polymerization, and (3) optimizing curing temperature and time based on organic solvent volatility. Finally, although more research is necessary, our results suggest the rugose morphology and relative hydrophobicity of high performance MPD-TMC membranes might enhance concentration polarization and exacerbate surface fouling. (C) 2007 Elsevier B.V All rights reserved.

作者关键词: reverse osmosis; polyamide; thin film composite; interfacial polymerization; desalination

KeyWords Plus: RO MEMBRANES; INTERFACIAL POLYCONDENSATION; NANOFILTRATION MEMBRANES; PERFORMANCE CORRELATION; FLUX-ENHANCEMENT; FILM FORMATION; THIN-FILMS; POLYMERIZATION

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第 72 条, 共 85 条

标题: Science and technology for water purification in the coming decades

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摘要: One of the most pervasive problems afflicting people throughout the world is inadequate access to clean water and sanitation. Problems with water are expected to grow worse in the coming decades, with water scarcity occurring globally, even in regions currently considered water-rich. Addressing these problems calls out for a tremendous amount of research to be conducted to identify robust new methods of purifying water at lower cost and with less energy, while at the same time

minimizing the use of chemicals and impact on the environment. Here we highlight some of the science and technology being developed to improve the disinfection and decontamination of water, as well as efforts to increase water supplies through the safe re-use of wastewater and efficient desalination of sea and brackish water.

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KeyWords Plus: OF-THE-ART; POLY(VINYLDENE FLUORIDE) MEMBRANES; CARBON NANOTUBE MEMBRANES; GRANULAR ACTIVATED CARBON; ULTRAFILTRATION MEMBRANES; POLYMER MEMBRANES; DRINKING-WATER; NANOFILTRATION MEMBRANES; SURFACE SEGREGATION; WASTE-WATER

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第 73 条, 共 85 条

标题: Advances in seawater desalination technologies

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引用的参考文献数: 175

摘要: A number of seawater desalination technologies have been developed during the last several decades to augment the supply of water in and regions of the world. Due to the constraints of high desalination costs, many countries are unable to afford these technologies as a fresh water resource. However, the steady increasing usage of seawater desalination has demonstrated that seawater desalination is a feasible water resource free from the variations in rainfall. A seawater desalination process separates saline seawater into two streams: a fresh water stream containing a low concentration of dissolved salts and a concentrated brine stream. The process requires some form of energy to desalinate, and utilizes several different technologies for separation. Two of the most commercially important technologies are based on the multi-stage flash (MSF) distillation and reverse osmosis (RO) processes. Although the desalination technologies are mature enough to be a reliable source for fresh water from the sea, a significant amount of research and development (R&D) has been carried out in order to constantly improve the technologies and reduce the cost of desalination. This paper reviews the current status, practices, and advances that have been made in the realm of seawater desalination technologies. Additionally, this paper provides an overview of R&D activities and outlines future prospects for the state-of-the-art seawater desalination technologies. Overall, the present review is made with special emphasis on the MSF and RO desalination technologies because they are the most successful processes for the commercial production of large quantities of fresh water from seawater.

作者关键词: seawater desalination technologies; multi-stage flash distillation desalination; multiple-effect distillation desalination; vapor compression distillation desalination; reverse osmosis desalination; freezing desalination; solar evaporation desalination; potabilization; desalination research and development

KeyWords Plus: OF-THE-ART; MSF DISTILLATION PLANTS; SEA-WATER DESALINATION;



YANBU AL-SINAIYAH; REVERSE-OSMOSIS; DEVELOPMENT PROGRAM; SOLAR DESALINATION; SYSTEMS; RO; PRETREATMENT

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来源出版物页码计数: 23

第 74 条, 共 85 条

标题: Designing carbon nanotube membranes for efficient water desalination

作者: Corry, B (Corry, Ben)

来源出版物: JOURNAL OF PHYSICAL CHEMISTRY B 卷: 112 期: 5 页: 1427-1434 DOI: 10.1021/jp709845u 出版年: FEB 7 2008

Web of Science 核心合集中的 "被引频次": 186

被引频次合计: 190

引用的参考文献数: 56

摘要: The transport of water and ions through membranes formed from carbon nanotubes ranging in diameter from 6 to 11 Å is studied using molecular dynamics simulations under hydrostatic pressure and equilibrium conditions. Membranes incorporating carbon nanotubes are found to be promising candidates for water desalination using reverse osmosis, and the size and uniformity of tubes that is required to achieve a desired salt rejection is determined. By calculating the potential of mean force for ion and water translocation, we show that ions face a large energy barrier and will not pass through the narrower tubes studied ((5,5) and (6,6) "armchair" type tubes) but can pass through the wider (7,7) and (8,8) nanotubes. Water, however, faces no such impediment due to the formation of stable hydrogen bonds and crosses all of the tubes studied at very large rates. By measuring this conduction rate under a hydrostatic pressure difference, we show that membranes incorporating carbon nanotubes can, in principle, achieve a high degree of desalination at flow rates far in excess of existing membranes.

PubMed ID: 18163610

KeyWords Plus: MOLECULAR-DYNAMICS SIMULATIONS; MECHANOSENSITIVE CHANNEL; ACETYLCHOLINE-RECEPTOR; GATING MECHANISM; MASS-TRANSPORT; ION-TRANSPORT; PERMEATION; CONDUCTION; MSCS; NANOPORES

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来源出版物页码计数: 8

第 75 条, 共 85 条

标题: Highly permeable polymeric membranes based on the incorporation of the functional water channel protein Aquaporin Z

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来源出版物: PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA 卷: 104 期: 52 页: 20719-20724 DOI: 10.1073/pnas.0708762104 出版年: DEC 26 2007

Web of Science 核心合集中的 "被引频次": 174

被引频次合计: 175

引用的参考文献数: 38

摘要: The permeability and solute transport characteristics of amphiphilic triblock-polymer vesicles

containing the bacterial water-channel protein Aquaporin Z (AqpZ) were investigated. The vesicles were made of a block copolymer with symmetric poly-(2-methyloxazoline)-poly(dimethylsiloxane)-poly-(2-methyloxazoline) (PMOXA(15)-PDMS110-PMOXA(15)) repeat units. Light-scattering measurements on pure polymer vesicles subject to an outwardly directed salt gradient in a stopped-flow apparatus indicated that the polymer vesicles were highly impermeable. However, a large enhancement in water productivity (permeability per unit driving force) of up to approximately 800 times that of pure polymer was observed when AqpZ was incorporated. The activation energy (E_a) of water transport for the protein-polymer vesicles (3.4 kcal/mol) corresponded to that reported for water-channel-mediated water transport in lipid membranes. The solute reflection coefficients of glucose, glycerol, salt, and urea were also calculated, and indicated that these solutes are completely rejected. The productivity of AqpZ-incorporated polymer membranes was at least an order of magnitude larger than values for existing salt-rejecting polymeric membranes. The approach followed here may lead to more productive and sustainable water treatment membranes, whereas the variable levels of permeability obtained with different concentrations of AqpZ may provide a key property for drug delivery applications.

PubMed ID: 18077364

作者关键词: permeability; triblock copolymer; water treatment

KeyWords Plus: TRIBLOCK COPOLYMER MEMBRANES; VESICLES; RECONSTITUTION; DESALINATION; TEMPERATURE; PROGRESS; CHIP; FLUX

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来源出版物页码计数: 6

第 76 条, 共 85 条

标题: A charge-driven molecular water pump

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来源出版物: NATURE NANOTECHNOLOGY 卷: 2 期: 11 页: 709-712 DOI: 10.1038/nnano.2007.320 出版年: NOV 2007

Web of Science 核心合集中的 "被引频次": 151

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引用的参考文献数: 30

摘要: Understanding and controlling the transport of water across nanochannels is of great importance for designing novel molecular devices, machines and sensors and has wide applications(1-9), including the desalination of seawater(5). Nanopumps driven by electric or magnetic fields can transport ions(10,11) and magnetic quanta(12), but water is charge-neutral and has no magnetic moment. On the basis of molecular dynamics simulations, we propose a design for a molecular water pump. The design uses a combination of charges positioned adjacent to a nanopore and is inspired by the structure of channels in the cellular membrane that conduct water in and out of the cell (aquaporins). The remarkable pumping ability is attributed to the charge dipole-induced ordering of water confined in the nanochannels(13,14), where water can be easily driven by external fields in a concerted fashion. These findings may provide possibilities for developing water transport devices that function without osmotic pressure or a hydrostatic pressure gradient.

PubMed ID: 18654410

KeyWords Plus: CARBON NANOTUBES; MASS-TRANSPORT; CHANNEL; FLOW; MICROFLUIDICS; CONDUCTION; MEMBRANES

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来源出版物页码计数: 4

第 77 条, 共 85 条

标题: State-of-the-art of reverse osmosis desalination

作者: Fritzmann, C (Fritzmann, C.); Lowenberg, J (Loewenberg, J.); Wintgens, T (Wintgens, T.); Melin, T (Melin, T.)

来源出版物: DESALINATION 卷: 216 期: 1-3 页: 1-76 DOI: 10.1016/j.desal.2006.12.009 出版年: OCT 5 2007

Web of Science 核心合集中的 "被引频次": 324

被引频次合计: 327

引用的参考文献数: 96

摘要: Throughout the world, water scarcity is being recognised as a present or future threat to human activity and as a consequence, a definite trend to develop alternative water resources such as desalination can be observed. The most commonly used desalination technologies are reverse osmosis (RO) and thermal processes such as multi-stage flash (MSF) and multi-effect distillation (MED). In Europe, reverse osmosis, due to its lower energy consumption has gained much wider acceptance than its thermal alternatives. This review summarises the current state-of-the art of reverse osmosis desalination, dealing not only with the reverse osmosis stage, but with the entire process from raw water intake to post treatment of product water. The discussion of process fundamentals, membranes and membrane modules and of current and future developments in membrane technology is accompanied by an analysis of operational issues as fouling and scaling and of measures for their prevention such as adequate cleaning procedures and antiscalant use. Special focus is placed on pre-treatment of raw water and post-treatment of brine as well as of product water to meet drinking and irrigation water standards, including evaluation of current boron removal options. Energy requirements of reverse osmosis plants as well as currently applied energy recovery systems for reduction of energy consumption are described and cost and cost structure of reverse osmosis desalination are outlined. Finally, current practices of waste management and disposal as well as new trends such as the use of hybrid plants, i.e. combining reverse osmosis with thermal processes and/or power generation are addressed.

作者关键词: desalination; reverse osmosis

KeyWords Plus: MODIFIED FOULING INDEX; SEAWATER DESALINATION; BORON REMOVAL; ENVIRONMENTAL-IMPACT; RO MEMBRANES; ULTRAFILTRATION MEMBRANES; WATER DESALINATION; PRESSURE EXCHANGER; SWRO PLANTS; RAW WATER

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来源出版物页码计数: 76

第 78 条, 共 85 条

标题: Influence of concentrative and dilutive internal concentration polarization on flux behavior in forward osmosis

作者: McCutcheon, JR (McCutcheon, Jeffrey R.); Elimelech, M (Elimelech, Menachem)

来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 284 期: 1-2 页: 237-247 DOI: 10.1016/j.memsci.2006.07.049 出版年: NOV 1 2006

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摘要: Osmosis through asymmetric membranes has been studied as a means of desalination via forward osmosis and power generation through a process known as pressure retarded osmosis. The primary obstacle to using asymmetric membranes for osmotic processes is the presence of internal concentration polarization, which significantly reduces the available osmotic driving force. This study explores the impact of both concentrative and dilutive internal concentration polarization on permeate water flux through a commercially available forward osmosis membrane. The coupling of internal and external concentration polarization is also investigated. A flux model that accounts for the presence of both internal and external concentration polarization for the two possible membrane orientations involving the feed and draw solutions is presented. The model is verified by data obtained from laboratory-scale experiments under well controlled conditions in both membrane orientations. Furthermore, the model is used to predict flux performance after hypothetical improvements to the membrane or changes in system conditions. (c) 2006 Elsevier B.V. All rights reserved.

作者关键词: forward osmosis; pressure retarded osmosis; desalination; concentration polarization; internal concentration polarization

KeyWords Plus: PRESSURE-RETARDED OSMOSIS; AMMONIA-CARBON DIOXIDE; SEA-WATER; MEMBRANE; POWER; DESALINATION; ENERGY

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来源出版物页码计数: 11

第 79 条, 共 85 条

标题: Forward osmosis: Principles, applications, and recent developments

作者: Cath, TY (Cath, Tzahi Y.); Childress, AE (Childress, Amy E.); Elimelech, M (Elimelech, Menachem)

来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 281 期: 1-2 页: 70-87 DOI: 10.1016/j.memsci.2006.05.048 出版年: SEP 15 2006

Web of Science 核心合集中的 "被引频次": 431

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引用的参考文献数: 80

摘要: Osmosis is a physical phenomenon that has been extensively studied by scientists in various disciplines of science and engineering. Early researchers studied the mechanism of osmosis through natural materials, and from the 1960s, special attention has been given to osmosis through synthetic materials. Following the progress in membrane science in the last few decades, especially for reverse osmosis applications, the interests in engineered applications of osmosis has been spurred. Osmosis, or as it is currently referred to as forward osmosis, has new applications in separation processes for wastewater treatment, food processing, and seawater/brackish water desalination. Other unique areas of forward osmosis research include pressure-retarded osmosis for generation of electricity from saline and fresh water and implantable osmotic pumps for controlled drug release. This paper provides the state-of-the-art of the physical principles and applications of forward osmosis as well as their strengths and limitations. (c) 2006 Elsevier B.V. All rights reserved.

作者关键词: osmosis; forward osmosis; direct osmosis; desalination; reverse osmosis; pressure-retarded osmosis

KeyWords Plus: PRESSURE-RETARDED OSMOSIS; DIRECT OSMOTIC CONCENTRATION; MEMBRANE CONTACTOR PROCESSES; AMMONIA-CARBON DIOXIDE; CONCENTRATION POLARIZATION; PROCESS PERFORMANCE; SEA-WATER; MODULE CONFIGURATION; CONCENTRATED BRINES; TUBULAR MEMBRANE

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来源出版物页码计数: 18

第 80 条, 共 85 条

标题: Desalination by ammonia-carbon dioxide forward osmosis: Influence of draw and feed solution concentrations on process performance

作者: McCutcheon, JR (McCutcheon, JR); McGinnis, RL (McGinnis, RL); Elimelech, M (Elimelech, M)

来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 278 期: 1-2 页: 114-123 DOI: 10.1016/j.memsci.2005.10.048 出版年: JUL 5 2006

Web of Science 核心合集中的 "被引频次": 205

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摘要: Forward (direct) osmosis (FO) using semi-permeable polymeric membranes may be a viable alternative to reverse osmosis as a lower cost and more environmentally friendly desalination technology. The driving force in the described FO process is provided by a draw solution comprising highly soluble gases-ammonia and carbon dioxide. Using a commercially available FO membrane, experiments conducted in a crossflow, flat-sheet membrane filtration cell yielded water fluxes ranging from 1 to 10 $\mu\text{m}^3/\text{s}$ (2.1 to 21.2 gal ft⁻² d⁻¹) or 3.6 to 36.0 l m⁻² h⁻¹) for a wide range of draw and feed solution concentrations. It was found, however, that the experimental water fluxes were far lower than those anticipated based on available bulk osmotic pressure difference and membrane pure water permeability data. Internal concentration polarization was determined to be the major cause for the lower than expected water flux by analysis of the available water flux data and SEM images of the membrane displaying a porous support layer. Draw solution concentration was found to play a key role in this phenomenon. Sodium chloride rejection was determined to be 95-99% for most tests, with higher rejections occurring under higher water flux conditions. Desalination of very high sodium chloride feed solutions (simulating 75% recovery of seawater) was also deemed possible, leading to the possibility of brine discharge minimization. (c) 2005 Elsevier B.V. All rights reserved.

作者关键词: forward osmosis; osmosis; desalination; concentration polarization; internal concentration polarization; draw solution

KeyWords Plus: CELLULOSE-ACETATE MEMBRANES; PRESSURE-RETARDED OSMOSIS; CONCENTRATION POLARIZATION; CROSS-FLOW; REVERSE-OSMOSIS; OSMOTIC REGIONS; NANOFILTRATION; FILTRATION; WATER

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来源出版物页码计数: 10

第 81 条, 共 85 条

标题: Recent developments on ion-exchange membranes and electro-membrane processes

作者: Nagarale, RK (Nagarale, RK); Gohil, GS (Gohil, GS); Shahi, VK (Shahi, VK)

来源出版物: ADVANCES IN COLLOID AND INTERFACE SCIENCE 卷: 119 期: 2-3 页: 97-130 DOI: 10.1016/j.cis.2005.09.005 出版年: FEB 28 2006

Web of Science 核心合集中的 "被引频次": 203

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引用的参考文献数: 330

摘要: Rapid growth of chemical and biotechnology in diversified areas fuels the demand for the



need of reliable green technologies for the down stream processes, which include separation, purification and isolation of the molecules. Ion-exchange membrane technologies are non-hazardous in nature and being widely used not only for separation and purification but their application also extended towards energy conversion devices, storage batteries and sensors etc. Now there is a quite demand for the ion-exchange membrane with better selectivities, less electrical resistance, high chemical, mechanical and thermal stability as well as good durability. A lot of work has been done for the development of these types of ion-exchange membranes during the past twenty-five years. Herein we have reviewed the preparation of various types of ion-exchange membranes, their characterization and applications for different electro-membrane processes. Primary attention has been given to the chemical route used for the membrane preparation. Several general reactions used for the preparation of ion-exchange membranes were described. Methodologies used for the characterization of these membranes and their applications were also reviewed for the benefit of readers, so that they can get all information about the ion-exchange membranes at one platform. Although there are large number of reports available regarding preparations and applications of ion-exchange membranes more emphasis were predicted for the usefulness of these membranes or processes for solving certain type of industrial or social problems. More efforts are needed to bring many products or processes to pilot scale and extent their applications. (c) 2005 Elsevier B.V. All rights reserved.

PubMed ID: 16325751

作者关键词: ion-exchange membranes; charged membranes; ionomers; electro-membrane processes; electro dialysis

KeyWords Plus: ELECTRODIALYSIS DESALINATION PLANT; SOLID POLYMER ELECTROLYTE; FUEL-CELL APPLICATION; IMPEDANCE SPECTROSCOPY CHARACTERIZATION; SULFONATED ENGINEERING POLYMERS; POLY(ARYLENE ETHER SULFONE); SEA-WATER DESALINATION; ELECTROCHEMICAL CHARACTERIZATION; TRANSPORT-PROPERTIES; DONNAN DIALYSIS

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来源出版物页码计数: 34

第 82 条, 共 85 条

标题: Ion exchange membranes: State of their development and perspective

作者: Xu, TW (Xu, TW)

来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 263 期: 1-2 页: 1-29 DOI: 10.1016/j.memsci.2005.05.002 出版年: OCT 15 2005

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引用的参考文献数: 224

摘要: During the last 50 years, ion exchange membranes have evolved from a laboratory tool to industrial products with significant technical and commercial impact. Today ion exchange membranes are receiving considerable attention and are successfully applied for desalination of sea and brackish water and for treating industrial effluents. They are efficient tools for the concentration or separation of food and pharmaceutical products containing ionic species as well as the manufacture of basic chemical products. The evolvement of an ion exchange membrane not only makes the process cleaner and more energy-efficient but also recovers useful effluents that are now going to wastes, and thus makes the development of society sustainable. Therefore, the intention of this review is to give a brief summary of the different preparation and characteristics of ion exchange membrane as well as their potential applications. The most relevant literatures in the field are surveyed and some elucidating case studies are discussed, also accounting for the results of some research programs carried out in the author's laboratory. (c) 2005 Elsevier B.V. All rights reserved.

作者关键词: ion exchange membranes; amphoteric ion exchange membrane; bipolar membrane; mosaic ion exchange membranes; hybrid ion exchange membrane; electro dialysis



KeyWords Plus: CHARGE-MOSAIC MEMBRANES; INDUCED GRAFT-COPOLYMERIZATION; AMPHOTERIC POLYMER MEMBRANES; METAL ALKOXIDE METHODS; TEFLON-FEP FILMS; 2,6-DIMETHYL-1,4-PHENYLENE OXIDE PPO; SULFONATED POLY(PHENYLENE SULFIDE); INORGANIC HYBRID MATERIALS;/ CATION-PERMEABLE MEMBRANES; FUEL-CELL APPLICATIONS

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来源出版物页码计数: 29

第 83 条, 共 85 条

标题: A novel ammonia-carbon dioxide forward (direct) osmosis desalination process

作者: McCutcheon, JR (McCutcheon, JR); McGinnis, RL (McGinnis, RL); Elimelech, M (Elimelech, M)

来源出版物: DESALINATION 卷: 174 期: 1 页: 1-11 DOI: 10.1016/j.desal.2004.11.002 出版年: APR 1 2005

Web of Science 核心合集中的 "被引频次": 251

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引用的参考文献数: 16

摘要: A novel forward (direct) osmosis (FO) desalination process is presented. The process uses an ammonium bicarbonate draw solution to extract water from a saline feed water across a semi-permeable polymeric membrane. Very large osmotic pressures generated by the highly soluble ammonium bicarbonate draw solution yield high water fluxes and can result in very high feed water recoveries. Upon moderate heating, ammonium bicarbonate decomposes into ammonia and carbon dioxide gases that can be separated and recycled as draw solutes, leaving the fresh product water. Experiments with a laboratory-scale FO unit utilizing a flat sheet cellulose tri-acetate membrane demonstrated high product water flux and relatively high salt rejection. The results further revealed that reverse osmosis (RO) membranes are not suitable for the FO process because of relatively low product water fluxes attributed to severe internal concentration polarization in the porous support and fabric layers of the RO membrane.

作者关键词: forward osmosis; direct osmosis; osmosis; desalination; ammonium bicarbonate; draw solution; osmotic pressure; internal concentration polarization

KeyWords Plus: MEMBRANE; WATER

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来源出版物页码计数: 11

第 84 条, 共 85 条

标题: Seawater desalination using renewable energy sources

作者: Kalogirou, SA (Kalogirou, SA)

来源出版物: PROGRESS IN ENERGY AND COMBUSTION SCIENCE 卷: 31 期: 3 页: 242-281 DOI: 10.1016/j.pecs.2005.03.001 出版年: 2005

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摘要: The origin and continuation of mankind is based on water. Water is one of the most abundant resources on earth, covering three-fourths of the planet's surface. However, about 97% of the earth's



water is salt water in the oceans, and a tiny 3% is fresh water. This small percentage of the earth's water - which supplies most of human and animal needs - exists in ground water, lakes and rivers. The only nearly inexhaustible sources of water are the oceans, which, however, are of high salinity. It would be feasible to address the water-shortage problem with seawater desalination; however, the separation of salts from seawater requires large amounts of energy which, when produced from fossil fuels, can cause harm to the environment. Therefore, there is a need to employ environmentally-friendly energy sources in order to desalinate seawater.

After a historical introduction into desalination, this paper covers a large variety of systems used to convert seawater into fresh water suitable for human use. It also covers a variety of systems, which can be used to harness renewable energy sources; these include solar collectors, photovoltaics, solar ponds and geothermal energy. Both direct and indirect collection systems are included. The representative example of direct collection systems is the solar still. Indirect collection systems employ two subsystems; one for the collection of renewable energy and one for desalination. For this purpose, standard renewable energy and desalination systems are most often employed. Only industrially-tested desalination systems are included in this paper and they comprise the phase change processes, which include the multistage flash, multiple effect boiling and vapour compression and membrane processes, which include reverse osmosis and electrodialysis. The paper also includes a review of various systems that use renewable energy sources for desalination. Finally, some general guidelines are given for selection of desalination and renewable energy systems and the parameters that need to be considered. (c) 2005 Elsevier Ltd. All rights reserved.

作者关键词: desalination; renewable energy; solar collectors; solar ponds; photovoltaics; wind energy; geothermal energy; solar stills; phase change processes; reverse osmosis

KeyWords Plus: BRACKISH-WATER DESALINATION; SOLAR DISTILLATION PLANT; WIND-POWERED DESALINATION; CORROSION-FREE COLLECTORS; REVERSE-OSMOSIS SYSTEM; FLAT-PLATE COLLECTOR; OF-THE-ART; ECONOMIC-ANALYSIS; EXERGY ANALYSIS; HEAT-TRANSFER

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第 85 条, 共 85 条

标题: Solar thermal collectors and applications

作者: Kalogirou, SA (Kalogirou, SA)

来源出版物: PROGRESS IN ENERGY AND COMBUSTION SCIENCE 卷: 30 期: 3 页: 231-295 DOI: 10.1016/j.pecs.2004.02.001 出版年: 2004

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摘要: In this paper a survey of the various types of solar thermal collectors and applications is presented. Initially, an analysis of the environmental problems related to the use of conventional Sources of energy is presented and the benefits offered by renewable energy systems are outlined. A historical introduction into the uses of solar energy is attempted followed by a description of the various types of collectors including flat-plate, Compound parabolic, evacuated tube, parabolic trough, Fresnel lens, parabolic dish and heliostat field collectors. This is followed by an optical, thermal and thermodynamic analysis of the collectors and a description of the methods used to evaluate their performance. Typical applications of the various types of collectors are presented in order to show to the reader the extent of their applicability. These include solar water heating, which comprise thermosyphon, integrated collector storage, direct and indirect systems and air systems, space heating and cooling, which comprise, space heating and service hot water, air and water systems and heat pumps, refrigeration, industrial process heat, which comprise air and water systems and steam generation systems, desalination, thermal power systems, which comprise the parabolic trough, power tower and dish systems, solar furnaces, and chemistry applications. As can be seen solar energy systems can be used for a wide range of applications and provide significant benefits,



therefore, they should be used whenever possible. (C) 2004 Elsevier Ltd. All rights reserved.

作者关键词: solar collectors; optical and thermal analysis; water heating; space heating; cooling; industrial process heat; solar power generation; desalination; solar chemistry

KeyWords Plus: FLAT-PLATE COLLECTOR; PARABOLIC-TROUGH; AIR HEATERS; WATER-HEATER; PERFORMANCE-CHARACTERISTICS; SUSTAINABLE DEVELOPMENT; ENVIRONMENTAL IMPACTS; ENERGY COLLECTORS; STEAM-GENERATION; COOLING SYSTEM

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SCI 化学工程期刊发表的题目中有海水淡化的论文

2014 年 (145 篇)

第 1 条, 共 145 条

标题: Desalination of dye solution utilizing PVA/INDF hollow fiber composite membrane modified with TiO₂ nanoparticles

作者: Li, XP (Li, Xipeng); Chen, YB (Chen, Yingbo); Hu, XY (Hu, Xiaoyu); Zhang, YF (Zhang, Yufeng); Hu, LJ (Hu, Linjia)

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摘要: Novel poly(vinyl alcohol) (PVA)/poly(vinylidene fluoride) (PVDF) hollow fiber composite membranes modified with nano-TiO₂ were prepared by a dip-coating method and they are suitable to be utilized in dye desalination and wastewater treatment. Glutaraldehyde (GA) was used as a cross-linker for the composite polymer membrane in order to enhance the chemical, thermal as well as mechanical stabilities. The surface morphologies and chemical structures of modified membranes were observed by scanning electronic microscopy (SEM), energy dispersive spectroscopy (EDS) and FIR spectroscopy. Zeta potential of the membrane surface was used to analyze the membrane separation performance. Separation efficiency of dye and salts through novel PVA/PVDF composite membrane was dramatically influenced by dye concentration, salts concentration, pH and temperature of feed solution. Fouling and thermal stability of the membrane were also evaluated with CR, NaCl, and Na₂SO₄ as model compounds. The separation data showed that the 1 nano-TiO₂ modified membrane presented highest performance in terms of the rejections to CR, MO, and MB being 94 +/- 2.57%, 52.1 +/- 2.45%, and 92 +/- 2.20%, respectively. And all the PVA composite membranes had no rejection to salts (NaCl, Na₂SO₄). Compared with PVA composite membrane, the PVA composite membrane modified with nano-TiO₂ has higher separation efficiency, antifouling and thermal stability. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Poly(vinyl alcohol); Hollow fiber membrane; Modification; Nano-TiO₂; Dye desalination

KeyWords Plus: NANOFILTRATION MEMBRANES; POLYVINYL-ALCOHOL; WASTE-WATER; REVERSE-OSMOSIS; PERFORMANCE; ADSORPTION; TRANSPORT; MECHANISMS; SEPARATION; REUSE

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第 2 条, 共 145 条

标题: A novel dual-layer bicomponent electrospun nanofibrous membrane for desalination by direct contact membrane distillation

作者: Tijing, LD (Tijing, Leonard D.); Woo, YC (Woo, Yun Chul); Johir, MA (Johir, Md Abu Hasan); Choi, JS (Choi, June-Seok); Shon, HK (Shon, Ho Kyong)

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引用的参考文献数: 22

摘要: In this study, a bicomponent nanofibrous composite membrane was fabricated by electrospinning and was tested for desalination by direct contact membrane distillation (DCMD). The nanofibrous membrane was composed of a dual-layered structure of poly(vinylidene fluoride-co-hexafluoropropylene) (PH) nanofibers and polyacrylonitrile (PAN) microfibers. Morphological characterization showed slightly beaded cylindrical PH nanofibers with porosity of about 90%. The contact angles of PH and PAN nano/microfibers were 150 degrees and 100 degrees, respectively. The nanofibrous membranes were tested by DCMD and a high water flux of 45 and 30 L m⁻² h⁻¹ was obtained for distilled water and 35 g L⁻¹ NaCl solutions as feed, respectively using DL2 membrane (i.e., 25/75 PH/PAN thickness ratio). The present dual-layer membrane showed better flux performance compared to a commercial flat-sheet membrane. The results suggest the potential of the dual-layer nanofibrous membrane for DCMD applications. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Membrane distillation; Dual-layer; PVDF-co-HFP; PAN; Electrospinning; Nanofiber

KeyWords Plus: HYDROPHOBIC/HYDROPHILIC COMPOSITE MEMBRANES; SELF-SUSTAINED WEBS; FABRICATION; FIBERS

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第 3 条, 共 145 条

标题: Natural zeolite clinoptilolite-phosphate composite Membranes for water desalination by pervaporation

作者: An, W (An, W.); Zhou, X (Zhou, X.); Liu, X (Liu, X.); Chai, PW (Chai, P. W.); Kuznicki, T (Kuznicki, T.); Kuznicki, SM (Kuznicki, S. M.)

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摘要: Natural zeolite membranes, directly sectioned from mineral deposits, have been previously reported to show molecular sieve characteristics in selective separation of water and hydrated cations. Although a high removal of cations was observed, the low water flux was a limitation for any potential industrial applications. In this study novel clinoptilolite-based phosphate composite membranes were prepared by dry pressing of mixed powder materials followed by high temperature autoclave steaming and characterized by XRD, SEM-EDX. Their performance for pervaporative water desalination was examined using different levels of salinity in a temperature range of 25-95 degrees C and feed side pressure of 1 atm. At 1400 ppm Na feed salinity and 95 degrees C, a water flux of 15 kg/m(2) h and over 95% removal of Na+ were obtained. The water flux achieved was about 10 times higher than the flux obtained using natural zeolite rock membranes. Introducing phosphate into the composite membranes appears to provide not only mechanical strength, through the possible chemical bonding between zeolite particles and the in-situ phosphate cement, but also to create a chemically favorable interface between zeolite crystals. Such interface might facilitate the desalination process bypassing the technical difficulties of ion leakage/diffusion through the inter-crystal spaces commonly associated with synthetic zeolite membranes. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Natural zeolite membrane; Water desalination; Zeolite-phosphate composite; High temperature; Clinoptilolite

KeyWords Plus: AMORPHOUS ALUMINUM PHOSPHATE; AQUEOUS-SOLUTIONS; REVERSE-OSMOSIS; ION-EXCHANGE; OIL

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第 4 条, 共 145 条



标题: On the potential of forward osmosis to energetically outperform reverse osmosis desalination

作者: McGovern, RK (McGovern, Ronan K.); Lienhard, JH (Lienhard, John H.)

来源 出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 469 页: 245-250 DOI: 10.1016/j.memsci.2014.05.061 出版年: NOV 1 2014

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摘要: We provide a comparison of the theoretical and actual energy requirements of forward osmosis and reverse osmosis seawater desalination. We argue that reverse osmosis is significantly more energy efficient and that forward osmosis research efforts would best be fully oriented towards alternate applications. The underlying reason for the inefficiency of forward osmosis is the draw-dilution step, which increases the theoretical and actual energy requirements for draw regeneration. As a consequence, for a forward osmosis technology to compete with reverse osmosis, the regeneration process must be significantly more efficient than reverse osmosis. However, even considering the optimisation of the draw solution and the benefits of reduced fouling during regeneration, the efficiency of an optimal draw regeneration process and of reverse osmosis are unlikely to differ significantly, meaning the energy efficiency of direct desalination with reverse osmosis is likely to be superior. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis; Seawater desalination; Reverse osmosis

KeyWords Plus: INTERNAL CONCENTRATION POLARIZATION; AMMONIA-CARBON DIOXIDE; HOLLOW-FIBER MEMBRANES; SEAWATER DESALINATION; PROCESS PERFORMANCE; FLUX BEHAVIOR; DRAW SOLUTE; WASTE-WATER; ENERGY; LAYER

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第 5 条, 共 145 条

标题: Enhanced water desalination efficiency in an air-cathode stacked microbial electrodeionization cell (SMEDIC)

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来源 出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 469 页: 364-370 DOI: 10.1016/j.memsci.2014.06.058 出版年: NOV 1 2014

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摘要: A microbial desalination cell was developed that contained a stack of membranes packed with ion exchange resins between the membranes to reduce ohmic resistances and improve performance. This new configuration, called a stacked microbial electro-deionization cell (SMEDIC), was compared to a control reactor (SMDC) lacking the resins. The SMEDIC+S reactors contained both a spacer and 1.4 +/- 0.2 mL of ion exchange resin (IER) per membrane channel, while the spacer was omitted in the SMEDIC-S reactors and so a larger volume of resin (24 +/- 0.2 mL) was used. The overall extent of desalination using the SMEDIC with a moderate (brackish water) salt concentration (13 g/L) was 90-94%, compared to only 60% for the SMDC after 7 fed-batch cycles of the anode. At a higher (seawater) salt concentration of 35 g/L, the extent of desalination reached 61-72% (after 10 cycles) for the SMEDIC, compared to 43% for the SMDC. The improved performance was shown to be due to the reduction in ohmic resistances, which were 130 Omega (SMEDIC-S) and 180 Omega (SMEDIC+S) at the high salt concentration, compared to 210 Omega without resin (SMDC). These results show that IERs can improve performance of stacked membranes for both moderate and high initial salt concentrations. (C) 2014 Elsevier B.V. All rights reserved

作者关键词: Microbial desalination cell; Ion exchange resin; Electrodeionization; Brackish water

desalination; Seawater desalination

KeyWords Plus: ION-EXCHANGE-RESIN; FUEL-CELLS; ELECTRICITY-GENERATION; PERFORMANCE; ELECTROLYSIS; ANODES; PH

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第 6 条, 共 145 条

标题: Experimental study on a humidification and dehumidification desalination system of solar air heater with evacuated tubes

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摘要: In this paper, a small scale solar humidification-dehumidification (HDH) experimental setup based on a new kind of solar air heater with all-glass evacuated tubes is designed and tested. Firstly, a new kind of solar air heater with evacuated tubes is designed and tested for the solar HDH desalination process. The test results of solar air heater show that the cut length of efficiency and overall heat loss coefficient is 0.47 and 1.60 respectively, while air flow rate is 140 m³/h. Secondly, the humidifier and dehumidifier are designed and optimized by the mathematical design methods. Finally, a desalination pilot plant is designed and built. And then, operation characteristics are tested and analyzed. Test results show that different inlet sprayed water temperature in the pad humidifier from 9 degrees C to 27 degrees C can effectively improve relative humidity of outlet moist air from 89% to 97% and the outlet air temperature from 35 degrees C to 42 degrees C. The results are valuable in the pursuit of the optimal design for a 1000 L/day solar HDH desalination system with the new kind of solar air heater. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Solar desalination; Humidification; Dehumidification; Solar air heater

KeyWords Plus: EXPERIMENTAL VALIDATION; SEAWATER DESALINATION; UNIT; OPTIMIZATION; PERFORMANCE; ENERGY

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第 7 条, 共 145 条

标题: Development of a steady-state mathematical model for MEE-TVC desalination plants

作者: Al-Mutaz, IS (Al-Mutaz, Ibrahim S.); Wazeer, I (Wazeer, Irfan)

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摘要: Multi-effect evaporation with thermal vapor compression (MEE-TVC) is one of the most effective desalination method. It plays a vital role in the production of fresh water in many regions of the world especially in the Arabian countries. A steady-state mathematical model of MEE-TVC system and its solution procedure are developed based on the basic laws of material balance, energy balance and heat transfer equations with correlations for physical properties estimation. The influence of important design and operating variables on the performance of the plant is investigated. These parameters include number of evaporation effects, motive steam pressure, top brine temperature, temperature difference across effects and feed water temperature. The purpose of this paper is to develop a mathematical model of the MEE-TVC systems and compare the results with the existing plants. A MATLAB program is also used to solve the model equations. The model validity is examined against some commercial MEE-TVC systems. Good agreement is obtained between data of these systems and model predictions. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Steady-state modelling; MEE-TVC; MED-TVC; Desalination plants

KeyWords Plus: MULTIPLE EFFECT EVAPORATION; SYSTEMS; SIMULATION; DESIGN; ENERGY

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第 8 条, 共 145 条

标题: Field evaluation of membrane distillation technologies for desalination of highly saline brines

作者: Minier-Matar, J (Minier-Matar, Joel); Hussain, A (Hussain, Altaf); Janson, A (Janson, Arnold); Benyahia, F (Benyahia, Farid); Adham, S (Adham, Samer)

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摘要: Membrane distillation (MD) is a hybrid thermal-membrane desalination process that uses low-grade waste heat and hydrophobic membrane to produce high quality distillate. The MD process can treat highly saline brines that other conventional desalination processes cannot treat. These unique features of the MD process make it an ideal candidate to desalinate concentrated brines from thermal desalination plants to augment fresh water production from existing facilities. A consortium consisting of ConocoPhillips Global Water Sustainability Center, Qatar University, and Qatar Electricity & Water Company was formed to evaluate the application of MD for the desalination of concentrated brines from thermal plants. Five different MD technologies were evaluated and the two most suitable technologies were selected for field-testing. The pilot units A 82 B are based on multi-effect vacuum and air gap MD technologies, respectively. These units were tested side-by-side at a full-scale thermal desalination plant in Qatar. Pilot unit A showed a stable flux of 6.2 LMH under optimized conditions with excellent salt rejection (>99.9%). Pilot unit B achieved a distillate flux of 2.5 LMH and salt rejection greater than 98.9%. Overall, MD was shown to be a feasible technology to produce potable quality water from the brines discharged from thermal desalination plants. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Membrane distillation; Seawater; Thermal desalination brine; Pilot plant; Thermal brine

KeyWords Plus: PLANTS; SOLAR

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第 9 条, 共 145 条

标题: Statistical regression and modeling analysis for reverse osmosis desalination process

作者: Subramani, S (Subramani, Sobana); Panda, RC (Panda, Rames C.)

来源出版物: DESALINATION 卷: 351 页: 120-127 DOI: 10.1016/j.desal.2014.07.038 出版年: OCT 15 2014

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摘要: Experiment is conducted, across different units of a typical desalination plant, to build correlations between inputs/outputs. Steady-state statistical models of reverse osmosis (RO) are developed using stream characteristic data (flow rate, concentration and pH) over a period of time. Data-driven models are useful for deciding real time operational control strategies of desalination plant. The statistical analysis of correlations obtained indicates that permeate characteristics depend on feed stream flow rate by a second degree polynomial. Significance of regression was evaluated based on multivariate ANOVA analysis, on visual standardized residuals distribution and their means for confidence levels of 95% and 99%, clearly validating these models. Sensitivity of parameters is found from interaction and co-relation studies. These models will help in safe



operation and control of RO-desalination plant. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Reverse osmosis; Statistical model; Regression; Multivariate ANOVA

KeyWords Plus: SYSTEM; WATER

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第 10 条, 共 145 条

标题: Preparation and electrochemical characterization of mixed matrix heterogeneous cation exchange membranes filled with zeolite nanoparticles: Ionic transport property in desalination

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摘要: In the current research mixed matrix PVC based-co-zeolite nanoparticles heterogeneous cation exchange membranes were prepared by solution casting technique. The effect of used additives and also electrolyte's concentration and pH variations on membrane electrochemical properties was studied. Results showed that membrane water content, membrane potential, transport number and selectivity were improved initially by use of zeolite nanoparticles up to 8 %wt. in the casting solution and then began to decrease by more increase in additive concentration from 8 to 16 %wt. Utilizing zeolite nanoparticles in the casting solution also led to increase in membrane electrical conductivity and ionic flux obviously. Membrane transport number, selectivity and membrane electrical conductivity were all enhanced by increase of electrolyte concentration. Moreover, membranes showed higher transport number/selectivity and lower electrical resistance at pH 7 compared to other pH values. Among the prepared membranes, modified membrane containing 8 %wt. zeolite nanoparticles showed more suitable electrochemical properties compared to others. Also obtained results revealed that modified membranes in this study are comparable with that of other commercial ones. The obtained results are valuable for electromembrane processes especially electrodialysis for water recovery and treatment. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Mixed matrix membrane; Ionic nanocomposite; Zeolite nanoparticles; Adsorption-ion exchange; Fabrication/desalination; Concentration/pH effect

KeyWords Plus: OXIDE NANOPARTICLES; OSMOSIS; PERFORMANCE; POLYAMIDE

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第 11 条, 共 145 条

标题: Comprehensive environmental assessment of seawater desalination plants: Multistage flash distillation and reverse osmosis membrane types in Saudi Arabia

作者: Tokui, Y (Tokui, Yusuke); Moriguchi, H (Moriguchi, Hitoshi); Nishi, Y (Nishi, Yoshiki)

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摘要: We examine the sustainability of seawater desalination plants using Inclusive Impact Index light (Triple-I light). This index quantifies the environmental and economic impact of a human activity through estimations of ecological footprint, biocapacity, cost, and benefit. The seawater desalination plants we treated are a multistage flash distillation (MSF) type and a reverse osmosis (RO) membrane type in the Kingdom of Saudi Arabia. Our calculations demonstrate that the indexes for the two plants are raised mainly by large ecological footprints. By conducting a sensitivity analysis with varying a few parameters, we reveal that the total amount of water supply can largely change the sustainability of the plants, and propose that reductions in electric power consumption can be a feasible strategy to keep these plants in sustainable condition. We show that if we can supply about 40-50% of the total power consumption for the desalination plants using renewable energy sources, the sustainable operation is achievable. These percentages can be used as the target value of the introduction of renewable energy. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Environmental impact; Multistage flash distillation; Reverse osmosis; Ecological footprint; Inclusive Impact Index

KeyWords Plus: SUSTAINABILITY; COUNTRIES; ENERGY; WATER

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第 12 条, 共 145 条

标题: Design and operation of water desalination supply chain using mathematical modelling approach

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摘要: This study presents the retrofit of water supply chain problem through multi period mixed integer linear program (MILP) model. The major strategic decisions include the determination of optimal new facility locations and capacity expansions of water desalination supply chain infrastructure assets which consists of water desalination plants, pipelines, and storage tanks, over a long time planning horizon. Other strategic decisions deal with the optimal selection of desalination technologies for existing and new desalination plants. In addition, the model provides decisions to define the pipeline network configuration for water transportation among several sites. The operation decisions are modelled to optimize the water production from desalination plants, energy consumption, brine disposal, as well as CO₂ emissions. In addition, water transportation through the pipeline network and water storage at every site are optimized to satisfy water demand at every time period, and to minimize the net present value of the supply chain network. Finally, the proposed approach is solved for a case study to illustrate the application of the proposed mathematical programming model. The results show economic and environmental benefits if one considers full site integration and water production coordination in the supply chain network through the planning time horizon. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Water desalination; Supply chain network; Capacity expansion; Integer linear



programming

KeyWords Plus: REVERSE-OSMOSIS NETWORKS; ECONOMIC-ENGINEERING OPTIMIZATION; SEAWATER DESALINATION; WASTE-WATER; OPTIMUM DESIGN; PLANTS; SYSTEMS; MANAGEMENT; CHALLENGES; ALLOCATION

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第 13 条, 共 145 条

标题: A novel process for low grade heat driven desalination

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摘要: Low grade process heat and geothermal energy with temperatures typically below 100 degrees C are significant untapped environmentally friendly resources for desalination. This article reports on a novel multi-effect distillation (MED) desalination process that is boosted by a multi-stage flashing process. Specifically the low grade heat first heats up the multi-effect distillation plant and is then maximally exploited through a multi-stage flashing process, with the produced steam of which being judiciously introduced into the multi-effect distillation plant for enhanced freshwater production. Compared with optimized conventional MED processes, the performance improvement is up to around 50% better in terms of freshwater production, with a modest increase in the pumping power consumption and 4% to 6% decrease in the specific capital cost. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: MED; Multi effect distillation; MSF; Multi stage flash; Flashing; Waste heat

KeyWords Plus: NON-CONDENSABLE GASES; STEADY-STATE ANALYSIS; MULTISTAGE EVAPORATORS; PROCESS INDUSTRY; ENERGY; TECHNOLOGIES; SEAWATER; DISTILLERS; RELEASE; PLANTS

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第 14 条, 共 145 条

标题: A study of the bubble column evaporator method for thermal desalination

作者: Shahid, M (Shahid, Muhammad); Pashley, RM (Pashley, Richard Mark)

来源出版物: DESALINATION 卷: 351 页: 236-242 DOI: 10.1016/j.desal.2014.07.014 出版年: OCT 15 2014

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摘要: A simple bubble column evaporator can be used to evaporate water from concentrated salt solutions without boiling. The process is made more effective by the inhibition of bubble coalescence caused by the presence of some concentrated salts, such as NaCl. This work examines the effects of high bubble temperatures on this coalescence inhibition and its effects on the efficiency of water vapor collection. A continuous flow of hot dry air, at 275 degrees C, produced about 10% higher rate of water vaporization than that expected from the equilibrium vapor pressures. Also, the use of a non-ionic surfactant monolayer bubble coating further improved the evaporation efficiency, by up to 18%, apparently due to supersaturation. In addition, the steady state temperature of the bubble column evaporator can be used to estimate the latent heat of vaporization even for inlet air temperatures of up to 275 degrees C. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Bubble column evaporator; Non-ionic surfactant; Monolayer; Supersaturation

KeyWords Plus: WATER DESALINATION; COALESCENCE; ELECTROLYTES; TECHNOLOGIES

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第 15 条, 共 145 条

标题: Recyclable composite nanofiber adsorbent for Li⁺ recovery from seawater desalination retentate

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摘要: Composite poly(acrylonitrile) (PAN) nanofibers with H1.6Mn1.6O4 (HMO) lithium ion-sieves were prepared, characterized and tested for lithium ion (Li⁺) recovery. Nanofibers were prepared by electrospinning 10 wt% HMO/PAN dope solutions in dimethylformamide with varied HMO loadings. Characterizations performed via XRD, SEM-EDS, capillary flow porometry and mechanical testing revealed highly porous, mechanically and chemically stable composite nanofibers with high water absorption capacity. The similar nanofiber diameters (<300 nm) and HMO particle sizes (<100 nm) rendered PAN as a binder to have minimal hindrance to the HMOs. Exposure of HMOs on the fiber surface provided good accessibility to the Li⁺ source, as indicated by the minimal loss of Li⁺ adsorption capacity of HMOs in PAN as compared to the support-free powdered HMO. All tested adsorbents followed Langmuir-type Li⁺ adsorption (q(m)). Increased HMO loadings resulted in improved adsorption performance as more HMOs were exposed on fiber surface and became less affected by the binder; the highest q(m) = 10.3 mg/g obtained from 60 wt% HMO/PAN was only 4% lower than the support-free HMO. Adsorption loss after ten reuses was minor (<4%), which suggests the long-term stability of HMO/PAN. In seawater desalination retentate, HMO/PAN (60 wt%) preferentially adsorbed Li⁺ over other cations, achieving 99-5312 Li⁺ separation factors and high Li⁺ distribution coefficient (K-D = 770). Li⁺ was concentrated up to 486 times while interfering cations were enriched only up to <7 times. Overall results demonstrate the potential use and

recyclability of the developed HMO/PAN composite nanofiber for Li⁺ recovery from seawater or other prospective sources. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Adsorption; Ion sieve; Lithium recovery; Nanofiber; Polyacrylonitrile; Seawater

KeyWords Plus: LITHIUM ION; MANGANESE OXIDE; SELECTIVE ADSORPTION; SIEVE; MEMBRANE; LI1.6MN1.6O4; PROPERTY; MNO2

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第 16 条, 共 145 条

标题: Surface initiated polydopamine grafted poly([2-(methacryloyloxy)ethyl]trimethylammonium chloride) coatings to produce reverse osmosis desalination membranes with anti-biofouling properties

作者: Blok, AJ (Blok, Andrew J.); Chhasatia, R (Chhasatia, Rinkubahen); Dilag, J (Dilag, Jessirie); Ellis, AV (Ellis, Amanda V.)

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摘要: Commercial polyamide (PA) reverse osmosis (RO) membranes were surface modified in a sequential two-step polymerization process to impart anti-biofouling properties to the membrane surface. In the first step, a 2-bromoisobutyryl bromide initiator-polydopamine (BiBBr-initiator-PDA) layer was deposited onto the membrane surface from a Tris(hydroxymethyl)aminomethane buffered solution of dopamine hydrochloride and 2-bromoisobutyryl bromide at ambient conditions. In the second step, polymer chains of [2-(methacryloyloxy)ethyl]trimethylammonium chloride (MTAC) were grafted-from the BiBBr-initiator-PDA surface using activators regeneration by electron transfer-atom transfer radical polymerization for between 1 and 24 h. The modified surfaces were characterized using attenuated reflectance-Fourier transform infrared spectroscopy and water contact angle and their pure water flux, saline water flux and ability to reject salt were determined. Results showed that the water flux and salt rejection properties of the PDA-g-PMTAC modified membranes were similar to the unmodified PA RO membranes. Chlorine resistance tests showed the coating had enhanced stability in regards to salt rejection properties. Significantly, after six days of incubation in nutrient solution there was 93.2% less bacteria on the PDA-g-MTAC modified PA RO membranes, compared to the unmodified membranes. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Reverse osmosis membranes; Polydopamine; Anti-biofouling; Water flux; Salt water flux

KeyWords Plus: POLY(ARYLSULFONE) ULTRAFILTRATION MEMBRANES; WATER-PURIFICATION; FUNCTIONALIZATION; POLYSULFONE; PERFORMANCE; RESISTANCE; REDUCTION; SULFONE; BEHAVIOR; ATRP

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第 17 条, 共 145 条

标题: Renewable energy powered membrane technology: Brackish water desalination system operated using real wind fluctuations and energy buffering

作者: Richards, BS (Richards, Bryce S.); Park, GL (Park, Gavin L.); Pietzsch, T (Pietzsch, Thomas); Schafer, AI (Schaefer, Andrea I.)

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摘要: The performance of a wind-powered membrane filtration system using a brackish water reverse osmosis (BW30) module and synthetic brackish (5500 mg/L NaCl) feed water was determined. When tested with real wind speed data (average wind speed 6.1 m/s; interval of 1 s) over one day of realistic fluctuation levels, the wind-membrane system produced 0.78 m³ of water with a final concentration of 191 mg/L NaCl at an average specific energy consumption (SEC) of 7.2 kWh/m³. When a single bank of supercapacitor (SC) energy buffers were added to the system, performance increased to 0.93 m³ of permeate produced and a final concentration of 173 mg/L NaCl at average SEC of 4.2 kWh/m³. Tripling the size of the SC bank further increased productivity to 1.15 m³ (47% increase) at a final concentration 172 mg/L NaCl and average SEC of 3.1 kWh/m³ (57% reduction). The time spent within the safe operating window (SOW) per day, increased from 8 h 12 m under the poorest operating conditions up to 19 h 56 m with the triple SC bank. Importantly, the results indicate that steady-state system performance at an average wind speed can be used as a very good indicator of the expected performance under fluctuating wind conditions. The results described can assist with the design of autonomous, decentralised, off-grid renewable energy powered water treatment systems and help decide whether to include energy buffering components. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Brackish water; Desalination; Reverse osmosis; Wind energy; Energy storage

KeyWords Plus: REVERSE-OSMOSIS SYSTEM; INTERMITTENT OPERATION; PERFORMANCE; BATTERIES; STORAGE; UNIT

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第 18 条, 共 145 条

标题: Renewable energy powered membrane technology: Safe operating window of a brackish water desalination system

作者: Richards, BS (Richards, Bryce S.); Park, GL (Park, Gavin L.); Pietzsch, T (Pietzsch, Thomas); Schafer, AI (Schaefer, Andrea I.)

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摘要: The safe operating window (SOW) of a renewable energy (RE) powered membrane filtration system for brackish water desalination is determined. The SOW is constrained by several factors: (i) operating limits of pump motor (pressure and flowrate), (ii) maximum recommended recovery, and (iii) the osmotic pressure of the feedwater. The membranes (and brackish feedwater salinities) used were BW30 (5500 and 10,000 mg/L), aged BW30 (5500 mg/L) and NF90 (5500 and 2750 mg/L). At lower salinities (2750-5500 mg/L) the main constraint was maximum recovery (30%), while at higher concentrations (10,000 mg/L) osmotic pressure played a more limiting role. The optimum operating strategy is 'constant recovery'. This produces the highest flux at a given power consumption and thus the lowest specific energy consumption (SEC) while maintaining good retention. However, this operating strategy can be difficult to implement. Therefore, 'constant set-point' mode is recommended for this system in order to provide a robust and effective solution, despite a minor reduction in performance. This approach is attractive for being powered by a wind turbine or solar energy (photovoltaics) given the low SEC (similar to 3 kWh/m³) that enables operation over a very wide power range (70-280 W) in order to achieve the desired pressure range (5-11.5 bar). Overall, the SOW methodology can be used in the performance evaluation of a wide range of membrane filtration systems. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Brackish water; Reverse osmosis; Renewable energy; System performance; Safe operating window

KeyWords Plus: REVERSE-OSMOSIS DESALINATION; RO; FLUCTUATIONS; BATTERIES; UNIT

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第 19 条, 共 145 条

标题: Using modelling approach to validate a bench scale forward osmosis pre-treatment process for desalination

作者: Zaviska, F (Zaviska, Francois); Zou, LD (Zou, Linda)

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摘要: Forward osmosis (FO) has recently attracted growing attention in wastewater, brackish groundwater and seawater desalination, and power generation. This study evaluates the potential of using a batch laboratory-scale FO system as a pre-treatment for the reverse osmosis (RO) process. FO is a low pressure-driven process that offers many advantages compared to the conventional pre-treatment for RO especially for brackish water with high potential of scaling and fouling. FO can help to reduce the RO process cost by avoiding RO membrane fouling and achieving higher water recovery. An experimental modelling has been employed to describe the FO process taking into account water flux, water recovery and final draw solution. Based on this experimental modelling, the energy consumption for RO has been estimated. It has been found that the treatment time for the FO process and the initial draw solute concentration are important parameters that have an interrelated effect on FO and RO efficiency. The optimal conditions for this FO pre-treatment process are determined by modelling and are experimentally validated by using real brackish water as feed in a bench-scale FO system. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis; Optimization; Modelling; Brackish water; Experimental design

KeyWords Plus: INTERNAL CONCENTRATION POLARIZATION; AMMONIA-CARBON DIOXIDE; PROCESS PERFORMANCE; ENERGY-CONSUMPTION; WATER; RO; PURIFICATION; PRINCIPLES; MEMBRANES; RECOVERY

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第 20 条, 共 145 条

标题: Desalination energy minimization using thin film nanocomposite membranes

作者: Subramani, A (Subramani, Arun); Voutchkov, N (Voutchkov, Nikolay); Jacangelo, JG (Jacangelo, Joseph G.)

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摘要: In this study, thin film nanocomposite (TFN) reverse osmosis (RO) membranes were evaluated at a demonstration-scale facility to determine the specific energy consumption (SEC) during seawater desalination. Conventional (same element type within pressure vessel) and hybrid (high and low rejection elements within pressure vessel) configurations were evaluated and compared to commercially available thin film composite (TFC) RO membranes. The specific flux at 25 degrees C for TFN RO membranes was 1.72 lm(-2) h(-1)/bar when compared to 1.48 lm(-2) h(-1)/bar for TFC RO membranes. Utilization of TFN RO membranes resulted in reduced feed pressure requirements when compared to TFC RO membranes, resulting in energy savings up to 10%. In order to achieve the same permeate water quality, the SEC for a 2-pass RO system with TFN RO membrane elements in the first pass was 3.24-3.45 kWh/m(3). The SEC with TFC RO membrane elements for the same conditions was 3.60 kWh/m(3). Results presented in this study show a promise for the utilization of TFN RO membranes to reduce energy consumption and minimize operational costs associated with electricity usage. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Energy recovery devices; Pump efficiency; Specific energy consumption; Boron rejection; Organic fouling

KeyWords Plus: REVERSE-OSMOSIS MEMBRANES; CARBON NANOTUBES; PERFORMANCE; WATER; PERMEATION; TRANSPORT; COMPOSITE; LAYER

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第 21 条, 共 145 条

标题: Scale formation model for high top brine temperature multi-stage flash (MSF) desalination plants

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摘要: In this work, a model for the development of scale formation in once-through (OT) and brine-recycle (BR) multi-stage flash (MSF) distiller is presented. The model begins to calculate the carbonate species and sulfate concentrations in the seawater feed and follow the path of the feed from the last stage to the first stage reaching the top brine temperature (TBT). The changes in the carbonate and sulfate scale are shown. As a net result, fouling factor increases with increasing the temperature. The developed model is validated with the experimental results when anti-scalant is used from literature. It is important to note that the plant cannot be operated without using anti-scalant because of the hard scale problem threatening the performance and materials of the MSF plant, which is, in fact, the strong point of the model. The model can be used to check the pretreatment efficiency. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Scale formation; Modelling; Fouling factor; High temperature MSF

KeyWords Plus: MULTIPLE-EFFECT DISTILLERS; FRESH-WATER DEMAND; CRYSTALLIZATION; DEPOSITION; IMPACT

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第 22 条, 共 145 条

标题: Efficiency in the use of solar thermal energy of small membrane desalination systems for decentralized water production

作者: Zaragoza, G (Zaragoza, G.); Ruiz-Aguirre, A (Ruiz-Aguirre, A.); Guillen-Burrieza, E (Guillen-Burrieza, E.)

来源出版物: APPLIED ENERGY 卷: 130 特刊: SI 页: 491-499 DOI: 10.1016/j.apenergy.2014.02.024 子辑: 1 出版年: OCT 1 2014

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摘要: The demand of freshwater has surpassed the renewable limit and new water sources are associated with an intensive use of energy. Coincidence between scarcity of water and availability of solar radiation makes solar energy the most suitable option to mitigate the water deficit. This paper analyzes the use of energy for decentralized water production using membrane desalination systems fed with solar energy. An analysis is performed based on experimental results from the most advanced commercial prototypes of different technologies of membrane distillation using various configurations, i.e., air-gap, permeate-gap and vacuum; with flat-plate and spiral-wound membranes. The systems operate with thermal energy, although there is some electrical consumption for pumping and in some cases for sustaining vacuum. The thermal energy requirements per unit volume of water produced are assessed in each case, considering the effect of different operational conditions like the temperature regime and the salinity of the input water. (C) 2014 Elsevier Ltd. All rights reserved.

作者关键词: Solar energy; Energy efficiency; Energy-water nexus; Solar desalination

KeyWords Plus: SPIRAL-WOUND MODULES; DISTILLATION

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第 23 条, 共 145 条

标题: Organic Rankine Cycle recovering stage heat from MSF desalination distillate water

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来源出版物: APPLIED ENERGY 卷: 130 特刊: SI 页: 738-747 DOI: 10.1016/j.apenergy.2014.02.038 子辑: 1 出版年: OCT 1 2014

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摘要: This investigation addresses the potential for heat recovery from Multi Stage Flash (MSF) desalination plant hot distillate water to power an Organic Rankine Cycle (ORC), comparing R134a and R245fa refrigerants as the working fluid. Using design characteristics of an existing ORC unit, the model was first validated against its measured output. The distillate hot water from MSF stages is utilised to provide heat to the ORC and performance is investigated for both working fluids and for the number of MSF stages for heat recovery. For the specific MSF plant investigated, the net produced ORC power is found the highest with extraction up to MSF powering stage 8, generating 359 kW when R245fa is used and 307 kW when R134a is used. Both refrigerants exhibit an increase of power output and decrease of energy efficiency as heat is recovered from more MSF stages. The influence of variation of the evaporator and cooling temperature on ORC performance is demonstrated to be significant for both refrigerants, with R245fa performing better in this specific application. (C) 2014 Elsevier Ltd. All rights reserved.

作者关键词: ORC; MSF desalination; Energy; Exergy; Parametric study

KeyWords Plus: POWER-GENERATION; RO DESALINATION; TECHNOLOGIES; DESIGN; ENHANCEMENT; SELECTION; SEAWATER; SYSTEMS; FLUID; PLANT

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第 24 条, 共 145 条

标题: Unusual behavior of propane as a co-guest during hydrate formation in silica sand: Potential application to seawater desalination and carbon dioxide capture

作者: Babu, P (Babu, Ponnivalavan); Kumar, R (Kumar, Rajnish); Linga, P (Linga, Praveen)

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摘要: We report an unusual behavior of hydrate formation in silica sand with gas mixtures containing propane as a co-guest. Based on morphology study we observed that propane as a co-guest has the ability to draw water dispersed in silica sand to the hydrate formation region and showed a tendency to result in drastic hydrate growth due to the migration of water molecules to the gas phase region. Hydrate nucleation occurred in the interstitial pore space between the silica sand particles and hydrate growth occurred in the gas phase above the silica sand bed and to sustain the hydrate growth, dispersed water was drawn towards the hydrate growth front. In addition, we elucidated the effect of sand bed height to maximize the growth rates utilizing this behavior that results in enhanced kinetics. We propose conceptual designs for utilizing this behavior of propane as a co-guest in sand for seawater desalination and an innovative approach to simultaneously capture carbon dioxide and desalinate seawater. (C) 2014 Elsevier Ltd. All rights reserved.

作者关键词: Gas hydrates; Propane hydrate: pre-combustion capture; Carbon dioxide capture; Enhanced kinetics; Desalination

KeyWords Plus: PRE-COMBUSTION CAPTURE; FIXED-BED REACTOR; GAS HYDRATE; NATURAL-GAS; PHASE-EQUILIBRIUM; HYDROGEN STORAGE; CLATHRATE; SEPARATION; KINETICS; DISSOCIATION

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第 25 条, 共 145 条

标题: Application of response surface methodology for modeling and optimization of membrane distillation desalination process

作者: Boubakri, A (Boubakri, Ali); Hafiane, A (Hafiane, Amor); Bouguecha, SA (Bouguecha, Salah Al Tahar)

来源出版物: JOURNAL OF INDUSTRIAL AND ENGINEERING CHEMISTRY 卷: 20 期: 5 页: 3163-3169 DOI: 10.1016/j.jiec.2013.11.060 出版年: SEP 25 2014

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摘要: In this work, response surface methodology (RSM) was applied for modeling and optimization of operating parameters for water desalination by direct contact membrane distillation (DCMD) process using polypropylene membrane (PP) with low pore size. Operating parameters including vapor pressure difference, feed flow rate, permeate flow rate and feed ionic strength were selected and the optimum parameters were determined for DCMD permeate flux. The developed model for permeate flux response was statistically validated by analysis of variance (ANOVA) which showed a high value coefficient of determination value ($R^2 = 0.989$). The obtained optimum operating parameters were found to be 0.355×10^5 Pa of vapor pressure difference, feed flow rate of 73.6 L/h, and permeate flow rate of 17.1 L/h and feed ionic strength of 309 mM. Under these conditions, the permeate flux was 4.191 L/(m² h). Compared to a predicted value, the deviation was 3.9%, which confirms the validity of the model for the DCMD process desalination optimization. In terms of product water quality, the DCMD process using hydrophobic PP membrane can produce high quality of water with low electrical conductivity for all experimental runs. (C) 2013 The Korean Society of Industrial and Engineering Chemistry. Published by Elsevier B.V. All rights reserved.

作者关键词: Response surface methodology; Direct contact membrane distillation; Desalination; Permeate flux; Polypropylene membrane

KeyWords Plus: SEAWATER DESALINATION; WATER; JUICE; RECOVERY

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第 26 条, 共 145 条

标题: Modeling the capacitive deionization batch mode operation for desalination

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来源出版物: JOURNAL OF INDUSTRIAL AND ENGINEERING CHEMISTRY 卷: 20 期: 5 页: 3356-3360 DOI: 10.1016/j.jiec.2013.12.020 出版年: SEP 25 2014

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摘要: Capacitive deionization (CDI) is an emerging desalination technology in which saline water flows through a pair of polarized/biased electrodes. The cations and anions are attracted towards the negative and positive electrodes, respectively. In CDI operation there are two possible modes: single pass and batch mode. In single pass operation, saline water passes only once through the CDI cell, whereas in batch mode operation, the fixed volume of saline water is recycled continuously until a steady state is reached. This paper presents the transient response of the CDI cell under batch mode operation. The model is developed by taking into account single pass CDI operation and the mixing phenomena that occur in the recycling tank. The developed model was successfully validated using experimental data, and the model helped to derive the equation for predicting the steady state of the CDI cell for the given operating parameters: flow rate, saline water quantity, CDI capacitance, CDI resistance, spacer volume, dead volume, applied potential, and initial concentration of the saline water. (C) 2013 The Korean Society of Industrial and Engineering Chemistry. Published by Elsevier B.V. All rights reserved.

作者关键词: Capacitive deionization; Batch mode operation; Steady state

KeyWords Plus: DIELECTRIC-CONSTANT; ENERGY-CONSUMPTION; WATER; TECHNOLOGY; ELECTRODES

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第 27 条, 共 145 条

标题: Optimum thermal design of humidification dehumidification desalination systems

作者: Sharqawy, MH (Sharqawy, Mostafa H.); Antar, MA (Antar, Mohamed A.); Zubair, SM (Zubair, Syed M.); Elbashir, AM (Elbashir, Abubaker M.)

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摘要: Humidification dehumidification (HDH) process is used for producing fresh water from saline water at sub-boiling temperature. This process uses a low-temperature source such as solar energy or waste heat source. Although these heat sources are available with minimal operating cost, an optimum thermal design is required to maximize the water production rate for a given heat input. In this paper, the main design and performance parameters are investigated for two HDH cycles namely, water-heated and air-heated cycles. First-law based thermal analyses are provided and performance charts are presented by considering assumptions. The design details of both the humidifier and dehumidifier are presented to determine their sizes under different design conditions. It has been demonstrated that optimum mass flow rate ratios exist for each cycle such that the gained-output ratio (GOR) is maximized. In addition, it is demonstrated that higher GOR can be obtained by using large-size humidifiers and dehumidifiers due to increasing their effectiveness. Moreover, increasing the temperature of water entering the humidifier reduces GOR for the water-heated cycle whereas it increases for the air-heated cycle. A comparison is also carried out between the two cycles to provide guidelines for designers in terms of, power requirements and components size. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Humidification; Dehumidification; Desalination; HDH; Optimization; Design

KeyWords Plus: DECENTRALIZED WATER PRODUCTION; DIFFUSION DRIVEN DESALINATION; WET-COOLING-TOWERS; MASS-TRANSFER; SOLAR DESALINATION; SEAWATER; UNIT; FIN; OPTIMIZATION; PERFORMANCE

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第 28 条, 共 145 条

标题: A CFD study of the hydrodynamics in a desalination membrane filled with spacers

作者: Sousa, P (Sousa, Paula); Soares, A (Soares, Armando); Monteiro, E (Monteiro, Eliseu); Rouboa, A (Rouboa, Abel)

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摘要: Reverse osmosis (RO) is by far the most widely used membrane desalination process worldwide. The RO process depends on the properties of semi-permeable membranes which allow the separation of water from a salt solution by applying external pressure higher than the osmotic pressure on the seawater. The main problem in membrane separation process is the fouling of the membrane walls, which decreases the permeate flux. Having spacer filaments in the feed channel has been proven to dynamically change the concentration boundary layer and preventing fouling. In this study, computational fluid dynamics (CFD) techniques were used to study the hydrodynamics of feed channels of a desalination membrane filled with spacers in zigzag arrangements and transverse in relation to the flow. Numerical solutions were obtained with FLUENT software for laminar flows. A fully developed laminar flow, quasi-periodically repeating in successive inter-filament regions, was used. Four types of settings were tested with different inter-filament distances in the range of Reynolds numbers between 10 and 300. The results show the effect of the distance between elliptical filaments in the velocity field, streamlines, local and average friction factors, pressure drop and on the shear stress developed in the membrane walls. Further, the decrease in distance between filaments may lead to more active recirculation patterns that may promote mass transfer on the membrane surfaces, despite the decrease in their usable area. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Membrane; Reverse osmosis; Zigzag spacers; Elliptical filaments

KeyWords Plus: SPIRAL-WOUND MODULES; OF-THE-ART; LADDER-TYPE SPACERS; REVERSE-OSMOSIS; HEAT-TRANSFER; CONCENTRATION POLARIZATION; TURBULENCE PROMOTERS; NUMERICAL-ANALYSIS; MASS-TRANSFER; FLOW

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第 29 条, 共 145 条

标题: Design strategy for networking membrane module and heat exchanger for direct contact membrane distillation process in seawater desalination

作者: Chung, S (Chung, Seungjoon); Seo, CD (Seo, Chang Duck); Lee, H (Lee, Hanyong); Choi, JH (Choi, Jae-Hoon); Chung, J (Chung, Jinwook)

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摘要: An energy-efficient design strategy for networking membrane modules and heat exchangers in membrane distillation (MD) process was developed in this work. A numerical simulation model was used to describe heat and mass transfer in direct contact type MD membrane module. Mass

transfer coefficients were evaluated under different feed flow rates and feed temperatures. Feed flow rate had the predominant effect on the mass transfer coefficient, while feed temperature had a minimal effect. Thus, an empirical equation for the mass transfer coefficient relative to feed flow rate was employed in the simulation to estimate flux and outlet temperatures of membrane module. This approach was verified by two-stage module test results, which showed a good correlation with simulation results. After comparison of different unit process designs, a desired one including partial brine recycle scheme was selected due to the highest efficiency of energy utilization. Replications of a selected unit process will be useful for design of a large scale MD process. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Direct contact membrane distillation; Membrane distillation process design; Membrane module and heat exchanger network; Numerical simulation of MD module; Seawater desalination

KeyWords Plus: DEVICES

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第 30 条, 共 145 条

标题: New insights on early stages of RO membranes fouling during tertiary wastewater desalination

作者: Ying, W (Ying, Wang); Siebdrath, N (Siebdrath, Nadine); Uhl, W (Uhl, Wolfgang); Gitis, V (Gitis, Vitaly); Herzberg, M (Herzberg, Moshe)

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摘要: In tertiary wastewater desalination, effective minimization and cleaning of membrane fouling requires an understanding of the physicochemical interactions between conditioning film-membrane surface, conditioning film-bacteria, bacteria-EPS and within the EPS. In this study, the effect of conditioning film on the attachment of bacteria and EPS (isolated from RO membrane biofouling layers) to the surface was analyzed using quartz crystal microbalance with dissipation (QCM-D) equipped with polyamide-coated sensors. A conditioning film originated from membrane bioreactor (MBR) ultra-filtration permeate (UFP), mainly consisting of effluent organic matter (EfOM). This conditioning film was shown to enhance bacterial attachment but had no effect on the EPS adsorption. Furthermore, the UFP and EPS were characterized and their effects on the swelling behavior of the model polyamide surface were delineated using QCM-D by altering pH values from 6 to 8 and back to 6. In parallel, fouling experiments with UFP and EPS were conducted in a parallel RO plate and frame unit. Reversible changes in the RO permeate flux were observed as pH values were altered (from 6 to 8 and back to 6) with pristine and fouled membrane with EPS. In contrast, irreversible flux decline was observed for the UFP fouled membrane: pH variation, back to 6, promoted further interaction between the UFP organic matter and the membrane, leading to a further reduced membrane permeability. These results are likely related to the swelling phenomenon and its inhibition by the UFP layers observed in the QCM-D. More studies need to be carried out in order to analyze the effects of humic substances, abundant in the UFP fouling layer, that irreversibly interact with the polyamide surface. Reduced membrane swelling capability, which is important for water transport, by different foulants is proposed as additional RO membrane fouling mechanism. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Biofouling; Organic fouling; Reverse osmosis; EfOM; EPS; Membrane swelling

KeyWords Plus: EXTRACELLULAR POLYMERIC SUBSTANCES; REVERSE-OSMOSIS MEMBRANES; NATURAL ORGANIC-MATTER; BIOREACTOR HG-MBR; BACTERIAL ADHESION; NANOFILTRATION MEMBRANES; EPS; GROWTH; ADHERENCE; SURFACE

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第 31 条, 共 145 条

标题: Application of a porous composite hydrophobic/hydrophilic membrane in desalination by air gap and liquid gap membrane distillation: A comparative study

作者: Essalhi, M (Essalhi, M.); Khayet, M (Khayet, M.)

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摘要: A first attempt was carried out comparing the two membrane distillation (MD) configurations, liquid gap (LGMD) and air gap (AGMD), using a porous composite hydrophobic/hydrophilic membrane, the same system and the same MD operating parameters. The surface modified membrane was prepared by the phase inversion technique in a single casting step using a fluorinated surface modifying macromolecule (SMM). Different membrane characterization techniques were applied. MD experiments were performed at different feed temperatures and sodium chloride aqueous solutions. The permeate fluxes were found to be slightly higher (2.2-6.5%) for LGMD compared to that of AGMD although the resistance to mass transfer in LGMD is higher due to the presence of the liquid permeate layer between the membrane and the cooling solid surface. This observed enhancement is attributed partly to the small established distance between the liquid/vapor interfaces at both side of the hydrophobic thin top-layer of the membrane in LGMD configuration, and the higher thermal conductivity of water, which is an order of magnitude higher than that of air, resulting in higher heat transfer coefficient of the permeate in LGMD. The salt rejection factors were found to be almost similar for both MD variants and higher than 99.61%. Compared to AGMD, the thermal efficiency is higher for LGMD, whereas the specific internal heat loss is lower. A linear increase of the thermal efficiency with the feed inlet temperature was observed for both MD configurations. The global heat transfer coefficient and the heat transfer of the permeate membrane side were also found to be greater for LGMD. The temperature polarization effect was found to be slightly higher for AGMD, whereas the concentration polarization effect was slightly higher for LGMD due to its higher permeate flux. In general, the LGMD proved to be more attractive than AGMD for desalination when using bilayered hydrophobic/hydrophilic membranes. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Porous hydrophobic/hydrophilic membrane; Surface modified membrane; Liquid gap membrane distillation; Air gap membrane distillation; Desalination

KeyWords Plus: FLUORIDE ELECTROSPUN NANOFIBERS; SELF-SUSTAINED WEBS; MODULE

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第 32 条, 共 145 条

标题: High temperature direct contact membrane distillation based desalination using PTFE hollow fibers

作者: Singh, D (Singh, Dhananjay); Sirkar, KK (Sirkar, Kamalesh K.)

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摘要: Thermally driven direct contact membrane distillation (DCMD)-based desalination process involving a microporous hydrophobic membrane separates a hot brine feed and a cold distillate which condenses the water vapor coming from the hot brine through the gas-filled membrane pores. Conventionally DCMD has been explored for hot brines and other aqueous solutions below 100 degrees C. For feed brines above 100 degrees C, desalination by a conventional membrane technique, such as, reverse osmosis (RO) requires cooling of the feed solution costing additional energy since RO cannot utilize the heat available in the feed solution; DCMD process is ideally suited for such a process. Produced water obtained from steam assisted gravity drainage (SAGD) process is one such example where DCMD can potentially be a very useful process. This process has been explored earlier with flat porous polytetrafluoroethylene (PTFE) membranes. In this paper, desalination by the DCMD technique has been explored in the temperature range of 50-120 degrees C for brine solutions containing 10,000 ppm sodium chloride using microporous PTFE hollow fiber membranes. The pressure of the solution went up to 2-3 atm. There was no leakage of salt under any conditions. The highest water vapor flux achieved was 115 kg/m(2) h at 118 degrees C, which is close to an order of magnitude higher than that for seawater reverse osmosis (RO) processes. A simulated SAGD produced water was also successfully desalinated. (C) 2014 Elsevier Ltd. All rights reserved.

作者关键词: Direct contact membrane distillation; High temperature and pressure; Polytetrafluoroethylene hollow fiber membrane; Steam-assisted gravity drainage process; Produced water

KeyWords Plus: MICROPOROUS MEMBRANES; TRANSPORT; GAS; DEVICE; HEAT

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第 33 条, 共 145 条

标题: Thermoresponsive copolymer-based draw solution for seawater desalination in a combined process of forward osmosis and membrane distillation

作者: Zhao, DL (Zhao, Dieling); Wang, P (Wang, Peng); Zhao, QP (Zhao, Qipeng); Chen, NP (Chen, Ningping); Lu, XM (Lu, Xianmao)

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摘要: A thermoresponsive copolymer, poly(sodium styrene-4-sulfonate-co-n-isopropylacrylamide) (PSSS-PNIPAM), is employed as a draw solute in forward osmosis (FO) for seawater desalination. When PSSS-PNIPAM is dissolved in water to form a draw solution, PSSS as a strong polyelectrolyte generates a high osmotic pressure and extracts water from seawater in an FO process. A water flux of 4 LMH has been attained with simulated seawater as the feed solution. The draw solution is then regenerated with membrane distillation (MD) at a temperature above the low critical solution temperature (LCST) of PNIPAM, which agglomerates and leads to decreased osmotic pressure of the solution and thus higher water vapor pressure. The combined FO-MD process with PSSS-PNIPAM as the draw solute should be promising not only for seawater desalination, but also for other membrane-involved separation processes in wastewater treatment and protein or medicine enrichment. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Thermoresponsive copolymer; Forward osmosis; Draw solution; Desalination; Membrane distillation

KeyWords Plus: THIN-FILM COMPOSITE; PRESSURE-RETARDED OSMOSIS; AMMONIA-CARBON DIOXIDE; MAGNETIC NANOPARTICLES; WATER DESALINATION; POWER-GENERATION; POLYMER HYDROGELS; FUTURE CHALLENGES; PERFORMANCE; ENERGY

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第 34 条, 共 145 条

标题: Simulation and optimization of novel configurations of triple absorption heat transformers integrated to a water desalination system

作者: Khamooshi, M (Khamooshi, Mehrdad); Parham, K (Parham, Kiyan); Egelioglu, F (Egelioglu, Fuat); Yari, M (Yari, Mortaza); Salati, H (Salati, Hana)

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摘要: A thermodynamic analysis of six different configurations of triple absorption heat transformer systems (TAHTs) utilizing H₂O/LiBr as the working pair which is integrated into water desalination systems is conducted in this study. The energy source of the desalination system is provided by the high temperature heat of the absorbers of TAHTs by utilizing the waste heat from a textile factory. A computer program is developed in the EES (Engineering Equation Solver) to study the performance of the system such as; COP, ECOP, distilled water, and absorber utilized heat, and also to optimize them in six different configurations. It is shown that modified configurations of TAHTs can increase the COP and fresh water productivity rather than that of conventional systems. The results indicated that the optimized amount of distilled water produced by the last configuration which is 0.1307 kg/s can supply 1131 residential units. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Triple absorption heat transformer; LiBr/H₂O; Desalination; Configuration; Economizer effectiveness

KeyWords Plus: THERMODYNAMIC DESIGN-DATA; SINGLE-STAGE; PURIFICATION SYSTEMS; SOURCE TEMPERATURE; SOLAR; PERFORMANCE; ENERGY; INCREASE; HYBRID; CYCLE

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第 35 条, 共 145 条

标题: Fabrication of novel heterogeneous cation exchange membrane by use of synthesized carbon nanotubes-co-copper nanolayer composite nanoparticles: Characterization, performance in desalination

作者: Zendeenam, A (Zendeenam, A.); Mokhtari, S (Mokhtari, S.); Hosseini, SM (Hosseini, S. M.); Rabieyan, M (Rabieyan, M.)

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摘要: In this research polyvinyl chloride/multi walled carbon nanotube-co-copper nanolayer composite nanoparticles heterogeneous cation exchange membranes were prepared by solution casting techniques. The MWCNT-co-Cu nanolayer composite nanoparticles were prepared by magnetron sputtering method. The effect of composite nanoparticle concentration on physico-chemical properties of membranes was studied. The SEM, TEM and XRD results showed uniform distribution and crystalline structure for the deposited Cu nanolayer on the MWCNTs' surface. SOM images also showed relatively uniform particle distribution for the membranes. The membrane potential, transport number, selectivity and electrical conductivity were improved by an increase of additive content in prepared membranes. Membrane average roughness was decreased slightly by an increase of additive concentration. Membrane ionic permeability and flux were decreased initially by an increase of additive ratio up to 05 wt.% and then showed an increasing trend by more additive concentration. Furthermore, mechanical stability of prepared membranes was improved by an increase of MWCNT-co-Cu nanolayer composite nanoparticle content in membrane matrix. Also, modified membrane containing 4 wt.% composite nanoparticles showed better electrochemical properties compared to other modified membranes, membrane containing pure MWCNTs and unmodified ones. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Ion exchange membrane; Mixed matrix; MWCNT-co-Cu nanolayer; Composite nanoparticles; Magnetron sputtering method/plasma; Desalination

KeyWords Plus: FUEL-CELL APPLICATIONS; ELECTROCHEMICAL CHARACTERIZATION; SILVER



NANOPARTICLES; TRANSPORT-PROPERTIES; ELECTROMEMBRANE PROCESSES; DEPOSITION; SURFACE; ELECTRODIALYSIS; PERMSELECTIVITY; POLYSULFONE

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第 36 条, 共 145 条

标题: Desalination supply chain decision analysis and optimization

作者: Al-Nory, MT (Al-Nory, Malak T.); Brodsky, A (Brodsky, Alexander); Bozkaya, B (Bozkaya, Burcin); Graves, SC (Graves, Stephen C.)

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摘要: The desalination industry has been growing progressively in the last few decades. A large number of new plants are contracted every year. Strategic decisions related to plant locations and capacity, the selection of the desalination technology, and many other technical decisions related to the plant design and operation are very critical to these strategic investments. Viewing the desalination industry network as a supply chain provides a holistic view allowing decision makers to perform optimization of water desalination operations end to end. The methodology we propose provides the decision makers with (1) a set of investment alternatives comprising combinations of the different desalination locations, capacities, technologies, and energy sources, and (2) a decision graph showing the performance of each decision alternative in terms of quantitative and qualitative performance metrics chosen by the decision maker. The case study of Saudi Arabia, the world leader in desalination, shows how the methodology can present strategic planners with an optimal configuration of the desalination supply chain. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Supply chain; Decision analysis; Strategic planning; Optimization modeling

KeyWords Plus: LIFE-CYCLE ASSESSMENT; TECHNOLOGIES; ENERGY; PLANTS

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第 37 条, 共 145 条

标题: Analysis of the process of environmental impact assessment for seawater desalination plants in Spain

作者: Fuentes-Bargues, JL (Luis Fuentes-Bargues, Jose)

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摘要: Desalination generates drinking water and enhances the economic, social, and environmental development of many areas with few water resources, such as parts of the Middle East, North Africa, and southern Europe (such as Spain and Cyprus).

Desalination plants may cause environmental impacts in coastal areas and so it is necessary to submit plans for new plants to a process of environmental impact assessment (EIA) in order to achieve more environmentally viable projects, meaning: optimal locations; appropriately used systems and technologies; effective preventive, compensatory, and corrective measures; and social and environmental acceptance.

This article contains a study of the process of environmental impact assessment for seawater desalination projects during the last 12 years in Spain through an analysis of information published in the Records of Decisions (RODs). The study describes the main aspects of the process and identifies areas for improvement. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Environmental impact assessment; Seawater desalination plants; Records of decisions; Spain; Environmental impact statement

KeyWords Plus: COST

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第 38 条, 共 145 条

标题: Superhydrophobic PVDF-PTFE electrospun nanofibrous membranes for desalination by vacuum membrane distillation

作者: Dong, ZQ (Dong, Zhe-Qin); Ma, XH (Ma, Xiao-hua); Xu, ZL (Xu, Zhen-Liang); You, WT (You, Wen-Ting); Li, FB (Li, Fang-bing)

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摘要: In this study, a superhydrophobic nanofibrous membrane was prepared on the basis of an electrospun polyvinylidene fluoride (PVDF)-polytetrafluoroethylene (PTFE) nanofibrous scaffold coupled with a microporous PTFE substrate. The PVDF-PTFE nanofibrous scaffold was fabricated by electrospinning of PVDF-PTFE blend solutions, it was observed that by changing the PTFE micro-powder content in the dope solutions from 0 wt.% to 12 wt.%, the water contact angle (WCA) and the liquid entry pressure (LEPw) of the membrane vary from 130.4 degrees and 84 kPa to 152.20 degrees and 137 kPa, respectively. The superhydrophobic PVDF-PTFE nanofibrous membrane was then tested for desalination by vacuum membrane distillation (VMD), a stable flux of 18.5 kg/m² h and salt rejection higher than 99.9% was presented throughout the entire testing period of 15 h, indicating the great potential of the PVDF-PTFE nanofibrous membranes in VMD. For further application of the PVDF-PTFE nanofibrous membranes in VMD, a mathematical model was presented to predict the vapor flux of the novel membrane under various operation conditions. A good agreement between the experimental and theoretical values for vapor fluxes was obtained; the results indicated that the VMD flux increased with the increase of feed temperature and flow rate and decreased with the increase of permeate pressure. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Electrospinning; PVDF-PTFE; Superhydrophobic; Nanofibrous membrane; Membrane distillation

KeyWords Plus: HOLLOW-FIBER MEMBRANES; PORE-SIZE DISTRIBUTION; WATER PRODUCTION; MASS-TRANSFER; CONTACT; PERFORMANCE; FLUX; PROPERTY; REMOVAL; HEAT

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第 39 条, 共 145 条

标题: High performance hydrophilic pervaporation composite membranes for water desalination

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摘要: A three-layer thin film nanofibrous pervaporation composite (TFNPVC) membrane was prepared by sequential deposition using electrospinning/electrospraying. The poly(vinyl alcohol) (PVA) top barrier layer was first electrospayed on aluminum foil and its thickness can be easily controlled by adjusting the collecting time. Next a polyacrylonitrile (PAN) nanofibrous scaffold was deposited by electrospinning as a mid-layer support. A nonwoven PET layer is used to complete the composite membrane. The pervaporation desalination performance of TFNPVC membranes was tested using NaCl solutions at 100 Pa and at room temperature. The TFNPVC membranes show excellent desalination performance (high water flux and salt rejection >99.5%) for different salt concentrations with virtually no change in performance after 50 h of operation. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Electrospinning nanofiber; Electrospaying; Hydrophilic; Pervaporation; Desalination

KeyWords Plus: HOLLOW-FIBER MEMBRANES; LINKED PVA MEMBRANES; OPERATING-CONDITIONS; SEPARATION; OSMOSIS; SCAFFOLDS; TRANSPORT; MIXTURES; ENERGY; BLEND

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第 40 条, 共 145 条

标题: Performance analysis of evaporation-freezing desalination system by humidity differences

作者: Gao, PH (Gao Penghui); Guo, Z (Guo Zhi); Zhang, DH (Zhang Donghai); Zhou, XY (Zhou Xingye); Zhou, GQ (Zhou Guoqing)

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摘要: Facing severer global shortage of fresh water and finite energy resource, it is of paramount importance to develop the new energy-efficient desalination methods to solve those problems. A new freezing seawater desalination is proposed in this study that sea water can be frozen driven by humidity difference (humidity difference denotes absolute humidity difference) between air and liquid surface in a 0 C environment, which utilizes latent heat of vaporization to freeze seawater and thereafter produces fresh water. Based on heat and mass balance equations, the theoretical model of this desalination process was built and it was verified through experimental results obtained from our experimental unit. The effects of humidity difference and airflow rate on fresh water production were studied and they were confirmed to be the key factors for the water production of



evaporation-freezing desalination. The theoretical data was consistent with experimental data, and the water production characteristic of this desalination approach was well illustrated by the theoretical model. The results in this research would be in favor of further studies and engineering applications for the evaporation-freezing desalination driven by humidity difference. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Evaporation-freezing; Humidity difference

KeyWords Plus: CONTACT HEAT-TRANSFER; SEA ICE; WATER; ENERGY

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第 41 条, 共 145 条

标题: Analysis of forward osmosis desalination via two-dimensional FEM model

作者: Sagiv, A (Sagiv, Abraham); Zhu, AH (Zhu, Aihua); Christofides, PD (Christofides, Panagiotis D.); Cohen, Y (Cohen, Yoram); Semiat, R (Semiat, Raphael)

来源出版物: JOURNAL OF MEMBRANE SCIENCE 卷: 464 页: 161-172 DOI: 10.1016/j.memsci.2014.04.001 出版年: AUG 15 2014

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摘要: Forward osmosis (FO) desalination was investigated via 2-D numerical model of the fully coupled hydrodynamics and mass transfer equations. The model was formulated for a detailed composite channel structure (feed and draw channels, membrane skin layer and porous support) being capable of describing co-current or counter current cross operation where the membrane skin faces the salt feed solution (SFF) or where the membrane skin faces the draw solution (SFD). Simulations based on existing experimental FO data confirmed that FO operation in a counter-current/SFD mode provides slight improvement with respect to water flux, and reduced cross migration of feed and draw solutes relative to the co-current mode of operation. Analysis of existing FO data also revealed the dependence of the intrinsic membrane water permeability and solute transport coefficients on draw solute concentration. Simulation results indicated significant cross membrane migration of feed and draw solutes for long (similar to 1 m) relative to short (similar to 10 cm) FO channels. Moreover, up to an order of magnitude decline of draw solute concentration difference (along the membrane) can be countered at the draw channel exit region. Simulation results suggest that accurate assessment of FO performance in long channels is critical for full-scale plant design in order to minimize salt leakage, optimize recovery, and setting accurate inlet/outlet conditions to enable simulations of membrane elements in series. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Forward osmosis; Mass transfer; FEM modeling; Concentration polarization

KeyWords Plus: SPIRAL WOUND MODULES; CONCENTRATION POLARIZATION; REVERSE-OSMOSIS;

FLUX BEHAVIOR; MASS-TRANSFER; MEMBRANE; FLOW; PERFORMANCE; DIFFUSION; LAYER

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第 42 条, 共 145 条

标题: Development of high flux thin-film composite membrane for water desalination: a statistical study using response surface methodology

作者: Gohil, JM (Gohil, J. M.); Suresh, AK (Suresh, A. K.)

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摘要: High flux thin-film composite reverse osmosis membranes for brackish water desalination have been fabricated by interfacial polymerization based on aromatic polyamide chemistry. A response surface methodology was used to optimize the concentrations of the monomers, 1,3-Diaminobenzene (MPDA) and 1,3,5-Benzenetricarbonyl trichloride (TMC), and a flux-enhancing additive, Dimethyl sulfoxide (DMSO). The membranes prepared showed a salt rejection of more than 95%. The membranes produced with DMSO additive exhibited a four-to five-fold higher flux rate as compared to the membranes without additive. Quadratic mathematical models have been proposed and verified using diagnostic plots, which adequately describe the flux rate and rejection ability within the limits of the factors investigated. The membrane rejection ability was contributed by a first-order effect of the membrane preparation parameters MPDA, TMC, and DMSO concentration, a quadratic effect of TMC and DMSO concentration, and an interaction effect between TMC and DMSO concentrations. For flux rate, first-order effect of TMC, MPDA, and DMSO concentration, and quadratic effect of MPDA concentration were significant model terms.

作者关键词: Desalination; Dimethyl sulfoxide; High flux; Thin film composite membrane; Response surface methodology; Interfacial polycondensation

KeyWords Plus: INTERFACIAL POLYMERIZATION; POLYAMIDE MEMBRANE; RO MEMBRANES; PERFORMANCE; ENHANCEMENT

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第 43 条, 共 145 条

标题: The analysis of salt production by a recrystallization method using the concentrated backflow effluent of the desalination units

作者: Mowla, O (Mowla, Omid); Mowla, D (Mowla, Dariush)

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摘要: Considering the fact that many oil-rich regions are located on the coastlines and islands, desalination units need to be established in these regions in order to supply required fresh water. In desalination units, a stream of concentrated saline water is also produced in addition to fresh water. This concentrated saline water is returned to the sea and may cause severe environmental problems in the region. Applying proper operations on the output-concentrated saline water from the desalination units not only prevents the salinity shock, as well as the thermal shock to the marine ecosystem, but it could produce two valuable products of fresh water and refined salt. In this study, first, the output-concentrated saline water from a desalination unit in Pars Special Economic Energy Zone, situated in south of Iran, is chemically treated to decrease the level of calcium and magnesium. Then, this purified concentrated saline water is concentrated in an electrodialysis machine to increase the salt level to about 20%. Then, the output concentrated solution is directed from electrodialysis into a crystallizer, in which it is heated to reach a saturated or supersaturated concentration, in order to form salt crystals. The slurry of the produced salt crystals and saline water is directed from the crystallizer to a centrifuge in order to separate salt crystals from the saline water. The separated salt crystals are dried and then analyzed. The analysis reveals that a high-quality salt is produced by this method.

作者关键词: Fresh water; Salt; Desalination units; Salinity shock; Heat shock; Recrystallization

KeyWords Plus: BRINE; PLANT

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第 44 条, 共 145 条

标题: Preparation and characterization of highly micro-porous PVDF membranes for desalination of saline water through vacuum membrane distillation

作者: Devi, S (Devi, Sadhana); Ray, P (Ray, Paramita); Singh, K (Singh, Kripal); Singh, PS (Singh, Puyam S.)

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摘要: Highly porous PVDF membranes supported on non-woven polyester fabric were prepared by the phase inversion method from the solutions of different concentrations at identical conditions of casting as temperature, relative humidity and air drying time before immersion in non-solvent using motorized machine to study the microstructures formed in the resulting membrane and correlate membrane morphology to membrane performance in membrane distillation process. The membranes were extensively characterized for porosity, hydrophobicity and surface topography. Morphology study indicated an anisotropic nature of the membranes resulting from phase inversion occurred through liquid-liquid demixing process. The membrane prepared from casting solution of low polymer content is highly porous compared to those prepared from solution of higher polymer content. The membranes demonstrated potential for desalination from 30,000 to 100,000 ppm synthetic seawater through membrane distillation. The membranes exhibited 99.0+% salt rejection efficiency and varied water flux ranging from 2 to 121 center dot m(-2) center dot h(-1) (LMH) depending on the membrane pore structure feed concentration and processing parameters. All the membranes exhibited practically uniform performance in all feed concentration ranges which indicated that there is no adverse effect of increased salinity in the feed on the performance of the membrane. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Polyvinylidene fluoride (PVDF); Membrane distillation; Desalination; Phase inversion method

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第 45 条, 共 145 条

标题: Performance of a newly developed titanium oxide nanotubes/polyethersulfone blend membrane for water desalination using vacuum membrane distillation

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摘要: The present paper introduces a comprehensive study of the performance of newly developed titanium oxide nanotubes (TNTs) incorporated into a Polyethersulfone (PES) blend membrane for desalination using vacuum membrane distillation (VMD) process. The study examines the effect of different operating conditions. The results showed a maximum salt rejection of 98% and a permeate flux of 15.2 kg/m² h at 7000 ppm feed salt concentration for the TNTs-PES membrane at a temperature of 65 degrees C and a vacuum pressure of 300 mbar with feed flow rate of 11 mL/s. A comparison between the performance of the developed TNTs-PES membrane, and commercial Polytetrafluoroethylene (PTFE) membrane was performed at different feed salt concentrations. The achieved results showed a significant improvement in the performance of the new membrane compared to the commercial PTFE membrane, where the salt rejection reached 99.3% at feed concentration 3000 ppm and 96.7% at 35,000 ppm using the new membrane, compared to salt rejection of up to 90.6% at 3000 ppm and 62.5% at 35,000 ppm using PTFE membrane. The dense TNTs layer formed on the top surface of the TNTs-PES blend membrane is considered a selective layer that prevents salt passage through the membrane. The decline in permeate flux may be overcome by membrane washing every hour. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Titanium oxide nanotubes; Polyethersulfone; Vacuum membrane distillation; Desalination

KeyWords Plus: SULFONE) ULTRAFILTRATION MEMBRANES; COMPOSITE TFC MEMBRANE; TIO2 NANOPARTICLES; NANOCOMPOSITE MEMBRANES; PHOTOCATALYTIC ACTIVITY; SURFACE MODIFICATION; FOULING MITIGATION; NANOTUBES; FABRICATION; POLYMERIZATION

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第 46 条, 共 145 条

标题: Pressure retarded osmosis for power generation and seawater desalination: Performance analysis (vol 344, pg 108, 2014)

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第 47 条, 共 145 条

标题: Treating produced water from hydraulic fracturing: Composition effects on scale formation and desalination system selection

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来源出版物: DESALINATION 卷: 346 页: 54-69 DOI: 10.1016/j.desal.2014.05.001 出版年: AUG 1 2014



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摘要: Produced water from unconventional gas and oil extraction may be hypersaline with uncommon combinations of dissolved ions. The aim of this analysis is to aid in the selection of produced water treatment technology by identifying the temperature, pH, and recovery ratio under which mineral solid formation from these produced waters is likely to occur. Eight samples of produced water from the Permian Basin and the Marcellus shale are discussed, with an average TDS of about 177 g/L but significant variability. Crystallization potential is quantified by the saturation index, and activity coefficients are calculated using the Pitzer model. The method is applied to estimate solid formation in the treatment of two design case samples: a 183 g/L sample representing the Permian Basin water and a 145 g/L sample representing the Marcellus. Without pretreatment, the most likely solids to form, defined by highest saturation index, are: CaCO₃, FeCO₃, MgCO₃, MnCO₃, SrCO₃, BaSO₄, CaSO₄, MgSO₄ and SrSO₄. Some options for mitigating the formation of these scales are discussed. With appropriate pretreatment, it is estimated that recovery ratios of as high as 40-50% are achievable before NaCl, a major constituent, is likely to limit further concentration without significant crystallization. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Wastewater treatment; Scaling; Fracking; Frack water; Marcellus; Permian Basin

KeyWords Plus: MIXED ELECTROLYTE-SOLUTIONS; THERMODYNAMIC PROPERTIES; MINERAL SOLUBILITIES; NATURAL-WATERS; ACTIVITY-COEFFICIENTS; TRANSPORT-PROPERTIES; SODIUM-CHLORIDE; HIGH-PRESSURES; HEAT-CAPACITY; 25-DEGREES-C

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第 48 条, 共 145 条

标题: Comparison of slow sand filtration and microfiltration as pretreatments for inland desalination via reverse osmosis (vol 334, pg 1, 2014)

作者: Corral, AF (Corral, Andrea F.); Yenal, U (Yenal, Umur); Strickle, R (Strickle, Roy); Yan, DX (Yan, Dongxu); Holler, E (Holler, Eric); Hill, C (Hill, Chris); Ela, WP (Ela, Wendell P.); Arnold, RG (Arnold, Robert G.)

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第 49 条, 共 145 条

标题: Thermal analysis for system uses pressurized hot water for seawater desalination (pressurized multistage)

作者: Attia, AAA (Attia, Ahmed A. A.); Abdel-Rehim, AA (Abdel-Rehim, Ahmed A.)

来源出版物: DESALINATION 卷: 346 页: 91-99 DOI: 10.1016/j.desal.2014.05.013 出版年: AUG 1 2014

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摘要: The present work is a description of a proposed system for seawater desalination. The suggested system operates basically the same as the MSF system operates but uses high pressurized saturated water. The system operating pressure through all stages of the system and the final stage pressure are higher than atmospheric pressure. The system is simple and easy to construct. No need for high operation maintenance or high technical stuff in operation. No need for vacuum pumps because it operates at pressure higher than atmospheric pressure which also makes the system starts to operate fast and easy. The seawater could be with any quality or grade even brackish water could be used so no need for seawater pretreatment. The system could also be run by solar energy through replacing heat exchanger with a solar collector according to operating pressure and assigned saturated temperature. Energy consumption and production cost are promising even if system uses electricity as heat source. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Thermal desalination; Hot pressurized water; RO; MSF

KeyWords Plus: ENERGY; TECHNOLOGIES

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第 50 条, 共 145 条

标题: Desalination combined with copper(II) removal in a novel microbial desalination cell

作者: An, ZY (An, Zhongyi); Zhang, HC (Zhang, Huichao); Wen, QX (Wen, Qinxue); Chen, ZG (Chen, Zhigiang); Du, MA (Du, Maoan)

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摘要: A novel four-chamber microbial desalination cell (FMDC) was proposed to treat synthetic Cu(II)-containing wastewater in the cathode chamber and simultaneously desalinate brine or seawater in the desalination chamber. In this study, two anion exchange membranes (AEMs) and one cation exchange membrane (CEM) were used as separators between the four different function chambers of the FMDC. Below a pH value of 3.0, the maximum current density was 2.0 A/m² with the initial Cu²⁺ concentration of 800 mg/L and an external resistance of 10 Ω. The copper removal rate, salt removal rate and total desalination rate, all conducted simultaneously, were 94.1 ± 1.2%, 43.9 ± 0.9% and 5.1 ± 0.6 mg/h in a batch-fed cycle, respectively. Scanning electron microscope-energy dispersive spectrometer (SEM-EDS) analysis indicated that the Cu(II) was reduced to Cu₂O plus Cu, which deposited on the cathode surface. These results suggested a novel approach to remove and recover Cu(II) from Cu(II)-containing wastewater and to desalinate salt water by using an FMDC reactor. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Four chamber microbial desalination cell (FMDC); Cu(II) reduction; Electricity generation; Desalination

KeyWords Plus: HEAVY-METAL; FUEL-CELLS; INDUSTRIAL WASTEWATERS; WATER; RECOVERY; CLINOPTILOLITE; PARAMETERS; REDUCTION; CATHODE

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第 51 条, 共 145 条

标题: Surface modification of heterogeneous cation exchange membranes by simultaneous using polymerization of (acrylic acid-co-methyl methacrylate): Membrane characterization in desalination process

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摘要: In the current research poly(vinyl chloride) based composite heterogeneous cation exchange membranes were prepared by solution casting technique. Poly(acrylic acid)-co-poly(methyl methacrylate) was used as membrane surface modifier by emulsion/graft polymerization technique to improve the membrane electrochemical properties. Also the effect of used emulsifier content ratio in modifier emulsion on properties of membranes was studied. The FT-IR spectrum analysis decisively proved the graft polymerization of poly(acrylic acid)-co-poly(methyl methacrylate). SOM images showed uniform particle distribution and relatively uniform surfaces for the membranes. Results revealed that surface modification of membrane led to increase in membrane potential, transport number, selectivity, surface charge density, ion exchange capacity and ionic permeability in modified membranes. Also, results showed that increase of emulsifier (SOBS) ratio in used emulsion led to increase in membrane transport number, selectivity and ionic flux for the modified composite membranes. Conversely, opposite trends were found for membrane electrical resistance by AA-co-MMA polymerization. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Composite cation exchange membrane; Surface modification; Synergetic polymerization; Emulsifier ratio; Electrochemical characterization

KeyWords Plus: ELECTROCHEMICAL CHARACTERIZATION; ELECTROMEMBRANE PROCESSES; GRAFT-POLYMERIZATION; TRANSPORT-PROPERTIES; CARBON; ELECTRODIALYSIS; PERMSELECTIVITY; NANOPARTICLES

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第 52 条, 共 145 条

标题: Portable and integrated solar-driven desalination system using membrane distillation for arid remote areas in Saudi Arabia

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摘要: We have developed an integrated solar-driven desalination system that uses membrane distillation process to produce potable water. The system encompasses the sources of both water and energy. The system is an integrated (self-contained) system that utilizes solar energy for its operation by combining solar photovoltaic (PV) and solar thermal collectors. The system is intended for autonomous operation in arid remote areas of Saudi Arabia where electricity and potable water are not readily available. Due to its portability, the system can be used in emergency situations in which potable water is essential for survival, such as natural disasters. The system has three major components: the solar-thermal system, solar-PV system, and membrane distillation system. A well-characterized memsys Vacuum Multi-Effect Membrane Distillation (V-MEMD) module was used as the core of the system. In addition, a heat pump was integrated into the system to improve the performance of the system. The novelty of the system is the engineered design of a portable and efficient integrated system that is reliable and easy to maintain. The system could be referred to as an environmentally friendly and sustainable desalination technology. The paper describes the design, configuration, and performance of the solar-driven desalination system. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Renewable energy; Solar desalination; Portable; Membrane distillation; Photovoltaic; Thermal collector

KeyWords Plus: SEAWATER DESALINATION; ENERGY; SIMULATION; DESIGN; COST

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第 53 条, 共 145 条

标题: Combined two stage desalination and cooling plant

作者: Chiranjeevi, C (Chiranjeevi, C.); Srinivas, T (Srinivas, T.)

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摘要: Two or more than two outputs from a single source result an overall high energy utilization factor (EUF) compared to the single output system. In this work, two stage humidification and dehumidification (HDH) desalination system has been extended with cooling system integration. Solar flat plate collector and concentrating collector are selected respectively for HDH desalination and single effect vapor absorption refrigeration (VAR) plant. The cooling after desalination increases the yield of distillation compared to without its integration. The sequence of operations in the combined plant is first stage air preheating-humidification-dehumidification, second stage air preheating-humidification-dehumidification and final cooling of air with chilled water. The work is aimed on thermodynamic study for maximization of EUF for cycle and plant. The role of humidifier efficiency, its effectiveness, hot water temperature and chilled water temperature (by varying VAR evaporator temperature) has been studied on integrated performance. The resulted distilled water is 670 LPH with 75 kW cooling at unit volume of air (1 m³/s). The cycle EUF and plant EUF are 0.58 and 0.33 respectively. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Air; Desalination; Energy; Humidification; Thermodynamics

KeyWords Plus: HUMIDIFICATION-DEHUMIDIFICATION PROCESS; REFRIGERATION SYSTEM; COMBINED POWER; CYCLE; UNIT

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第 54 条, 共 145 条

标题: Neural network based correlation for estimating water permeability constant in RO desalination process under fouling

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摘要: The water permeability constant, (K-w), is one of the many important parameters that affect

optimal design and operation of RO processes. In model based studies, e.g. within the RO process model, estimation of W-w is therefore important. There are only two available literature correlations for calculating the dynamic K-w values. However, each of them is only applicable for a given membrane type, given feed salinity over a certain operating pressure range. In this work, we develop a time dependent neural network (NN) based correlation to predict K-w in RO desalination processes under fouling conditions. It is found that the NN based correlation can predict the K-w values very closely to those obtained by the existing correlations for the same membrane type, operating pressure range and feed salinity. However, the novel feature of this correlation is that it is able to predict K-w values for any of the two membrane types and for any operating pressure and any feed salinity within a wide range. In addition, for the first time the effect of feed salinity on K-w values at low pressure operation is reported. Whilst developing the correlation, the effect of numbers of hidden layers and neurons in each layer and the transfer functions is also investigated. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Reverse osmosis; Physical property models; Fouling; Water permeability elevation; Neural network modelling

KeyWords Plus: REVERSE-OSMOSIS MEMBRANES; TEMPERATURE ELEVATION; PERFORMANCE; SEAWATER; SYSTEMS; SALT

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第 55 条, 共 145 条

标题: Incipient membrane scaling by calcium sulfate during desalination in narrow spacer-filled channels

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摘要: New insights were gained by studying in detail (using Scanning Electrode Microscopy SEM) incipient calcium-sulfate scaling of desalination membranes under realistic conditions; i.e. low supersaturation ratio S , once-through flow in narrow spacer-filled channels, with permeate-flux and cross-flow velocity levels encountered at the tail spiral-wound membrane (SWM) elements, where supersaturation first appears. Moreover, the feed-fluid was fully characterized, including its small-particle content. SEM images from desalination membranes and filters retaining small particles from feed- and retentate-samples were statistically analyzed. For 90 min tests, elongated gypsum crystals are sparsely distributed throughout the membrane, at the smallest supersaturation; at elevated S , clusters of needles/rods and platelets develop with increasing membrane-surface density. Similarly, the initial scale deposition rate [$\text{mg}/(\text{m}^2 \text{ min})$] and membrane-surface coverage tend to increase rather sharply with increasing S . The data provide no evidence of induction period for membrane scaling, as also recently observed in studying incipient CaCO_3 scaling. Additionally, there is strong indication that incipient CaSO_4 scaling is due to growth of membrane surface particles (from nuclei developing right on the surface and/or transported to the membrane) and not due to deposition of crystals developing in the bulk. The implications of the new results are discussed and related R&D needs are outlined. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Incipient CaSO_4 scaling; Membrane water desalination; Very small super-saturation; Initial scaling rate; Membrane surface coverage

KeyWords Plus: REVERSE-OSMOSIS MEMBRANE; FLUX DECLINE; FORMATION MECHANISM; MASS-TRANSFER; RO MEMBRANES; NANOFILTRATION; MODULES; SYSTEMS; PRECIPITATION



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第 56 条, 共 145 条

标题: Polyamide-POSS hybrid membranes for seawater desalination: Effect of POSS inclusion on membrane properties

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摘要: We have shown using both experiments and simulations that incorporation of polyoctaheclral oligomeric silsequioxanes (POSS) to the active layer of polyamide (PA) thin film composite membrane results in higher water flux and salt rejection than pure PA membranes. We report that the water flux increased by a factor of 1.32 and salt rejection increased from 99.0% to 99.62% for the PA-POSS. Molecular dynamics simulation was employed to study the effect of POSS on membrane polymerization, water and salt diffusion and free volume. Quantities, such as water diffusivity, water partition coefficient, fractional free volume and range of free volume size computed on the equilibrated configurations, increased on the inclusion of POSS in PA membranes. Moreover salt diffusivity was lower in PA-POSS than PA. Therefore from the simulation study, it was concluded that the introduction of POSS into PA membrane improved (a) porosity of composite membrane, (b) hydrophilicity and (c) charge on the membrane. These effects explain the increase of water flux and salt rejection in nanocomposite membranes. (c) 2014 Elsevier 13.V. All rights reserved.

作者关键词: Desalination; Polyamide membrane; POSS; Molecular dynamic simulations; Free volume theory

KeyWords Plus: FILM NANOCOMPOSITE MEMBRANES; REVERSE-OSMOSIS MEMBRANES; MOLECULAR-DYNAMICS; PERFORMANCE; WATER; SIMULATION; TRANSPORT; SIZE

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第 57 条, 共 145 条

标题: A conceptual design of low fouling and high recovery FO-MSF desalination plant

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摘要: Forward Osmosis (FO) has many applications in water and wastewater treatment and seawater desalination. In this paper, the FO was suggested for seawater pretreatment to the thermal desalination processes such as Multi Stage Flashing (MSF). The integrated FO-MSF hybrid system was designed to reduce the cost of desalination in which the brine reject from MSF was

recycled and reused as a draw solution in the FO process. A simple model was suggested here to estimate water flux and power consumption in the FO process and compared with Nanofiltration (NF) process which was previously used in seawater softening. The simulation results showed that for feed salinities between 32,000 mg/L and 50,000 mg/L the recovery rate in the NF was higher than that in the FO. It is also found that the water permeability and specific power consumption was higher in the NF than that in the FO. However, power consumption in the FO wasn't affected by the feed salinity while it increased with feed salinity in NF. Therefore, the FO process has the potential to replace the NF seawater pretreatment for thermal desalination. Crown Copyright (C) 2013 Published by Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis; Seawater softening; Forward osmosis power consumption; FO-MSF hybrid system

KeyWords Plus: INTERNAL CONCENTRATION POLARIZATION; SEAWATER DESALINATION; MEMBRANE; OSMOSIS

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第 58 条, 共 145 条

标题: Toward improvement of methods for predicting fouling of desalination membranes - The effect of permeate flux on specific fouling resistance

作者: Karabelas, AJ (Karabelas, A. J.); Sioutopoulbs, DC (Sioutopoulbs, D. C.)

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摘要: Progress is reported toward development of a realistic and theoretically sound approach, enabling reliable predictions of membrane fouling in desalination processes. A significant amount of recent data obtained with typical organic foulants, in constant-flux and constant-pressure desalination, is revisited focusing on the dependence of specific fouling resistance a on permeate-flux J . Although clarifying quantitatively this dependence requires more work, these data suggest that, for the initial phase of fouling, a depends on J to a power greater than one. Furthermore, it is argued that a is the most appropriate fouling layer (intrinsic) property to both develop constitutive-type expressions relating fouling resistances to system variables (for predicting fouling evolution throughout membrane modules), and serve as a reliable indicator of feed-fluid fouling propensity. The advantages of resistance a for both applications are discussed; for the latter case, a simple parametric analysis of main process variables (flux, foulant concentration, membrane resistance R_m) shows that there is no single-value indicator (a or other) that can represent the fouling propensity of feed-fluids under all conditions (e.g. for both high-pressure and low-pressure desalination). Moreover, specific narrow ranges of resistance a values can be identified as criteria to assess membrane fouling for various desalination conditions. (c) 2013 Elsevier B.V. All rights reserved.

作者关键词: Desalination membrane fouling; Organic foulants; Constant flux and constant pressure filtration; Correlation of fouling resistances; Effect of flux on specific resistance

KeyWords Plus: REVERSE-OSMOSIS MEMBRANES; EGG-BOX MODEL; RO MEMBRANES;

CONCENTRATION POLARIZATION; NANOFILTRATION MEMBRANES; ORGANIC FOULANTS; WATER-QUALITY; PERFORMANCE; SEAWATER; FILTRATION

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第 59 条, 共 145 条

标题: Surface modification of seawater desalination reverse osmosis membranes: Characterization studies & performance evaluation

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摘要: In this work we report surface modification of commercial reverse osmosis membranes by depositing ultrathin copolymer coatings, which could potentially enhance the biofouling resistance of RO membranes. Hydrophilic monomer hydroxyethyl methacrylate (HEMA) and a hydrophobic monomer, perfluorodecyl acrylate (PFDA) were copolymerized directly on the active layer of commercial aromatic polyamide reverse osmosis (RO) membranes using an initiated Chemical Vapor Deposition (iCVD) technique. Attenuated total reflective Fourier transform infrared spectra (ATR-FTIR) verified the successful modification of the membrane surfaces as a new FTIR adsorption band around 1730 cm⁻¹ corresponding to carbonyl groups in the copolymer film appeared after the deposition. X-ray Photoelectron spectroscopy (XPS) analysis also confirmed the presence of the copolymer film on the membrane surface by showing strong fluorine peaks emanating from the fluorinated alkyl side chains of the PFA molecules. Contact angle measurements with deionized water showed the modified membrane surfaces to be initially very hydrophobic but quickly assumed a hydrophilic character within few minutes. Atomic Force Microscopy (AFM) revealed that the deposited films were smooth and conformal as the surface topology of the underlying membrane surface remained virtually unchanged after the deposition. FESEM images of the top surface also showed that the typical ridge-and-valley structure associated with polyamide remained intact after the deposition. Short-term permeation tests using DI water and 2000 ppm NaCl water showed that the deposited copolymer coatings had negligible effect on permeate water flux and salt rejection. (c) 2013 Elsevier B.V. All rights reserved.

作者关键词: Reverse osmosis; Surface modification; Copolymer; Amphiphilic

KeyWords Plus: COMPOSITE POLYAMIDE MEMBRANES; NANOFILTRATION MEMBRANES; THIN-FILMS; PHYSICOCHEMICAL CHARACTERIZATION; INTERFACIAL POLYMERIZATION; ULTRAFILTRATION MEMBRANES; POLY(ETHYLENE OXIDE); PROTEIN ADSORPTION; FOULING RESISTANT; LAYERS

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第 60 条, 共 145 条

标题: Critical appraisal of current nanofiltration modelling strategies for seawater desalination and further insights on dielectric exclusion

作者: Oatley-Radcliffe, DL (Oatley-Radcliffe, Darren L.); Williams, SR (Williams, Steffan R.); Barrow, MS (Barrow, Matthew S.); Williams, PM (Williams, Paul M.)

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摘要: Adequate fresh water supply is an increasing global issue as water stress continues to grow in many areas of the planet Seawater desalination processes are essential to supply domestic needs as well as those of industry and agriculture. Membrane processes are now the dominant technology for desalination and will continue to grow in use for the foreseeable future. Accurate methods for the design, development and scale-up of salt water desalination plants are a vital tool for developing cost effective and sustainable plants. In this paper, the current best practice for modelling nanofiltration and reverse osmosis using the extended Nernst-Planck equation is discussed and a critical appraisal is made. The role of dielectric exclusion from nanofiltration membranes is discussed and experimentation at the membrane isoelectric point indicates that screening of this phenomenon may be occurring. The paper highlights the need for a rigorous evaluation of membrane modelling for seawater desalination, especially for multi-component and concentrated salt solutions. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Nanofiltration; Modelling; Dielectric exclusion; Non-ideal behaviour

KeyWords Plus: ATOMIC-FORCE MICROSCOPY; REVERSE-OSMOSIS MEMBRANES; PORE-SIZE DISTRIBUTION; WATER DESALINATION; ULTRAFILTRATION MEMBRANES; SALT REJECTION; PERFORMANCE; PRETREATMENT; EQUILIBRIUM; SINGLE

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第 61 条, 共 145 条

标题: ELECTROMEMBRANE PROCESSES FOR DESALINATION Preface



作者: Kabay, N (Kabay, Nalan); Bryjak, M (Bryjak, Marek)

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第 62 条, 共 145 条

标题: Application of Capacitive Deionisation in water desalination: A review

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摘要: This manuscript spans over 180 years of ideas, discoveries, inventions, breakthroughs and research in Capacitive Deionisation (CDI) and Membrane CDI (MCDI) desalination. Starting with the first discovery of the dissociation of ions in solution under an electric field by M. Faraday (1833), through the pioneering work of carbon aerogel flow through capacitors by J. Farmer's group (1996) at Lawrence Livermore National Laboratory (LLNL), to the utilization of novel graphene and carbon nanotube (CNT) materials as electrodes, the CDI and MCDI technologies are progressively making its path to the desalination industry. Through this review various deficiencies of this technology have been identified, first and far most was the need for low cost and efficient electrode materials. The review identified that a low cost and high efficiency electrode capable of processing high salinity (seawater) stream still does not exist and is considered important if the technology is to make it to the industry. Furthermore, the lack of long term reliability, operation demonstrations and experience meant that information about scaling and fouling are rather scarce. Taking a step further, no comprehensive environmental assessment such as Life Cycle Assessment (LCA) or Environmental Impact Assessment (EIA) has been performed yet. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Capacitive Deionisation; Membrane Capacitive Deionisation

KeyWords Plus: CARBON AEROGEL ELECTRODES; ION-EXCHANGE MEMBRANES; COMPOSITE FILM ELECTRODES; BRACKISH-WATER; AQUEOUS-SOLUTIONS; DEIONIZATION TECHNOLOGY; DOUBLE-LAYER; REVERSE ELECTRODIALYSIS; MESOPOROUS CARBON; ELECTROPHORETIC DEPOSITION

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第 63 条, 共 145 条

标题: TiO₂ sol-gel spray method for carbon electrode fabrication to enhance desalination efficiency of capacitive deionization

作者: Kim, C (Kim, Choonsoo); Lee, J (Lee, Jaehan); Kim, S (Kim, Seoni); Yoon, J (Yoon, Jeyong)

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摘要: Capacitive deionization (CDI), which is an ion removal technology using electro ad/desorption, has attracted much attention as an alternative to conventional desalination due to its eco-friendly and low energy consumption process. Carbon materials were actively employed as an electrode material for CDI and further treated with various methods such as acid/alkali treatments and the addition of organic/inorganic materials to enhance its desalination efficiency. The present study reports a new fabrication method for a carbon electrode to enhance CDI desalination efficiency. A highly durable TiO₂ coated carbon electrode, on which a TiO₂ coating layer was well dispersed, was fabricated with the sol-gel spray method on a carbon electrode. This TiO₂ coated electrode showed approximately two times higher desalination efficiency than the carbon electrode itself in a CDI performance test although the specific capacitance of the TiO₂ coated electrode was not significantly different from that of the carbon electrode. This enhanced desalination efficiency was attributed to the facile accessibility of water and ions from bulk solution to the electrode surface because of the high wettability of the TiO₂ coated electrode. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Capacitive deionization; TiO₂ sol-gel coating; Wettability; Desalination

KeyWords Plus: AQUEOUS-SOLUTION; NaCl SOLUTION; WATER; ELECTROSORPTION; PERFORMANCE; IMPROVEMENT; AEROGELS; POLYMER; ENERGY; CLOTH

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第 64 条, 共 145 条

标题: Desalination at overlimiting currents: State-of-the-art and perspectives

作者: Nikonenko, VV (Nikonenko, Victor V.); Kovalenko, AV (Kovalenko, Anna V.); Urtenov, MK (Urtenov, Mahamet K.); Pismenskaya, ND (Pismenskaya, Natalia D.); Han, J (Han, Jongyoon); Sstat, P (Sstat, Philippe); Pourcelly, G (Pourcelly, Gerald)

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摘要: For about 60 years, it is known that "limiting current" density does not really limit the current density in electrodialysis (ED). The use of intensive currents allows one to decrease the area of expensive ion-exchange membranes, hence to obtain more compact ED plants with lower investment costs. However, in practice overlimiting currents are applied solely in electrodeionization, and not in conventional ED devices. In literature (H. Strathmann [1]), overlimiting current density operation ED is considered as being under ongoing research and development. Where is the research today? What is the actual understanding of overlimiting mass transfer processes in membrane systems? As far as electroconvection is involved as a major mechanism of overlimiting transfer, what could bring specific knowledge and practice acquired in nano- and microfluidics into desalination? Can overlimiting ED be economically advantageous? Is there an alternative for classical ED devices applied? This review is intended to give some responses to these questions. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Ion-exchange membranes; Intensive overlimiting transfer; Concentration polarization; Current-induced convection; Water splitting; Diffusion boundary layer; Nano- and microfluidics; Mathematical modeling

KeyWords Plus: ION-EXCHANGE MEMBRANES; MASS-TRANSFER CHARACTERISTICS; CONCENTRATION POLARIZATION; WATER DISSOCIATION; BIPOLAR MEMBRANE; 2ND KIND; CAPACITIVE DEIONIZATION; TRANSPORT PHENOMENA; CONDUCTING SPACERS; PROTON-TRANSFER

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第 65 条, 共 145 条

标题: Development of a computer simulation program of feed-and-bleed ion-exchange membrane electrodialysis for saline water desalination

作者: Tanaka, Y (Tanaka, Yoshinobu)

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摘要: A computer simulation program is developed to predict the desalinating performance of a



constant voltage feed-and-bleed electrodialysis process, inputting membrane characteristics, electrodialyzer specifications and electrodialytic conditions. A salt solution is supplied to a one-stage or a two-stage process to produce drinking water. Energy consumption for ion transport and limiting cell voltage in both processes are equivalent. In order to operate the two-stage process effectively, the cell pair number in the first stage should be the same to that in the second stage. Current density in the two-stage process becomes larger than that in the one-stage process because salt concentration in the first stage in the two-stage process is increased. Thus, the cell pair number integrated in the two-stage process is reduced compared to that in the one-stage process for producing the same amount of drinking water. Water recovery of the two-stage process is larger than that in the one-stage process because the cell pair number (thus solution feed to concentrating cells in the two-stage process) is reduced compared to that in the one-stage process. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Ion-exchange membrane; Feed-and-bleed electrodialysis; Saline water desalination; Drinking water production; Computer simulation; Limiting current density

KeyWords Plus: MASS-TRANSPORT; SEAWATER; PLANT

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第 66 条, 共 145 条

标题: Small/medium nuclear reactors for potential desalination applications : Mini review

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摘要: Small/medium nuclear reactors (SMRs) are a promising alternative for powering large scale desalination plants. The modern generations of these systems manifest cost effectiveness and built-in safety features. The compatibility with geological and topological challenges is an added advantage. Moreover, funding opportunities and packages could be easily arranged for small/medium nuclear reactors (SMR). This mini review article provides the latest technical features of SMR nuclear plants with emphasis on pressurized light water reactors (PWR), boiling water reactors (BWR), heavy water reactors (HWR), gas cooled reactors (GCR), and liquid metal fast breeder reactors (LMFBR). Preliminary cost indicators for typical units were investigated as a part of joint effort to develop a cost database for these types of reactors. Security and safety features of small/medium reactors are identified and reviewed. This paper identifies and briefly discusses the various types of small/medium nuclear reactors to provide a preliminary evaluation and consideration of using this type of reactor in potential seawater desalination applications.

作者关键词: Desalination; Small/Medium Nuclear Reactors; Technical Features

KeyWords Plus: DESIGN-FEATURES; PASSIVE SAFETY; POWER-PLANTS; HTR-PM; SYSTEMS; TEMPERATURE; HTTR

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第 67 条, 共 145 条

标题: Valorisation of Ca and Mg by-products from mining and seawater desalination brines for water treatment applications

作者: Casas, S (Casas, Sandra); Aladjem, C (Aladjem, Carlos); Larrotcha, E (Larrotcha, Enric); Gibert, O (Gibert, Oriol); Valderrama, C (Valderrama, Cesar); Cortina, JL (Luis Cortina, Jose)

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摘要: BACKGROUND Brines from the drainage of potash mine tailings and from seawater reverse osmosis (SWRO) desalination were previously evaluated as sources of NaCl for the chlor-alkali industry. Valorisation of NaCl as raw material is required to meet the membrane electrolysis specifications of NaCl saturation and control of interferences (Ca, Mg and sulphate). Brines concentration in NaCl was previously achieved for SWRO brines using electrodialysis (ED). In this work, valorisation of Ca and Mg by-products via selective recovery was evaluated.

RESULTS Recovery of Ca(II) and Mg(II) using chemical precipitation with Na₂CO₃ and NaOH was evaluated at 25 degrees C and 65 degrees C using one single reagent and mixtures of reagents. The excess of reactants needed to achieve the maximum removal efficiency ranged from 0.35 to 14 g L⁻¹ Na₂CO₃ and 0.85 g L⁻¹ NaOH. Selective concentration of SWRO brines by ED benefited the purification, as it slightly diluted the antiscalants. The increase of temperatures also benefited their removal process.

CONCLUSION Total chemical analysis of Ca and Mg by-products showed the presence of mixed salts of Ca and Mg when Na₂CO₃ was used and more pure precipitates of Mg when NaOH was used. In both cases, small amounts of minor traces initially present in the brines were found. (c) 2014 Society of Chemical Industry.

作者关键词: calcium; magnesium; valorisation brines; seawater; potash tailings

KeyWords Plus: REVERSE-OSMOSIS CONCENTRATE; SEAGRASS POSIDONIA-OCEANICA; CALCIUM-CARBONATE; CHLORALKALI INDUSTRY; PRECIPITATION; ELECTRODIALYSIS; PLANT; RECOVERY; SULFATE; IMPACT

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第 68 条, 共 145 条

标题: Studying the impact of RO membrane surface functional groups on alginate fouling in seawater desalination

作者: Wu, JJ (Wu, Jinjian); Contreras, AE (Contreras, Alison E.); Li, QL (Li, Qilin)

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摘要: Despite extensive studies on the relationship between membrane surface properties and fouling, the roles of specific surface functional groups in RO membrane fouling under different solution conditions are still poorly understood. This research aims to elucidate how specific surface functional groups affect RO membrane fouling by alginate in solution conditions relevant to seawater desalination. Common RO membrane surface functionalities are represented by self-assembled mono-layers with -COOH, -NH₂, -CONH₂ and -OH ending groups. Alginate adsorption and removal was studied under relevant solution conditions using quartz crystal microbalance with dissipation monitoring (QCM-D). The results show that ionic composition has great impacts on alginate-alginate interaction, which is more important than membrane surface chemistry in determining alginate adsorption equilibrium at the high ionic strength of seawater. The initial adsorption rate is highly sensitive to surface chemistry. The -NH₂ group has strong affinity for alginate, yet the -COOH group exhibits the highest adsorption rate in simulated seawater. The reversibility of the adsorbed layer was influenced by both alginate-surface interaction and the structure of the layer. The large alginate aggregates formed in the presence of Ca²⁺ result in loosely packed and less viscous adsorbed layer on the surface, which is easier to remove by surfactant cleaning. (C) 2014 Elsevier B.V. All rights reserved

作者关键词: RO membrane; Seawater desalination; Alginate; Fouling; Surface functionalities; QCM-D

KeyWords Plus: REVERSE-OSMOSIS MEMBRANES; POLYAMIDE NANOFILTRATION MEMBRANES; DISSOLVED ORGANIC-MATTER; SOLUTION CHEMISTRY; QCM-D; ADSORPTION; PROTEIN; DEPOSITION; MECHANISM

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第 69 条, 共 145 条

标题: A predictive model for the assessment of the temperature polarization effect in direct contact membrane distillation desalination of high salinity feed

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摘要: Temperature polarization is one of the major sources responsible for flux drop in membrane distillation systems due to the reduction in the driving force across the membrane. The present study offers a predictive model developed for the estimation of the temperature polarization coefficient across the membrane taking into consideration the simultaneous heat and mass transfer phenomena. The uniqueness of the developed model is its ability to predict the intermediate temperatures (temperatures along the flow path of the membrane sheet) which can be used to estimate the local flux and local temperature polarization coefficients as opposed to the methods used by others which estimate the TPC, using the average bulk temperatures, resulting in a tool that enables the estimation of the temperature polarization coefficient (TPC) at different operating conditions. It was found that higher feed temperatures result in higher temperature polarization effect and hence a lower TPC. It was also observed that TPC increases with feed flow rate. The highest TPC value of 0.82 was achieved for a flow rate of 3 L/min and a feed-permeate temperature system of 60-20. The use of flow promoters further enhances the performance of the DCMD system and was reflected on increasing the TPC values (0.66 for a spacer filled channel compared to 0.47 for a spacer free operation) at 1.5 L/min flow condition with 70-30 temperature system. The axially integrated local flux values predicted by the model were in good agreement with the experimentally measured fluxes. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Membrane distillation desalination; Temperature polarization; High salinity feed; Membrane distillation modeling; Simultaneous heat and mass transfer; Hydrophobic membrane

KeyWords Plus: MASS-TRANSFER; HEAT; TRANSPORT; MODULES; ENERGY; DROP

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第 70 条, 共 145 条

标题: A hybrid solar desalination system of air humidification, dehumidification and water flashing evaporation: Part II. Experimental investigation

作者: Kabeel, AE (Kabeel, A. E.); El-Said, EMS (El-Said, Emad M. S.)

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摘要: This paper describes laboratory experiments with a hybrid solar desalination system consisting of a humidification-dehumidification unit and single stage flashing evaporation unit configured by a (Al₂O₃/H₂O) nano-fluid solar water heater under the climatological conditions of Tanta City, Egypt. The laboratory work has been carried out in actual thermal environment in August 2013. The validation has an emphasis on the main parameters with impact on the water production capacity. These are the solar radiation, feed water mass flow rate, inlet cooling water temperature, mass flow rate of cooling water and nano-particle volume fraction. The main conclusion is that good agreement is obtained between simulated and measured variations of water production and

performance ratio values for variations of these parameters. The performance ratio of SSF unit is varied between 0.32 and 1.4 and flashing ranges between 3 and 9 degrees C. The maximum productivity of the system reached 41.8 kg/day according to test and operation conditions. The solar water heater efficiency is affected by the nano-particle volume fraction. The humidifier efficiency is affected by increasing water mass flow rate more than the increasing air mass flow rate and reaches about 98%. Finally, collector's efficiencies are about 55% and 56% for solar water heater and solar air heater respectively. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Humidification-dehumidification; Flashing desalination; Hybrid; Nano-fluid

KeyWords Plus: UNIT; PERFORMANCE

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第 71 条, 共 145 条

标题: Effects of number of cell pairs on the performance of microbial desalination cells

作者: Ge, Z (Ge, Zheng); Dosoretz, CG (Dosoretz, Carlos G.); He, Z (He, Zhen)

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摘要: Microbial desalination cells (MDCs) are being developed as a low-energy desalination technology. Most MDCs in the previous studies contained one cell pair (CP, a pair of cation and anion exchange membranes) and very few had multiple CPs (<5). The effect of the number of CPs on the MDC performance has not been well understood. Herein we examined the current generation, desalination, and water recovery in a bench-scale MDC containing up to 10 CPs, fed with salt water containing either 35 or 5 g L⁻¹ NaCl. It was found that current generation decreased with more CPs, while the charge transfer efficiency increased; the highest value of 450% was achieved with 10 CPs when treating 35 g L⁻¹, which also yielded the highest salt removal rate of 90.8 +/- 83 mg h⁻¹. Applying an external voltage of 0.8 V greatly increased current generation and salt removal rate, and decreased the desalination time from 12 to 4 h. Water loss tended to be more serious and water recovery became lower with more CPs and/or lower salinity of the salt water. The results suggest that both desalination performance and water recovery should be evaluated when developing the MDC technology. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Microbial desalination cells; Cell pairs; Microbial fuel cells; Water recovery; Wastewater treatment

KeyWords Plus: CHEMICAL-PRODUCTION CELL; FUEL-CELLS; ELECTROLYSIS DESALINATION; SEAWATER DESALINATION; WATER; TECHNOLOGY; ENERGY

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第 72 条, 共 145 条

标题: Electrodialysis heterogeneous anion exchange membrane modified by PANI/MWCNT composite nanoparticles: Preparation, characterization and ionic transport property in desalination

作者: Hosseini, SM (Hosseini, S. M.); Jeddi, F (Jeddi, F.); Nemati, M (Nemati, M.); Madaeni, SS (Madaeni, S. S.); Moghadassi, AR (Moghadassi, A. R.)

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摘要: In this research polyaniline (PANI)-co-multi walled carbon nanotubes (MWCNTs)/polyvinylchloride (PVC) nano-composite heterogeneous anion exchange membranes were prepared by solution casting technique. The effect of PANI/MWCNT nanoparticle concentration on membrane electrochemical properties was studied. Membrane water content was decreased by the increase of nanoparticle concentration. Ion exchange capacity (IEC) was improved initially by the increase of nanoparticle concentration up to 2 wt.% and then showed decreasing trend by more additive content from 2 to 4 wt.%. IEC was enhanced again with more increase in additive concentration from 4 to 16 wt.%. Fixed ionic concentration (FIC) also showed increasing trend by an increase in nanoparticle content. Membrane potential, transport number and selectivity were improved in NaCl and Na₂SO₄ ionic solutions by the increase of PANI/MWCNT nanoparticles. Also membranes exhibited lower selectivity and transport number for bivalent ions compared to monovalent type. Membrane permeability and flux were enhanced initially in both monovalent and bivalent ionic solutions by an increase in additive concentration up to 1 wt.% and then showed decreasing trends by more additive content from 1 to 16 wt.%. Prepared membranes showed lower permeability and flux for bivalent ions compared to monovalent type. Modified membranes showed better performance in comparison with pristine membrane. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Anion exchange membrane; Mixed matrix; PANI-co-MWCNT nanoparticles; Electrochemical characterization/desalination; Mono/bivalent ionic transport

KeyWords Plus: MULTIWALLED CARBON NANOTUBES; FUEL-CELL APPLICATIONS; METAL ALKOXIDE METHODS; ELECTROCHEMICAL CHARACTERIZATION; PERMEATION CHARACTERISTICS; POLYANILINE NANOPARTICLES; ELECTROMEMBRANE PROCESSES; BIVALENT-CATIONS; WATER; PERMSELECTIVITY

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第 73 条, 共 145 条

标题: Nanodiamond immobilized membranes for enhanced desalination via membrane distillation

作者: Bhadra, M (Bhadra, Madhuleena); Roy, S (Roy, Sagar); Mitra, S (Mitra, Somenath)

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摘要: Recent years have witnessed the emergence of detonation nanodiamonds (DNDs) as a new member of the nanocarbon family. This paper reports the immobilization of DNDs within a hydrophobic membrane for desalination applications. A dispersion of DNDs in polyvinylidene fluoride polymer was injected through a hydrophobic membrane, which incorporated the DNDs within the membrane. Embedding only a minimal quantity of (approximately 2%) the nanocarbon favorably altered the water vapor-membrane interactions to enhance water vapor permeability while preventing liquid penetration into the membrane pores thereby enhancing water vapor flux. Overall, desalination was consistently better with DND immobilized membrane than with conventional polypropylene, with flux enhancement as high as 118% in the sweep gas membrane distillation mode. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Detonation nanodiamonds (DNDs); Sweep gas membrane distillation; Flux; Detonation nanodiamond immobilized membrane (DNDIM); Hydrophobic

KeyWords Plus: DELIVERY; DETONATION; EXTRACTION; CHEMISTRY; CARRIERS

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第 74 条, 共 145 条

标题: Humidification compression desalination

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摘要: In this communication, a new Humidification De-Humidification process desalination technology is identified which has some advantages (such as: high energy performance, high recovery flow rate, energy recovery and so on) in comparison with other similar methods; this technology is named "Humidification Compression". This method is simulated by a commercial process simulation software and the results are compared with two conventional methods. It is seen that, gain output ratio (GOR) for proposed method is higher than conventional methods; also capital cost per product for proposed method is lower than two others. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Humidification-dehumidification; HDH; Desalination; Humidification-compression

KeyWords Plus: DEHUMIDIFICATION DESALINATION; SEAWATER DESALINATION; WATER DESALINATION; SOLAR DESALINATION; SYSTEM; ENERGY; AIR; EXTRACTION; DRIVEN

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第 75 条, 共 145 条

标题: Ozonation of phosphonate antiscalants used for reverse osmosis desalination: Parameter effects on the extent of oxidation

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摘要: The recovery of usable product water in brackish water reverse osmosis (RO) desalination is limited by the potential for membrane scaling. This limited recovery results in high costs of disposal of the concentrate (waste) stream. Concentrate treatment to improve recovery is vital, and treatment that includes antiscalant oxidation prior to precipitation and solid/liquid separation might allow increased precipitation through antiscalant deactivation. Ozone and hydrogen peroxide were used to oxidize phosphonate-type antiscalants under varying conditions of water composition, pH, ozone dose, and antiscalant type; orthophosphate (P) is an oxidation product and was used to measure the extent of oxidation. Antiscalant oxidation increases with ozone dose (1-10 mg/L O₃) and in the presence of calcium, from 1 mg/L P to 7 mg/L P for an antiscalant concentration of 27 mg/L as P. The addition of hydrogen peroxide causes only minor increases in antiscalant oxidation. The extent of oxidation varies with pH as a function of metal-ligand speciation, with the doubly-protonated metal-ligand species dominating the reactivity of the antiscalant. In the presence of calcium, the primary oxidation pathway for phosphonate antiscalants is through direct reaction with ozone (70-80% of measured P). In the absence of calcium, ozone and hydroxyl radicals appear to contribute relatively equally to oxidation. These results suggest phosphonate antiscalants can be oxidized with relatively low ozone doses, thereby deactivating the chelating behavior of the antiscalant and allowing increased precipitation of scaling salts such as calcium and magnesium. Published by Elsevier B.V.

作者关键词: Phosphonate; Antiscalant; Ozone; Hydroxyl radical; Reverse osmosis desalination; Calcium complexation

KeyWords Plus: EARTH-METAL-IONS; ETHYLENEDIAMINETETRAACETIC ACID EDTA; OZONE DECOMPOSITION; AQUEOUS-SOLUTION; BRACKISH-WATER; WASTE-WATER; COMPLEXES; PH; RO; NITRILOTRIACETATE

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第 76 条, 共 145 条

标题: Desalination of water with high conductivity using membrane-free electrodeionization

作者: Shen, XL (Shen, Xiaolan); Li, TJ (Li, Tianjun); Jiang, XP (Jiang, Xiaping); Chen, XM (Chen, Xueming)

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摘要: Our previous work has shown that membrane-free electrodeionization (MFEDI) is a promising process for high purity water (HPW) production. However, this technique was only suitable to feed water with low conductivity, usually below 20 μ S/cm. To extend the applicable range, type I strong base resin was used together with type II strong base resin in this work, due to the high capacity and easy regeneration of type II strong base resin and the excellent purification performance of type I strong base resin. It was demonstrated that although the conductivity of the feed water increased to 50 μ S/cm, effective purification was still achieved, with effluent conductivity being 0.056-0.066 μ S/cm only. The average conductivity of the concentrate collected during regeneration was over 380 μ S/cm, indicating high regenerating efficiency. The water recovery reached 86% and the power consumption was 1.5 kW h/m³ water. In addition, repetitive experimental results showed that the MFEDI system could work stably. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Membrane-free electrodeionization; Purification; High purity water; Electrical regeneration; Resins

KeyWords Plus: HIGH-PURITY WATER; ION-EXCHANGE; WASTE-WATER; BIPOLAR MEMBRANES; CURRENT-DENSITY; REMOVAL; RECOVERY; DISSOCIATION; PERFORMANCE; ELECTRODES

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第 77 条, 共 145 条

标题: Hybrid thermal-thermal desalination structures

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来源出版物: DESALINATION AND WATER TREATMENT 卷: 52 期: 16-18 页: 2905-2919 DOI: 10.1080/19443994.2013.803769 出版年: MAY 12 2014

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摘要: Opportunities exist to improve industrial-scale thermal desalination system performance and reliability through novel process structures. Herein, hybrid thermal-thermal desalination structure concepts that combine the merits of MSF, MED, or MED-TVC are proposed. The first is a system which transitions from forward-feed MED effects to parallel-cross MED effects (FF-PC-MED) and could be combined with TVC (FF-PC-MED-TVC). The second is a system which transitions from MSF stages to forward-feed MED effects (MSF-MED) and employs a vapor routing for MSF which typically not used. Finally, the last system uses parallel steam supplies to power MSF stages and MED-TVC effects configured in series (MSF-MED-TVC). Through the simulation of their performance, it is found that these concepts can exhibit higher performance ratio and/or lower specific heat transfer surface area as compared to standard thermal desalination configurations for fixed operating conditions. While these results indicate that the hybrid thermal-thermal desalination structures are promising alternatives to standard thermal desalination configurations, detailed modeling, and numerical optimization of the concepts is necessary in future work.

作者关键词: Thermal desalination; Optimal design; MSF; MED; Structural optimization

KeyWords Plus: EFFECT EVAPORATION; SYSTEM; MSF; OPTIMIZATION; PERFORMANCE; DESIGN; PLANT; SIMULATION; SEAWATER; ENERGY

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第 78 条, 共 145 条

标题: Performance evaluation of five years operation experience of WMZM RO desalination plant

作者: Yassin, AY (Yassin, Aziz Y.); Ghandour, I (Ghandour, Ibrahim)

来源出版物: DESALINATION AND WATER TREATMENT 卷: 52 期: 16-18 页: 2939-2955 DOI: 10.1080/19443994.2013.800293 出版年: MAY 12 2014

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摘要: The main two supply of potable water to Amman city are Zai water treatment plant (represent 60%) and Wadi Ma'in, Zara, and Mujib (WMZM) water treatment plant (represent 30%). WMZM receives raw water from three main sources originally flowing to the Dead Sea, now collected and conveyed to a raw water reservoir at the treatment plant to produce about 110,000 m³/day. WMZM was commissioned in 2006 and still operating at the original design capacity. WMZM water treatment plant and its conveyance system are presently operated by Jordan Water Company-Miyahuna. This paper covers the plant description, original design parameters, and RO membrane performance after more than five years of operation.

作者关键词: Water cost; Brackish water RO desalination; Pumping stations; Remineralization; WMZM water treatment plant; Pretreatment

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第 79 条, 共 145 条

标题: Energy-Optimal Control of RO Desalination

作者: Gao, L (Gao, Larry); Rahardianto, A (Rahardianto, Anditya); Gu, H (Gu, Han); Christofides, PD (Christofides, Panagiotis D.); Cohen, Y (Cohen, Yoram)

来源出版物: INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH 卷: 53 期: 18 页: 7409-7420 DOI: 10.1021/ie402304d 出版年: MAY 7 2014

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摘要: A novel model-based control system for the operation of a spiral-wound RO membrane desalination system was developed with a focus on maintaining energy-optimal operation. The control scheme utilized an operational model for spiral-wound RO desalting with a supervisory controller providing real-time updates of membrane permeability and the appropriate feed pressure set-points for maintaining the target permeate productivity at the lowest feasible specific energy consumption. System RO feed pressure and flow rates were controlled by a lower-level RO controller through adjustment of the RO high pressure feed pump, variable frequency drive, and RO concentrate valve. Seawater desalination tests with an RO plant, capable of permeate productivity up to 18 000 gallons/day, demonstrated effective self-adaptive energy-optimal operation, subject to

feed salinity fluctuations, constraints imposed by the system's physical limitations (i.e., minimum and maximum feasible operational pressures and flow rates), and the thermodynamic restriction for cross-flow RO operation.

KeyWords Plus: REVERSE-OSMOSIS DESALINATION; SPIRAL-WOUND MODULES; MODEL-PREDICTIVE CONTROL; WATER DESALINATION; COST OPTIMIZATION; SYSTEMS-DESIGN; RECOVERY; PERFORMANCE; CONSUMPTION; PLANTS

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第 80 条, 共 145 条

标题: Process intensification using energy-free highly enriched air: Application to seawater desalination plants

作者: Manenti, F (Manenti, Flavio); Pirola, C (Pirola, Carlo)

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摘要: A new process layout to intensify and make more sustainable chemical processes that use open-loop cooling/heating systems is broached. This new process demonstrates the possibility to recover a stream of highly enriched air without any additional operational cost, but simply exploiting differently the existing energy sources. Enriched air can therefore be used to reduce the variable costs of the intensified plants as well as to reduce the volume of process facilities dedicated to steam generation or to directly increase the net operating margin as additional product (industrial or medical gas). General and dedicated process simulations combined with experimental evidence demonstrate the feasibility and the effectiveness of the proposed intensification. The application to the multi-effect distillation technology for seawater desalination is described. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Enriched air; Energy-free; Process intensification; Sustainable desalination

KeyWords Plus: SUPPLY CHAINS; OPTIMIZATION; WATER

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第 81 条, 共 145 条

标题: Desalination by capacitive deionization process using nitric acid-modified activated carbon as the electrodes

作者: Huang, W (Huang, Wei); Zhang, YM (Zhang, Yimin); Bao, SX (Bao, Shenxu); Cruz, R (Cruz, Roel); Song, SX (Song, Shaoxian)

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摘要: In this work an activated carbon modified by nitric acid has been used as the electrodes in capacitive deionization (CDI) process for the desalination of an aqueous electrolytic solution. The experimental results have shown that the modification could greatly increase the salt removal from the solution. The desalination efficiency was increased about 15%, and the desalination kinetics was improved in the form of rate constant from 0.09208 to 0.09922. It has been found that the modification greatly increased the oxygen-containing functional groups on the surfaces of activated carbon, leading to the increases of the capacitance and the reduction of the charging resistance, which might be attributed to the improvement of the desalination. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Capacitive deionization; Activated carbon electrode; Nitric acid modification; Desalination

KeyWords Plus: AQUEOUS-SOLUTIONS; NANOTUBES; WATER; DEIONISATION; IMPROVEMENT; EFFICIENCY; BINDER; CLOTH

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第 82 条, 共 145 条

标题: RO-PRO desalination: An integrated low-energy approach to seawater desalination

作者: Prante, JL (Prante, Jeri L.); Ruskowitz, JA (Ruskowitz, Jeffrey A.); Childress, AE (Childress, Amy E.); Achilli, A (Achilli, Andrea)

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摘要: Although reverse osmosis (RO) is currently the most energy efficient desalination technology, it still requires a great deal of energy to create the high pressures necessary to desalinate seawater. An opposite process of RO, called pressure retarded osmosis (PRO), utilizes the salinity gradient between a relatively fresh impaired water source and seawater to produce pressure and hence, energy. In this paper, PRO is evaluated in conjunction with RO, in a system called RO-PRO desalination, to reduce the energy requirement of seawater RO desalination. RO-PRO specific energy consumption was modeled using RO conditions at the thermodynamic restriction and a newly developed module-based PRO model. Using a well-characterized cellulose triacetate (CTA) membrane, the minimum net specific energy consumption of the system was found to be approximately 40% lower than state-of-the-art seawater RO. A sensitivity analysis was performed to determine the effects of membrane characteristics on the specific energy production of the PRO process in the RO-PRO system. The sensitivity analysis showed that the minimum specific energy consumption using virtual membranes is approximately 1.0 kW h per m³ of RO permeate at 50% RO recovery and that a maximum power density of approximately 10 W/m² could be achieved. Published by Elsevier Ltd.

作者关键词: Pressure retarded osmosis; Reverse osmosis; Salinity gradient; Desalination

KeyWords Plus: PRESSURE-RETARDED OSMOSIS; INTERNAL CONCENTRATION POLARIZATION; SPACER GEOMETRICAL CHARACTERISTICS; SUSTAINABLE POWER-GENERATION; NATURAL SALINITY GRADIENTS; REVERSE-OSMOSIS; FILLED CHANNELS; MASS-TRANSFER; WATER; RECOVERY

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第 83 条, 共 145 条

标题: Study of the performances of different configurations of seawater desalination with a solar membrane distillation

作者: Ben Abdallah, S (Ben Abdallah, Samira); Frikha, N (Frikha, Nader); Gabsi, S (Gabsi, Slimane)

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摘要: The object of this study is the comparison between two configurations of hollow fiber module for seawater vacuum membrane distillation. The first one is a module membrane in series with a solar compound parabolic collector (CPC). The second configuration is a hollow fiber module integrated in a cylindrical absorber of CPC. A model describing the operation of a hollow fiber module, with and without recycling, will be developed. This model determines the instantaneous variation of the temperature of each element of the installation with the distillate flow variation. A comparison of each module production is carried out. A mathematical model describing the performances of different configurations for membrane hollow fibers shows that: (1) The permeate flow for the integrated configuration is always higher than that of not integrated. It can be multiplied by two and even more. (2) The recycling of concentrate makes it possible to improve the production. This is due to the high level temperature at the exit of the module. (3) The energy recovery from the distillate will make it possible to increase the production and to reduce the plant size.

作者关键词: Desalination; Modelling; Configuration; Hollow fiber module; Integrated

KeyWords Plus: WATER DESALINATION; SIMULATION; SYSTEMS

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第 84 条, 共 145 条

标题: Water desalination using R141b gas hydrate formation

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摘要: In this paper, water desalination was performed by R141b hydrate formation in systems containing refrigerant and a brine aqueous solution to determine of R141b hydrate growth rate and efficiency of process. Kinetic experiments were conducted with initial temperatures of 0, 2, and 4 degrees C with saline concentrations of 1, 2, 4, and 6% weight of NaCl and also with the molarity 0.304mol/L of NaCl, KCl, CaCl₂, and MgCl₂ aqueous solutions. The results show that R141b hydrate formation rate depends on the saline concentration, initial temperature, and salt type. Moreover, the results of water desalination based on R141b hydrate formation indicate that the removal efficiency depends on the ionic size and electrical charge. Each dissolved mineral is removed in following order: K⁺¹>Na⁺¹>CA⁽⁺²⁾>Mg⁺² with 79% of efficiency.

作者关键词: R141b; Gas hydrate; Growth rate; Desalination

KeyWords Plus: SEA-WATER; GROWTH; ICE



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第 85 条, 共 145 条

标题: Design of a parabolic solar collector system for seawater desalination in Gaza

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来源出版物: DESALINATION AND WATER TREATMENT 卷: 52 期: 13-15 页: 2502-2511 DOI: 10.1080/19443994.2013.797546 出版年: APR 16 2014

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摘要: This paper presents the design of a parabolic-trough solar collector system for seawater desalination in Gaza, collector-aperture and rim-angle optimization together with the receiver-diameter selection are presented. A comparison of concentrating collectors against conventional flat-plate collectors is presented. It is shown that for large-scale water production the parabolic-trough collectors are more efficient than the flat plate ones. The analysis considers visible radiation transfer, IR radiation exchange, conductive and convective losses, and energy transfer to a fluid flowing through the collector tube. The collector may have a tilted north-south axis, an east-west axis or it may fully track the sun and geometric parameters associated with tracking the sun are considered.

作者关键词: Solar desalination; Parabolic-trough collectors; Solar radiation

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第 86 条, 共 145 条

标题: Seawater desalination in China: Retrospect and prospect

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摘要: China has been and will be facing water shortage issues due to the disparity between water supply and demand, especially within Chinese coastal areas. Seawater desalination can increase the total water supply and is an important component in addressing water shortage issues in China. With the development of the last six decades, seawater desalination technologies and applications have been advanced remarkably. Total seawater desalination capacity has increased from 10,000 m³/d in 2000 to approximately 660,000 m³/d in 2011. Seawater desalination has been primarily used in power generation, steel manufacturing, petrochemical industry, and public water supply. 75 desalination plants have been constructed in China, among which 16 desalination plants have capacities of 10,000 m³/d or more. Nine desalination plants are under construction, which will provide capacity of 408,000 m³/d. Most of the desalination applications (99.5% of the desalination capacity) are located within five provinces: Liaoning, Shandong, Hebei, Tianjin, and Zhejiang. The dominant desalination technologies are reverse osmosis (RO) and multi-effect distillation (MED). 80.3% of desalination plants employ RO and 14.5% of desalination plants adopt MED. The desalination capacities of RO and MED are 348,000 and 232,000 m³/d, respectively. Facing the challenge of water shortage, seawater desalination is of necessity in China and is increasingly an inevitable national strategy to address the issue. China is one of the most promising market for seawater desalination. However, international desalination companies will still dominate seawater desalination market for the foreseeable future. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Seawater desalination; RO; MED; Economic analysis; Prospect



KeyWords Plus: PLANT; RO; PURIFICATION; MEMBRANE

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第 87 条, 共 145 条

标题: Where does solar-aided seawater desalination make sense? A method for identifying sustainable sites

作者: Grubert, EA (Grubert, Emily A.); Stillwell, AS (Stillwell, Ashlynn S.); Webber, ME (Webber, Michael E.)

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摘要: Global water planners are increasingly considering seawater desalination as an alternative to traditional freshwater supplies. Since desalination is both expensive and energy intensive, taking advantage of favorable natural and societal conditions while siting desalination facilities can provide significant financial and environmental returns. Currently, policy makers do not use a location-specific integrated analytical framework to determine where natural and societal conditions are conducive to desalination. This analysis seeks to fill that gap by demonstrating a multi-criteria, geographically-resolved methodology for identifying suitable regions for desalination infrastructure where 1) available renewable resources can offset part of the fossil energy load; 2) feedwater characteristics reduce the total energy needed for desalination; and 3) human populations have capacity and willingness to pay for desalinated water. This work demonstrates the method with a quantitative global analysis that identifies favorable sites for solar-aided seawater reverse osmosis desalination (SWRO) based on specific target criteria. Location-based data about natural conditions (solar insolation, ocean salinity, and ocean temperature) are integrated and mapped with social indicators (water stress, prevailing water prices, and population) to identify regions where solar-aided SWRO has the highest potential. This work concludes that water-stressed tropical and subtropical cities show the highest potential for economically sustainable solar-aided SWRO. (C) 2014 The Authors. Published by Elsevier B.V.

作者关键词: Desalination; Geographic information systems multicriteria decision analysis (GIS-MCDA); Site selection; Energy intensity; Sustainability; Renewable energy



KeyWords Plus: WATER-RESOURCES; CLIMATE-CHANGE; TECHNOLOGIES; SELECTION; GROWTH; SYSTEM

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第 88 条, 共 145 条

标题: Forward osmosis pretreatment of seawater to thermal desalination: High temperature FO-MSF/MED hybrid system

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摘要: Forward osmosis (FO) seawater pretreatment was proposed for the removal of scale ions from seawater to the thermal desalination plant. In the current study, previously developed models were applied to estimate the effectiveness of FO pretreatment in the removal of divalent ions from feed solution to MSF/MED at elevated temperatures. The simulation results showed that the water and salt flux across the FO membrane increased with increasing the seawater salinity. However, for given seawater salinity, the water and salt flux across the FO membrane decreased with increasing the FO recovery rate. It was found that the concentration of Ca^{2+} , Mg^{2+} and SO_4^{2-} ions increased with increasing the operating temperature in the thermal plant but decreased with increasing the recovery rate of the FO pretreatment. Additionally, an FO pretreatment-MED Scale Index (FMSI) was developed to determine the required FO recovery rate and avoids scale problems at different MED operating temperatures. Initially, Ryznar Scale Index (RSI) of the feed solution was calculated for different MED operating temperatures. Then, RSI was plotted against the FO recovery rates and the desirable FO recovery rate was determined from the plot based on the operating temperature of the MED plant. The scale index was also applied to determine the required mixing ratio of NF permeate-makeup water in the NF-MED desalination hybrid system. The application of the FO pretreatment-MED Scale Index has the potential to reduce the required time and resources to determine the desirable FO/NF pretreatment ratio of feed water to the MED plant. Crown Copyright (C) 2014 Published by Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis; Seawater softening; NF pretreatment; High TBT thermal desalination; FO pretreatment

KeyWords Plus: INTERNAL CONCENTRATION POLARIZATION; MEMBRANE; NANOFILTRATION

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第 89 条, 共 145 条

标题: Energy recovery consideration in brackish water desalination

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来源出版物: DESALINATION 卷: 339 页: 34-39 DOI: 10.1016/j.desal.2014.02.008 出版年: APR 15 2014



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摘要: In brackish water RO desalination, the low feed water TDS and relatively low brine flow make the use of energy recovery devices ambiguous. The decision to implement energy recovery device must always be based on the Life Cycle Cost estimation of the plant. Design considerations concerning the energy recovery device selection and field experience in Lahat brackish water desalination plant (40,000 m³/day) are presented in this article. Two types of energy recovery device are generally considered in the brackish water RO desalination, turbocharger and isobaric energy recovery devices. Taking into consideration the simplicity of the turbocharger, it was selected for the 1st phase of the Lahat brackish water desalination plant with the design recovery range of 80%-88%. The turbocharger was designed for max recovery and external bypass line was added to operate the plant at low recoveries. For such wide recovery range the turbocharger entire efficiency range of 30%-40% was achieved. Due to the limitation of the turbocharger to operate efficiently at the broad recovery range and Life Cycle Cost benefits of isobaric energy recovery device, the isobaric energy recovery device was selected for the 2nd phase of the Lahat brackish water desalination plant. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Brackish water desalination; Energy recovery device; Reverse osmosis; Life Cycle Cost

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第 90 条, 共 145 条

标题: An investigation of low biofouling copper-charged membranes for desalination

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摘要: The goal of this project was to develop low-biofouling membranes through the functionalization of cellulose acetate (CA) membranes with metal chelating ligands charged with biocidal metal ions, i.e. copper ions. To this end, glycidyl methacrylate (GMA),(1) an epoxy, was used to attach a chelating agent, iminodiacetic acid (IDA),(2) to facilitate the charging of copper to the membrane surface. CA and copper charged membranes were characterized chemically and structurally. The permeation experiments were conducted with DI water and then subjected to protein rejection measurements. The permeation of the copper-charged membranes was initially lower than the cellulose acetate membrane during the filtration of DI water. The membranes were then subjected to bovine serum albumin (BSA) and lipase filtration. The copper charged membrane showed higher permeation values of both proteins as compared to CA membranes. This resulted from an increased resistance from the IDA and copper on the surface during DI water filtration, and later, from reduced fouling from both proteins. The rejection of BSA and lipase was the same for both the copper charged and CA membranes. Therefore, the modified membranes have a potential to be used as low-biofouling membranes in the future. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Biofouling; Cellulose acetate; Nanofiltration; Surface functionalization; Copper

KeyWords Plus: REVERSE-OSMOSIS MEMBRANES; NATURAL ORGANIC-MATTER; ULTRAFILTRATION MEMBRANES; POLYPROPYLENE FEEDSPACERS; WATER-SYSTEMS; POLYMER; PREVENTION; IONS; LEGIONELLA; SEPARATION

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第 91 条, 共 145 条

标题: Performance simulation of a multi-VMD desalination process including the recycle flow

作者: Shim, SM (Shim, S. M.); Lee, JG (Lee, J. G.); Kim, WS (Kim, W. S.)

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摘要: In this paper, a performance evaluation of a multi-vacuum membrane distillation (VMD) module was conducted using a one-dimensional model. The mathematical model consisted of momentum, mass and energy balance equation using the water permeate flux model and heat flux model. The simulation results were in good agreement with the experimental results from previous literature. The validated VMD model was implemented into Aspen Plus. Then, a multi-VMD module with one-through flow was simulated. As a result, in the high velocity region, the hydraulic pressure was used as the constraint to determine the number of membrane modules. In the low velocity region, the number of membrane module was determined based on the feed temperature. To improve water recovery and thermal efficiency of the multi-VMD module, the recycle flow was considered and the waste heat included in the discharge brine was recovered. As a result, it was possible to achieve water recovery over 40%. In addition, as the recycle flow ratio increased, thermal efficiency also improved since heat duty and thermal consumption per unit water production decreased. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Seawater desalination; Membrane; Distillation; Hollow fiber; Modeling

KeyWords Plus: VACUUM MEMBRANE DISTILLATION; MASS-TRANSFER; OSMOTIC DISTILLATION; OPERATING PARAMETERS; NUMERICAL-SIMULATION; MODULES

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第 92 条, 共 145 条

标题: Novel reverse osmosis membranes incorporated with a hydrophilic additive for seawater desalination

作者: Zhao, L (Zhao, Lin); Ho, WSW (Ho, W. S. Winston)

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摘要: Novel thin-film-composite reverse osmosis membranes were synthesized successfully for seawater desalination by incorporating the hydrophilic additive, o-aminobenzoic acid-ti ethylamine (O-ABA-TEA) salt, into the aqueous rn-phenylenediamine (MPD) solution to react with ti imesoyl chloride (TMC) in the organic solution during the interfacial polymerization on a nanoporous polysulfone support. The membrane synthesis conditions, including O-ABA-TEA salt concentration,



isopropanol (IPA) concentration, additional amine drying time, and hydrocarbon removal time, were optimized by characterizing membrane performances using synthetic 3.28 wt% NaCl solution under seawater desalination conditions at 800 psi (5.52 MPa) and 25 degrees C. The synthesized membranes showed a very high flux (311.81 m³/m²/day (444 gallons/ft²/day (gfd)) and a salt rejection of 99.41%. The improvement of membrane hydrophilicity was confirmed by comparing the contact angles of the membranes synthesized with and without the hydrophilic additive. The high-flux membrane was further tested using seawater from Port Hueneme, CA and exhibited a very good and stable desalination performance for 30 days. The fouling-resistant properties of the membranes synthesized with and without the hydrophilic additive were evaluated by using sodium alginate, a common contaminant derived from seaweed, as the model foulant. The membrane synthesized with hydrophilic additive showed significantly smaller water flux decline. The surface morphologies of the membranes were analyzed using atomic force microscopy (AFM). The results showed a smoother membrane surface for the membrane incorporated with the hydrophilic additive. (C) 2013 Elsevier B.V. All rights reserved,

作者关键词: Reverse osmosis; Thin-film-composite membrane; Seawater desalination; Hydrophilic additive; Fouling resistance

KeyWords Plus: THIN-FILM COMPOSITE; NANOFILTRATION MEMBRANES; SURFACE MODIFICATION; INTERFACIAL POLYCONDENSATION; CONCENTRATION POLARIZATION; FOULING RESISTANCE; TETRAACYL CHLORIDE; M-PHENYLENEDIAMINE; RO MEMBRANES; FLUX

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第 93 条, 共 145 条

标题: Performance evaluation of the DCMD desalination process under bench scale and large scale module operating conditions

作者: Francis, L (Francis, L.); Ghaffour, N (Ghaffour, N.); Alsaadi, AS (Alsaadi, A. S.); Nunes, SP (Nunes, S. P.); Amy, GL (Amy, G. L.)

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摘要: The flux performance of different hydrophobic microporous flat sheet commercial membranes made of poly tetrafluoroethylene (PTFE) and poly propylene (PP) was tested for Red Sea water desalination using the direct contact membrane distillation (DCMD) process, under bench scale (high Delta T) and large scale module (low Delta T) operating conditions. Membranes were characterized for their surface morphology, water contact angle, thickness, porosity, pore size and pore size distribution. The DCMD process performance was optimized using a locally designed and



fabricated module aiming to maximize the flux at different levels of operating parameters, mainly feed water and coolant inlet temperatures at different temperature differences across the membrane (ΔT). Water vapor flux of 88.8 kg/m² h was obtained using a PTFE membrane at high ΔT (60 degrees C). In addition, the flux performance was compared to the first generation of a new locally synthesized and fabricated membrane made of a different class of polymer under the same conditions. A total salt rejection of 99.99% and boron rejection of 99.41% were achieved under extreme operating conditions. On the other hand, a detailed water characterization revealed that low molecular weight non-ionic molecules (ppb level) were transported with the water vapor molecules through the membrane structure. The membrane which provided the highest flux was then tested under large scale module operating conditions. The average flux of the latter study (low ΔT) was found to be eight times lower than that of the bench scale (high ΔT) operating conditions. (C) 2013 Elsevier B.V. All rights reserved

作者关键词: Seawater desalination; DCMD flux; MD membranes; Rejection; Large scale module operating conditions

KeyWords Plus: CONTACT MEMBRANE DISTILLATION; SOLAR DESALINATION; FLUX ENHANCEMENT; SEAWATER DESALINATION; GEOTHERMAL-ENERGY; WATER; COEFFICIENTS; FABRICATION; TRANSPORT; RECOVERY

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第 94 条, 共 145 条

标题: Vacuum membrane distillation for desalination of water using hollow fiber membranes

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摘要: Vacuum membrane distillation (VMD) for desalination of water using hollow fiber membranes with a Shell-side feed configuration was investigated. The effects of membrane permeability, water salinity, feed temperature and flow rate on the water permeation rate were evaluated, and the water vapor pressure buildup in the fiber lumen was analyzed. The pressure buildup of water vapor in the fiber lumen was shown to adversely affect the driving force for water vapor permeation through the membrane pores, and a mathematical model was developed to describe the mass transfer in VMD by incorporating the permeate pressure build up. The model predictions were validated with experimental data. The higher the membrane permeability, the more significant the permeate pressure build-up. This is especially important to consider in module design for practical applications. For VMD of saline water, the membrane played a dominant role in the overall mass transfer process, and the significance of the effect of liquid phase resistance on water permeation depended on the membrane permeability. An increase in operating temperature increased the water productivity in VMD, primarily due to increased driving force for permeation, whereas the permeability of the membrane was not significantly affected. A factorial design experiment was carried out to illustrate the effects of main factors involving membrane permeability and operating parameters (feed concentration, temperature and flow rate) on the VMD performance, and some interactions among the effects were shown to occur as well. (C) 2013 Elsevier B.V. All rights reserved,

作者关键词: Hollow fiber; Vacuum membrane distillation; Desalination; Pressure buildup

KeyWords Plus: NANOFIBER MEMBRANES; PORE-SIZE; SEPARATION; PERFORMANCE; FABRICATION; ADDITIVES; REMOVAL; SYSTEM; MODULE; DEVICE

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第 95 条, 共 145 条

标题: Key issues for improving the design and operation of spiral-wound membrane modules in desalination plants

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来源出版物: DESALINATION AND WATER TREATMENT 卷: 52 期: 10-12 页: 1820-1832 DOI: 10.1080/19443994.2013.790322 出版年: MAR 21 2014

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摘要: Spiral-wound membrane (SWM) modules are the most important components of reverse osmosis and nanofiltration desalination and water treatment plants; their optimum design and operation is crucial for achieving satisfactory membrane plant efficiency associated with reduced product cost and environmental impact. This paper is focused on: (a) the main SWM module design parameters, in need of optimization, which include the geometrical characteristics of retentate-side spacers and the membrane sheet dimensions (for a module of fixed total active surface area); (b) the major operating variables, i.e. the permeate flux and the cross-flow velocity at the retentate side. Membrane element problems, usually encountered in operating plants and affected by the above SWM element parameters, include membrane fouling by various species (commonly organic matter, inorganic colloids, and bio-foulants), membrane scaling due to sparingly soluble salts, increased friction losses and uneven flow distribution in the SWM channels. A brief review is presented of the fluid dynamics and mass transfer in spacer-filled narrow channels, stressing the strong interrelation of SWM design and operating parameters. Moreover, the direct effect of the main SWM design and operating parameters on the above membrane element problems is highlighted and quantified, to the possible extent; the impact of these parameters on the efficient plant performance is also outlined. Significant R and D results are summarized, including currently favoured research approaches for tackling the complicated problem of optimizing desalination SWM module and overall plant performance.

作者关键词: Spiral-wound membrane modules; Desalination; Design and operating parameters; Optimization; Operating problems

KeyWords Plus: SPACER-FILLED CHANNELS; MASS-TRANSFER; REVERSE-OSMOSIS; PRESSURE-DROP; GEOMETRICAL CHARACTERISTICS; NUMERICAL-SIMULATION; NARROW CHANNELS; NET SPACERS; FLOW; RO

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第 96 条, 共 145 条

标题: Technical feasibility study for coupling a desalination plant to an Advanced Heavy Water Reactor

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来源出版物: DESALINATION 卷: 337 页: 76-82 DOI: 10.1016/j.desal.2013.11.004 出版年: MAR 17 2014

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摘要: Advanced Heavy Water Reactor (AHWR) is the latest Indian design for a next generation nuclear reactor. It is 300 MWe, vertical, pressure tube type, boiling light water cooled natural circulation and heavy water moderated reactor. It burns thorium in its fuel core to meet the objectives of using thorium fuel cycles for commercial power generation. Desalination systems are included in the reactor circuit to produce high quality water from seawater utilizing thermal energy of AHWR to meet the reactor make-up and other process water requirements. Studies have been carried out for various options of using thermal energy of AHWR for desalination. LTE and MED-TVC desalination plants are planned to be coupled with the reactor using Main Heat Transport purification circuit waste heat and using steam from a tapping between the cross-over line of HP and LP turbine respectively. Metallic barriers, intermediate loops and pressure reversal concepts are applied to prevent radioactive ingress to product water of desalination plant. This paper describes the technical feasibility studies of coupling 250 m³/day LTE and 2400 m³/day MED-TVC seawater desalination plants coupled to AHWR. Coupling of desalination plants, methodologies, loss of reactor power and various safety considerations are discussed in details. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: MED desalination; Waste heat; Desalination plant coupling to AHWR; Nuclear desalination; Isolation heat exchangers; LTE

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第 97 条, 共 145 条

标题: Feasibility study of a small-sized nuclear heat-only plant dedicated to desalination in the UAE

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摘要: The development of a small-sized nuclear heat-only plant with maximized safety features



dedicated to seawater thermal desalination was proposed to address both a serious water crisis and nuclear safety issues, which continue to be perennial problems. In this study, the feasibility of a dedicated nuclear heat-only desalination system for a target country was evaluated in comparison with a target nuclear thermal desalination system. First, the target country was selected, and its current energy and desalination status was investigated. The suitable nuclear desalination options for the target country were then selected. Finally, using corresponding analysis tools, performance and economic analyses were conducted for a dedicated nuclear heat-only desalination system and the target nuclear thermal desalination system. The results of the analyses indicate that operating the small-sized nuclear heat-only plant at low pressures coupled with a seawater thermal desalination plant will considerably improve both the safety and economy without a significant loss in desalination performance. In conclusion, the proposed dedicated nuclear heat-only desalination system is expected to have high potential for solving both problems. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Nuclear desalination; Heat-only; Dedicated; DEEP; UAE; MED-TVC

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第 98 条, 共 145 条

标题: Thermodynamic evaluation on the integrated system of VHTR and forward osmosis desalination process

作者: Park, MY (Park, Min Young); Kim, ES (Kim, Eung Soo)

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摘要: In order to effectively tackle the two global issues, water shortage and energy demand, an integrated system of a very high temperature reactor (VHTR) and forward osmosis (FO) desalination system is proposed. The integration basically implies the coupling of the waste heat from VHTR with the draw solute recovery system of FO seawater desalination system which is the only energy consuming part of the whole FO process. By integrating the two novel technologies, several advantages can be achieved, such as production of fresh water using waste heat and environment protection through waste heat reduction. In order to thermodynamically analyze the integrated system, the FO system and the power conversion systems (PCSs) of VHTR are simulated and integrated using UNISIM program and OLI property package. As a result, the integrated system of FO-VHTR was calculated to have higher Gain Output Ratio (GOR) values ranging from 9.0 to 13.8, than the typical GOR values, ranging from 6 to 12, of multi-stage flash (MSF) and multi-effect distillation (MED). Furthermore, when the technologies were coupled to the same capacity VHTR, the proposed system was calculated to have a significantly higher waste heat utilization rate than the other systems. Accordingly, the water production of the FO-VHTR system was found to be at least 5 times larger than that of the MSF-VHTR system. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: VHTR; Forward osmosis; Integration; Nuclear desalination; Ammonium bicarbonate

KeyWords Plus: AMMONIA-CARBON DIOXIDE

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第 99 条, 共 145 条

标题: Self-sustained webs of polyvinylidene fluoride electrospun nano-fibers: Effects of polymer concentration and desalination by direct contact membrane distillation

作者: Essalhi, M (Essalhi, M.); Khayet, M (Khayet, M.)

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摘要: The effects of the polymer polyvinylidene fluoride (PVDF) concentration on the characteristics and direct contact membrane distillation (DCMD) desalination performance of self-sustained electrospun nanofibrous membranes (ENMs) have been studied. Different polymer concentrations ranging from 15 to 30 wt% were considered in the solvent mixture N,N-dimethyl acetamide and acetone, while all other electrospinning parameters were maintained the same. Viscosity, electrical conductivity and surface tension of the polymer solutions were measured and the effects of the PVDF concentration on fiber diameter, thickness, water contact angle, inter-fiber space, void volume fraction, liquid entry pressure, mechanical and thermal properties of the ENMs were investigated. The minimum polymer concentration, critical chain entanglement concentration, required for electrospinning beaded fibers and the concentration needed for the formation of bead-free fibers were localized. Two groups of ENMs were identified based on the surface structure of the ENMs, their void volume fraction and inter-fiber space. Bead-free ENMs, prepared with PVDF concentration higher than 22.5 wt%, exhibit higher DCMD permeate flux than the beaded ENMs. Beaded ENMs can be used in desalination by DCMD. Among the prepared ENMs, the optimized membrane exhibiting the highest DCMD performance was prepared with 25 wt% PVDF concentration. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Electrospinning; Nano-fiber; Desalination; Membrane distillation; Polyvinylidene fluoride; Polymer concentration

KeyWords Plus: NANOFIBER MEMBRANES; POLY(VINYLDENE FLUORIDE); SURFACE-MORPHOLOGY; POLYSTYRENE FIBERS; SOLUTION RHEOLOGY; MOLECULAR-WEIGHT; GOOD SOLVENT; AIR-GAP; FABRICATION; DIAMETER

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第 100 条, 共 145 条

标题: Comparative study of brine management technologies for desalination plants

作者: Morillo, J (Morillo, Jose); Usero, J (Usero, Jose); Rosado, D (Rosado, Daniel); El Bakouri, H (El Bakouri, Hicham); Riaza, A (Riaza, Abel); Bernaola, FJ (Bernaola, Francisco-Javier)

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摘要: In recent years, reverse osmosis (RO) has grown as an alternative to traditional potable water sources. A major disadvantage of the RO process is the huge amount of brine and its negative impact as a result of its high salinity. This brine is usually discharged to inland water bodies or to the sea and constitutes a threat to ecosystems and species, such as *Posidonia oceanica* in the Mediterranean Sea; thus, further research is needed for introducing environmentally friendly and economically viable management options for RO brines.

This paper gives an overview of recent research as well as different technologies available at several scales to overcome the environmental problems and evaluate profitability related to discharge of RO concentrates. The treatment options have been classified into four different groups according to their final purpose: 1) technologies for reducing and eliminating brine disposal, 2) technologies for commercial salt recovery, 3) brine adaptation for industrial uses and 4) metal recovery. Solar evaporation, two-stage reverse osmosis, electrodialysis, integrated processes and brine adaptation for the chlor-alkali industry are some of the topics that this paper deals with. In the conclusion section, all of the technologies are compared emphasizing all their advantages and drawbacks, feasibility and development stage in order to provide a decision tool to select the best technology for each situation. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Seawater desalination; Reverse osmosis; Brine treatment; Water recovery; Salt recovery

Keywords Plus: REVERSE-OSMOSIS CONCENTRATE; SEAGRASS POSIDONIA-OCEANICA; AMMONIA-CARBON DIOXIDE; AIDED INTENSIFIED EVAPORATION; MEMBRANE DISTILLATION; SALT PRODUCTION; HIGH-RECOVERY; SEAWATER DESALINATION; INLAND DESALINATION; BRACKISH-WATER

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第 101 条, 共 145 条

标题: Comparison between Forward Osmosis-Reverse Osmosis and Reverse Osmosis processes for seawater desalination

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摘要: The combination of Forward Osmosis (FO) and Reverse Osmosis (RO) was evaluated for seawater desalination. RO process was suggested for the draw solution regeneration because of its high efficiency and applicability for a wide range of ionic solution treatments. Two different salts, NaCl and MgCl₂, were used as a draw solution. The performance of FO and RO regeneration processes was simulated using pre-developed software. A comparison between the RO and FO-RO processes was carried out. The simulation results showed that the total power consumption in the RO was lower than that in the FO-RO process. But, the difference in total power consumption between the RO and 0.65 mol MgCl₂ FO-RO processes was insignificant. The results also showed that the power consumption in the FO process was only 2%-4% of the total power consumption in the FO-RO process. However, the difference in total power consumption between the RO process and the FO-RO process decreased with a higher seawater salinity. In the FO-RO process, the results showed that the permeate TDS was increased with increasing the concentration of draw solution. The lowest permeate TDS was achieved in the 0.65 mol MgCl₂ FO-RO process and it was attributed to the high rejection rate of MgCl₂ by the RO regeneration unit. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Forward Osmosis; Reverse Osmosis; Desalination; FO energy consumption; FO-RO process

KeyWords Plus: AMMONIA-CARBON DIOXIDE; MEMBRANE DISTILLATION; FUTURE-PROSPECTS; FEED SOLUTION; WATER REUSE; PLANTS; NANOFILTRATION; DESIGN; PERFORMANCE; EFFICIENCY

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第 102 条, 共 145 条

标题: Optimization of the operational parameters for desalination with response surface methodology during a capacitive deionization process

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摘要: The performance of capacitive deionization (CDI) and the effects of various operational parameters in CDI experiments were investigated for desalination on activated carbon electrodes. The pore size distribution determined using density functional theory showed that the carbon electrode materials used in this study contained some mesopores that could reduce the electric double-layer overlapping effect. From a Nyquist plot derived from electrochemical impedance spectroscopy, the equivalent circuit and impedance for the CDI system were analyzed, and the specific capacitance of the electrodes was approximately 71.05 F/g. Optimization of the operational conditions under the main experimental parameters, including the cell voltage (1.2-1.6 V), initial NaCl concentration (200-1000 mg/l) and flow rate (10-40 ml/min), was performed by Box-Behnken design with response surface methodology. A quadratic polynomial model was properly fit to the experimental data with a determination coefficient (R²) of 0.9945 and a p-value <0.0001. The analysis of variance for the quadratic model demonstrated that the model was highly significant and reliable. The predicted maximum electrosorption capacity (10.67 mg/g) was given under the optimal conditions consisting of a cell voltage, initial NaCl concentration and flow rate of 1.57 V, 1000 mg/l and 25 ml/min, respectively, in accordance with the results of the validation experiments. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Electrosorption; Capacitive deionization; Electrochemical impedance spectroscopy; Response surface methodology; Box-Behnken design

KeyWords Plus: CARBON ELECTRODES; BRACKISH-WATER; MESOPOROUS CARBON; ELECTROSORPTION; PERFORMANCE; ADSORPTION; NANOTUBE

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第 103 条, 共 145 条

标题: Carbon nanotube membranes for water purification: A bright future in water desalination

作者: Das, R (Das, Rasel); Ali, ME (Ali, Md Equb); Abd Hamid, SB (Abd Hamid, Sharifah Bee); Ramakrishna, S (Ramakrishna, Seeram); Chowdhury, ZZ (Chowdhury, Zaira Zaman)

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摘要: Water pollutants have huge impacts on the entire living systems including terrestrial, aquatic, and aerial flora and fauna. In addition to conventional priority, and newly emerging micro/nano-pollutants, increasing global warming and consequent climate changes are posing major threats to the fresh water availability. Global warming and climate change are constantly increasing the salinity level of both land and sea water, dwindling the availability of existing fresh water for household, agriculture and industry. This has made it urgent to invent an appropriate water treatment technology that not only removes macro-, micro- and nano-pollutants but also desalinates water to a significant extent. Tip-functionalized nonpolar interior home of carbon nanotubes (CNTs) provides strong invitation to polar water molecules and rejects salts and pollutants. Low energy consumption, antifouling and self-cleaning functions have made CNT membranes extraordinary over the conventional ones. We comprehensively reviewed here molecular modeling and experimental aspects of CNT-membrane fabrication and functionalization for the desalination of both sea and brackish water. We present here the current problems and future challenges in water treatments. The article is potentially important for the hydrologists, membrane technologists, environmentalists and industrialists working in the field of water purification technologies to eradicate fresh water crisis in near future. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Carbon nanotubes; Nonpolar interior; Membranes; Desalination

KeyWords Plus: REVERSE-OSMOSIS MEMBRANES; NANOCOMPOSITE MEMBRANES; SALT REJECTION; INTERFACIAL POLYMERIZATION; ENVIRONMENTAL REMEDIATION; NANOFILTRATION MEMBRANE; PERFORMANCE EVALUATION; MASS-TRANSPORT; BRACKISH-WATER; MICROFILTRATION

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第 104 条, 共 145 条

标题: Concentrating solar power (CSP) system integrated with MED-RO hybrid desalination

作者: Iaquaniello, G (Iaquaniello, G.); Salladini, A (Salladini, A.); Mari, A (Mari, A.); Mabrouk, AA (Mabrouk, A. A.); Fath, HES (Fath, H. E. S.)

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摘要: Renewable energy technologies, in particular concentrating solar power (CSP), are becoming more and more interesting for powering water desalination system. Moving from a European Community funded project called MATS, Multipurpose Applications by Thermodynamics Solar, which is in an advanced phase of detailed engineering, the authors have further developed an alternative scheme by a proper integration of CSP with multi-effect distillation (MED) and reverse osmoses (RO) desalination processes. According to the proposed scheme MED is powered by the low temperature exhaust steam delivered from the back pressure steam turbine while the RO is powered by the electricity produced by the same steam turbine in addition to that generated by a conventional gas turbine integrated as a thermal backup system. The effective match of the alternative solar thermal and electricity into such hybrid power-desalination scheme is discussed in details. An economical analysis together with a developed comprehensive model is provided where power availability, water production rates and environmental benefits have been implemented. Desalination using the CSP system through such hybrid integration allows also for a continuous operation and can be an effective way to lower the total water production costs not only for large-scale plants. (C) 2014 Elsevier B.V. All rights reserved.

作者关键词: Hybrid desalination; MED; RO; Renewable energy; CSP; Techno-economics

KeyWords Plus: THERMAL ELECTRICITY TECHNOLOGY; REVERSE-OSMOSIS DESALINATION; WATER DESALINATION; PLANTS; ENERGY; COST

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第 105 条, 共 145 条

标题: Quantifying the potential of ultra-permeable membranes for water desalination

作者: Cohen-Tanugi, D (Cohen-Tanugi, David); McGovern, RK (McGovern, Ronan K.); Dave, SH (Dave, Shreya H.); Lienhard, JH (Lienhard, John H.); Grossman, JC (Grossman, Jeffrey C.)

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摘要: In the face of growing water scarcity, it is critical to understand the potential of saltwater desalination as a long-term water supply option. Recent studies have highlighted the promise of new membrane materials that could desalinate water while exhibiting far greater permeability than conventional reverse osmosis (RO) membranes, but the question remains whether higher permeability can translate into significant reductions in the cost of desalinating water. Here, we address a critical question by evaluating the potential of such ultra-permeable membranes (UPMs) to improve the performance and cost of RO. By modeling the mass transport inside RO pressure vessels, we quantify how much a tripling in the water permeability of a membrane would reduce the energy consumption or the number of required pressure vessels for a given RO plant. We find that a tripling in permeability would allow for 44% fewer pressure vessels or 15% less energy for a seawater RO plant with a given capacity and recovery ratio. Moreover, a tripling in permeability would result in 63% fewer pressure vessels or 46% less energy for brackish water RO. However, we also find that the energy savings of UPMs exhibit a law of diminishing returns due to thermodynamics and concentration polarization at the membrane surface.

KeyWords Plus: REVERSE-OSMOSIS DESALINATION; CONCENTRATION POLARIZATION; COST OPTIMIZATION; GRAPHENE; PURIFICATION; PERFORMANCE; TECHNOLOGY; ENERGY

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第 106 条, 共 145 条



标题: Model and Design of Cogeneration System for Different Demands of Desalination Water, Heat and Power Production

作者: Wu, XL (Wu Xianli); Hu, YD (Hu Yangdong); Wu, LY (Wu Lianying); Li, H (Li Hong)

来源出版物: CHINESE JOURNAL OF CHEMICAL ENGINEERING 卷: 22 期: 3 页: 330-338 DOI: 10.1016/S1004-9541(14)60036-7 出版年: MAR 2014

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摘要: In order to improve the energy efficiency, reduce the CO₂ emission and decrease the cost, a cogeneration system for desalination water, heat and power production was studied in this paper. The superstructure of the cogeneration system consisted of a coal-based thermal power plant (TPP), a multi-stage flash desalination (MSF) module and reverse osmosis desalination (RO) module. For different demands of water, heat and power production, the corresponding optimal production structure was different. After reasonable simplification, the process model of each unit was built. The economical model, including the unit investment, and operation and maintenance cost, was presented. By solving this non-linear programming (NLP) model, whose objective is to minimize the annual cost, an optimal cogeneration system can be obtained. Compared to separate production systems, the optimal system can reduce 16.1%-21.7% of the total annual cost, showing this design method was effective.

作者关键词: cogeneration system; thermal power plant; multi-stage flash desalination; reverse osmosis desalination; non-linear programming; optimal design

KeyWords Plus: SEAWATER DESALINATION; FEASIBILITY; PLANTS

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第 107 条, 共 145 条

标题: Desalination of seawater ion complexes by MFI-type zeolite membranes: Temperature and long term stability

作者: Zhu, B (Zhu, Bo); Hong, Z (Hong, Zhou); Milne, N (Milne, Nicholas); Doherty, CM (Doherty, Cara M.); Zou, LD (Zou, Linda); Lin, YS (Lin, Y. S.); Hill, AJ (Hill, Anita J.); Gu, XH (Gu, Xuehong); Duke, M (Duke, Mikel)

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摘要: Ceramic membranes made from zeolites possess the nanoporous structure required for desalination of saline water including seawater. In this research, an alpha-Al₂O₃ supported MR-type silicalite membrane was synthesised by the direct in-situ crystallisation method via a single hydrothermal treatment in an autoclave under autogenous pressure. Desalination performance of the prepared silicalite membrane was carried out with a seawater solution (0.3 wt% TDS (total dissolved solids)) over a long period of around 180 days at a constant pressure of 700 kPa at various temperatures. The prepared silicalite membrane achieved a high rejection (>93%) for all major seawater ions including Na⁺ (except for K⁺, 83%) at an applied pressure of 700 kPa and room



temperature (22 degrees C), but showed a continuous decrease in ion rejection when increasing the temperature from 22 degrees C and 90 degrees C. Permeation flux of the zeolite membrane significantly increased with increasing in temperature. Upon closer observation of the major cations, size selective diffusion in the zeolite membrane was observed over the temperatures tested. Larger ions Ca²⁺ and Mg²⁺ were less responsive to temperature than smaller ions Na⁺ and K⁺. No changes in membrane structure were observed by X-ray diffraction (XRD) and field emission scanning electron microscopy (FESEM) after 180 days seawater exposure. However, energy-dispersive X-ray spectroscopy (EDS) mapping on the surface of the membrane revealed a small quantity of tightly bound divalent cations present in the structure, which appear to have penetrated the zeolite, accelerated by temperature. They were suspected to have altered the permstructure, explaining why original high rejections at room temperature were not reversed after heat exposure. The work has shown that zeolite membranes can desalinate seawater, but other unusual effects such as ion selective diffusion as a function of temperature indicate a unique property for desalination membrane materials. (C) 2013 Elsevier By, All rights reserved,

作者关键词: Desalination; Seawater ions; Zeolite membrane; MEI; Silicalite

KeyWords Plus: REVERSE-OSMOSIS; MOLECULAR SIMULATION; PERMEATION PROPERTIES; SILICALITE-1 ZEOLITE; AQUEOUS-SOLUTIONS; SI/AL-RATIO; WATER; HYDRATION; ZSM-5; FILMS

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第 108 条, 共 145 条

标题: Analysis of reverse osmosis membrane performance during desalination of simulated brackish surface waters

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摘要: In this study, three different brackish surface water qualities, which represented the water quality in the Iraqi marshes, were simulated and used as feed waters to run a flat sheet reverse osmosis (RO) membrane system. The performance of three different types of the RD membrane (Thin-Film Composite (SE), Cellulose Acetate (CE), and Polyamide (AD)), under these water qualities, was investigated. The effect of the high and low feed water temperature (37 degrees C and 11 degrees C) on the operation efficiency of the three RD membranes was also investigated. In addition, using the Microfiltration (MF) membrane to pretreat the feed water and its effect on the performance of the RD membrane was examined. The results revealed that the SE membrane produced the highest permeate flux, while the AD membrane produced the lowest permeate flux in all three feed waters. Also, the elemental analyses showed that the CE membrane had the least

rejection percentage (from 911% to 99.2%), but the AD membrane had the highest rejection percentage (from 97.6% to 99.5%) for all the existing feed water ions. Moreover, using the MU membrane increased the permeate flux, particularly of the runs conducted with a high temperature, and slightly improved salt ions rejection ratios by the RD membranes. Additionally, all membranes at the temperature of 37 degrees C exhibited higher permeate fluxes than those of corresponding membranes at a lower temperature (11 degrees C). (C) 2013 Elsevier B.V. All rights reserved

作者关键词: Reverse osmosis; Permeate; Brackish water; Salt ion rejection; Pretreatment

KeyWords Plus: RO MEMBRANES; TEMPERATURE

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第 109 条, 共 145 条

标题: Impact of intrinsic properties of foulants on membrane performance in osmotic desalination applications

作者: Arkhangelsky, E (Arkhangelsky, Elizabeth); Lay, SS (Lay, Susan Sulaiman); Wicaksana, F (Wicaksana, Filicia); Al-Rabiah, AA (Al-Rabiah, Abdulrahman A.); Al-Zahrani, SM (Al-Zahrani, Saeed M.); Wang, R (Wang, Rong)

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摘要: This study investigates the effect of intrinsic physico-chemical properties of polysaccharides and proteins on the performance of flat sheet and hollow fiber forward osmosis (FO) membranes in different modes. Results showed that the foulant hydrodynamic diameter, zeta potential and rheological behavior were essential characteristics that govern the osmotic desalination processes. Diffusivity was the dominant mechanism governing the performance of hollow fiber membranes in FO mode, while the performance of flat sheet membrane in pressure retarded osmosis (PRO) mode was controlled by a combination of three mechanisms: diffusivity, size exclusion and electrostatic forces. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Forward osmosis; Desalination; Intrinsic properties of foulants; Diffusivity; Size exclusion; Electrostatic forces

KeyWords Plus: HOLLOW-FIBER MEMBRANES; THIN-FILM-COMPOSITE; INTERNAL CONCENTRATION POLARIZATION; BOVINE SERUM-ALBUMIN; OSMOSIS MEMBRANES; REVERSE-OSMOSIS; XANTHAN GUM; FLUX; ULTRAFILTRATION; NANOFILTRATION

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第 110 条, 共 145 条

标题: Fault Detection and Isolation in a Spiral-Wound Reverse Osmosis (RO) Desalination Plant

作者: Pascual, X (Pascual, Xavier); Gu, H (Gu, Han); Bartman, A (Bartman, Alex); Zhu, AH (Zhu, Aihua); Rahardianto, A (Rahardianto, Anditya); Giralt, J (Giralt, Jaume); Rallo, R (Rallo, Robert); Christofides, PD (Christofides, Panagiotis D.); Cohen, Y (Cohen, Yoram)

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摘要: Sensor fault detection and isolation (SFDI) approaches, based on support vector regression (SVR) plant sensor models and self-organizing-map (SOM) analysis, were investigated for application to reverse osmosis (RO) desalination plant operation. SFDI-SVR and SFDI-SOM were assessed using operational data from a small spiral-wound RO pilot plant and synthetic faulty data generated as perturbations relative to normal plant operational data. SFDI-SVR was achieved without false negative (FN) detections for sensor deviations of $\geq 10\%$ and FN detections of, at the most, less than or similar to broken 5% , and for sensor deviations of greater than or similar to 4% at sensor fault detection (FD) thresholds of up to similar to 4% . False positive (FP) detections were almost invariant, with respect to sensor FD, being less than or similar to 5% for sensor deviations of greater than or similar to 5% . Corrections of faulty sensor readings were within SVR model accuracy (AARE $< 1\%$) for SFDI-SVR and less than or similar to 5% for SFDI-SOM. Although SFDI-SOM has lower detection accuracy, it requires a single overall plant model (or SOM), while providing pictorial representation of plant operation and depiction of faulty operational trajectories.

KeyWords Plus: SUPPORT VECTOR MACHINES; ARTIFICIAL NEURAL-NETWORKS; MODEL-PREDICTIVE CONTROL; FEED FLOW REVERSAL; DIAGNOSIS; SYSTEMS; UNIT

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第 111 条, 共 145 条

标题: Qatar water problem and solar desalination

作者: Darwish, M (Darwish, Mohamed)

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摘要: The reasons of water problem in Qatar are outlined. The water resources include very limited ground water that is heavily exploited, desalted seawater consuming too much energy and negatively affecting the environment, and treated wastewater that is not fully utilized. Heavy water leakage in the distribution network is an added problem. Water consumption is high due to the government heavy subsidization. The population increase and the rising standard of living are increasing the water demand, and there is clear demand gap that eventually should be secured by desalination. Using solar energy can be a sustainable solution that is considered in the paper. Although it is expensive, the prospect of decreasing the cost exist.

作者关键词: Qatar water problem; Water resources; Groundwater; Wastewater; Treated wastewater; Desalination; Multi stage Flash; Thermal vapor compression; Seawater reverse osmosis; Water demand; Water consumption; Water leakage; Solar desalination

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第 112 条, 共 145 条

标题: A UPCA-based monitoring and fault detection approach for reverse osmosis desalination plants

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摘要: This article studies and describes a monitoring, fault detection, and diagnosis technique based on the unfolded PCA (UPCA) approach and its application to a reverse osmosis desalination plant. The UPCA approach is normally applied to batch processes, but in this case, the UPCA



approach is applied to a continuous process, which does not present a strict steady state. The classical principal component analysis (PCA) approach is not very suitable for this process due to the nonlinearities of this type of processes. The principal characteristics of PCA and UPCA methods are described. The different considerations and adaptations required to perform a UPCA monitoring tool applied to a continuous process, such as unfolding, alignment, and imputation, are also described and explained.

作者关键词: PCA; UPCA; Fault detection and isolation; Desalination plant

KeyWords Plus: PRINCIPAL COMPONENT ANALYSIS; MULTIVARIATE SPC; BATCH PROCESSES; MISSING DATA; DIAGNOSIS; OPERATIONS; CHARTS; MSPC

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第 113 条, 共 145 条

标题: Optimal design of integrated total site utility-multi-stage flash desalination plant

作者: Manesh, MHK (Manesh, M. H. Khoshgoftar); Janalizadeh, H (Janalizadeh, H.); Marigorta, AMB (Blanco Marigorta, A. M.); Amidpour, M (Amidpour, M.); Hamedi, MH (Hamedi, M. H.)

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摘要: Central site utility of process industries can produce steam at different levels and the excess steam can be used to produce the desalinated water simultaneously. This paper presents the potential of total site process integration and exergoeconomic optimization to find optimal coupling between central site utility system and multi stage flash (MSF) desalination. In the first step, total site analysis has been applied to better understand the integration between site utility and MSF desalination. In this regard, the total site sink/source profiles and Site Utility Grand Composite Curves have been demonstrated to find best scenario for integration. Also, an accurate targeting procedure has been used. In the second step, exergoeconomic optimization has been applied to find optimum MSF desalination integrated with central utility. A case study is used to illustrate the usefulness of the proposed procedure to find optimum integrated MSF/site utility plant.

作者关键词: Site utility; Total site; MSF desalination; Integration; Exergoeconomic; Optimization

KeyWords Plus: EVOLUTIONARY ALGORITHMS; REVERSE-OSMOSIS; SEAWATER DESALINATION; WATER DESALINATION; ENERGY-CONSUMPTION; OPTIMIZATION; SYSTEMS; POWER; COST; FUEL

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第 114 条, 共 145 条

标题: Effects of inter-membrane distance and hydraulic retention time on the desalination performance of microbial desalination cells

作者: Ping, QY (Ping, Qingyun); He, Z (He, Zhen)

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摘要: Microbial desalination cell (MDC) is a promising technology for simultaneous water desalination and wastewater treatment. To further understand the factors that affect MDC performance, we investigated the complementary roles of inter-membrane distance and hydraulic retention time (HRT) in desalination by a bench-scale MDC. When the inter-membrane distance was changed from 2.5 to 0.3cm while maintaining the same influent flow rate, the HRT of the salt solution decreased; the desalination efficiency reached a maximum at 0.5cm distance with 10g/L salt concentration or at 2.5cm distance with 30g/L. The rate of salt removal was clearly improved at a shorter inter-membrane distance. The MDC with an inter-membrane distance of 0.3cm achieved a specific desalination rate twelve or seven times higher than that with 2.5cm at an initial salt concentration of 10 or 30g/L. At the same inter-membrane distance of 1.0cm, a greater HRT led to better desalination efficiency. While at the same HRT of 6h, the smaller inter-membrane distances resulted in higher desalination efficiency. In addition to electric current, water osmosis was found to be a major contributor to conductivity reduction. The future design and operation of MDCs should consider the trade-off between inter-membrane distance and HRTs.

作者关键词: Microbial desalination cell; Wastewater treatment; Bioelectrochemical; Membrane; Energy

KeyWords Plus: SIMULTANEOUS WATER DESALINATION; ELECTRICITY-GENERATION; ELECTRODIALYSIS; SEAWATER

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第 115 条, 共 145 条

标题: Simulation of an autonomous solar vacuum membrane distillation for seawater desalination

作者: Frikha, N (Frikha, Nader); Matlaya, R (Matlaya, Radhouane); Chaouachi, B (Chaouachi, Bechir); Gabsi, S (Gabsi, Slimane)



来源出版物: DESALINATION AND WATER TREATMENT 卷: 52 期: 7-9 页: 1725-1734 DOI: 10.1080/19443994.2013.809638 出版年: FEB 23 2014

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摘要: Several papers deal with membrane distillation of seawater and mainly focus on the choice of membranes and comparison of this technique with other desalination techniques, but there are very few studies that quantitatively estimate the potential of this technology coupled with solar energy. The objective of this work is to develop a model describing the operation of a desalination membrane powered by solar energy. This model determines the performance of the unit over time and for any day of the year. This model is established from the balance equations of mass and heat on the different units (membrane, exchanger, condenser, and field of solar collectors). The model is used to evaluate the evolution of the distillate flow rate and temperature changes for different flows. The model also allows to estimate the productivity of the unit during the year. The simulation of the operation of the unit shows that the daily production of distilled water is between 63 and 188kg/m² for the days of 21 December and 21 June.

作者关键词: Membrane distillation; Solar collectors; Photovoltaic cells

KeyWords Plus: WATER DESALINATION; ENERGY

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第 116 条, 共 145 条

标题: Techno-economic feasibility of wind-powered reverse osmosis brackish water desalination systems in southern Algeria

作者: Triki, Z (Triki, Z.); Bouaziz, MN (Bouaziz, M. N.); Boumaza, M (Boumaza, M.)

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摘要: Water desalination is one of the most important factors that can help in developing remote areas and the desert. A critical technical parameter of desalination applications is the way the system is powered. This decision is taken according to the selected method of desalination and the characteristics of the candidate area. Nowadays, the method of reverse osmosis dominates globally; it requires only electricity, has a quite low specific energy demand, and can cooperate with technologies of renewable energy sources such as wind turbine and photovoltaics. Hence, renewable energy-powered reverse osmosis systems are promising technologies for brackish and seawater desalination in remote regions as they exhibit low energy consumption and can be designed according to water demand and energy resource. This study analyzes the feasibility of using wind energy to power brackish water reverse osmosis desalination units proposed for the development of the southern region of the case study country of Algeria. A reverse osmosis desalination scheme powered by a stand-alone wind turbine of 1MW rated power is presented to



elucidate its feasibility. The modeling results show that at average wind speeds, the amount of product water is sufficient to meet freshwater demand in this region. The effect of different operating and design conditions on the purified water production rate was investigated. The paper is concluded with the economic feasibility of wind-desalination systems at the selected sites.

作者关键词: Remote areas; Brackish groundwater; Renewable energy sources; Wind power; Reverse osmosis desalination; Energy recovery

KeyWords Plus: ENERGY-CONSUMPTION; ECONOMIC-ANALYSIS; RENEWABLE ENERGY; OPTIMIZATION; PLANT; DESIGN; PERFORMANCE; RECYCLE; MODULES

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第 117 条, 共 145 条

标题: Economic feasibility of a solar still desalination system with enhanced productivity

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摘要: Solar still desalination systems offer sustainable tools for fresh water production. However, their widespread application is often hindered by their relatively low production rates compared to other desalination methods. In this study, a simple amendment, in the form of a slowly-rotating hollow cylinder, was introduced within the solar still, significantly increasing the evaporative surface area. This new modified still was analyzed in terms of both operation and economic feasibility. The introduced cylinder resulted in a 200-300% increase in water output relative to a control, which did not include the cylinder. The resulting percent improvement far exceeds that obtained by other modifications. Unit production cost estimates varied between 6 and 60 \$/m³ depending on discount rates, productivity, service lifetime and initial capital costs. These projections are well within reported cost ranges for renewable-based technologies. In order to evaluate the system's feasibility in real market value, different scenarios that introduce carbon-trading schemes and environmental degradation costs for fuel-based desalination, were performed. Reported costs for fuel-based brackish water and seawater desalination were thus adjusted to include unaccounted-for costs related to environmental damage. This analysis yielded results that further justify the economic feasibility of the new modified solar still, particularly for seawater desalination. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Cost analysis; Cylinder; Desalination; Environmental degradation; Water productivity; Solar still

KeyWords Plus: EXPERIMENTAL VALIDATION; SEAWATER DESALINATION; THERMAL PERFORMANCE; ABSORBING MATERIALS; BASIN STILL; WATER; DISTILLATION; DESIGN; ENERGY; YIELD

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第 118 条, 共 145 条

标题: An improved protocol for electrodialytic desalination yielding mineral-balanced potable water

作者: Thakur, AK (Thakur, Amit K.); Srivastava, N (Srivastava, Niharika); Chakrabarty, T (Chakrabarty, Tina); Rebary, B (Rebary, Babulal); Patidar, R (Patidar, Rajesh); Sanghavi, RJ (Sanghavi, Rahul J.); Shahi, VK (Shahi, Vinod K.); Ghosh, PK (Ghosh, Pushpito K.)

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摘要: Brackish water desalination through distillation produces essentially distilled water devoid of all minerals. In reverse osmosis (RO) all dissolved minerals get depleted but depletion of useful minerals (Mg^{2+} , Ca^{2+} , SO_4^{2-} and CO_3^{2-}/HCO_3^-) is even greater than of Na^+ and Cl^- . Conventional electrodialysis (EDconv) too fails to meet the desired objective, all constituents being depleted in similar proportions with respect to feed. Consequently, remineralisation is necessary but in many cases not implemented. We report selective electrodialysis (EDsel), for production of desalinated water containing relatively higher proportions of desirable minerals. Commercial cation- and anion exchange membranes (CEMCNS and AEM(CNS)) were coated with polyaniline (PANI), and the resultant membranes (PANI-CEMCNS, PANI-AEM(CNS)) were characterised by physico-chemical and electrochemical techniques. Due to sieving and hydrophobic effects, the PANI coating was demonstrated to improve the retention of Mg^{2+} , Ca^{2+} and SO_4^{2-} during desalination. Retention of mineral constituents was further enhanced with PANI modified styrene-co-divinylbenzene-polyethylene-based interpolymer cation- and anion-exchange membranes (CEMIP and AEM(IP)). The total alkalinity of the treated stream increased during EDsel, presumably due to concentration polarisation accompanied by preferential transport of H^+ over OH^- . The process efficiency was only marginally lower (5%) for EDsel, suggesting that this approach to desalination may be of practical importance. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Useful mineral retention; Selective electrodialysis; Drinking water

KeyWords Plus: ANION-EXCHANGE MEMBRANES; COMPOSITE MEMBRANES; DRINKING-WATER; PERMSELECTIVITY; CATIONS; IONS

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第 119 条, 共 145 条

标题: The reclamation of brine generated from desalination process by bipolar membrane electrodialysis

作者: Wang, M (Wang, Meng); Wang, KK (Wang, Kai-kai); Jia, YX (Jia, Yu-xiang); Ren, QC (Ren, Qing-chun)

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摘要: Some techno-economical analyses and environmental impact evaluation have proved that bipolar membrane electrodialysis (BMED) is feasible for the reclamation of industrial saline water. However, to date, the technology cannot be put into practice due to some unsolved application-oriented problems, such as the requirements of BMED for feed solution, the availability of the produced acid and base, relatively high salt concentration of the effluent, and relatively low desalinating efficiency and capacity. In this work, a novel hybrid process, which coupled conventional electrodialysis installed with monovalent selective cation-exchange membranes with BMED running in a constant-voltage mode, was designed to reclaim brine generated from surface water desalination by the ion-exchange process. Subsequently, the response surface methodology was employed to establish the empirical models for understanding the influences of some initial operating conditions on BMED performance. Finally, the BMED-based reclamation scheme was confirmed again by a continuous BMED experiment on real solution. Specially, the effects of product concentration on current efficiency and energy consumption were investigated. In this case, an acceptable current efficiency and energy consumption were obtained on the basis of the conventional membranes and spacers when the product concentration was set as 0.9 M, which is adequate for the regeneration of ion exchange resins. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Bipolar membrane electrodialysis; Industrial saline water; Reclamation; Response surface methodology; Monovalent selective ion-exchange membrane

KeyWords Plus: WASTE-WATER; PRETREATMENT

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第 120 条, 共 145 条

标题: One-step self-assembly fabrication of amphiphilic hyperbranched polymer composite membrane from aqueous emulsion for dye desalination

作者: Wang, L (Wang, Lin); Ji, SL (Ji, Shulan); Wang, NX (Wang, Naixin); Zhang, R (Zhang, Rong); Zhang, GJ (Zhang, Guojun); Li, JR (Li, Jian-Rong)

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摘要: Organic solvent usually was used in a polymer-based membrane fabricating process. In this study, otherwise pure water was utilized to prepare the polymer composite membrane. A pure aqueous emulsion was firstly prepared through directly dissolving a commercially available amphiphilic hyperbranched polymer (HBP), Bottom W3000 into water. As the cross-linking agent, glutaraldehyde, glycol, triethylamine, or tetraethyl orthosilicate was then added into the emulsion, respectively. Finally, the HBP was self-assembled onto the surface of polyacrylonitrile (PAN) ultrafiltration membrane by immersing the PAN substrate into the emulsion to form the composite membrane. The homogeneous dispersion of the HBP in the emulsion was confirmed by transmission electron microscopy, and the formation of the composite membrane was characterized by IR spectra, field emission scanning electron microscopy and atomic force microscopy. Importantly, the composite membrane performed an excellent separation performance in dye retention and desalination. For example, with the operation pressure of 0.5 MPa, the retention of methyl blue could reach 97.0% with a flux of 55.0 L m⁻² h⁻¹, while the salt retention was lower than 12.0%. This work thus not only illustrated a new approach for the preparation of nanofiltration membrane in aqueous solution, but also produced a potentially useful polymer-based composite membrane for highly efficient dye desalination. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Amphiphilic polymer; Dye retention; Hyperbranched polymer; Nanofiltration; Self-emulsify

KeyWords Plus: POLYAMIDE NANOFILTRATION MEMBRANES; GAS SEPARATION MEMBRANES; INTERFACIAL POLYMERIZATION; ULTRAFILTRATION MEMBRANE; FILM FORMATION; WASTE-WATER; EFFECTIVE REMOVAL; LATEX FILMS; DENDRIMERS; FLUX

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第 121 条, 共 145 条

标题: Evaluation of commercial PTFE membranes in desalination by direct contact membrane distillation

作者: Shirazi, MMA (Shirazi, Mohammad Mandi A.); Kargari, A (Kargari, Ali); Tabatabaei, M (Tabatabaei, Meisam)

来源出版物: CHEMICAL ENGINEERING AND PROCESSING 卷: 76 页: 16-25 DOI: 10.1016/j.cep.2013.11.010 出版年: FEB 2014

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摘要: In this study, nine flat-sheet commercially available hydrophobic PTFE membranes were used in desalination by direct contact membrane distillation and their characteristics were investigated under different operating conditions including feed temperature, feed flow rate, cold stream flow rate, and feed concentration. Membrane properties, i.e. pore size, thickness, support layer, and salt rejection were also studied. Moreover, membrane module designs including flow arrangements (co-current, counter-current and tangential) for process liquid and depth both on hot and cold sides were tested experimentally. Finally, the long-term performance of the selected membranes for direct contact membrane distillation as a standalone desalination process was investigated. The results indicated that increasing feed temperature, hot feed flow rate, and module depth on the cold side led to increase permeate flux. On the other hand, increasing membrane thickness and module depth on the hot side (at constant flow rate) had negative effects on the flux. The highest permeation flux and salt rejection was achieved when the membranes with a pore size of 0.22 μm were used in the cross-current follow arrangement of hot and cold streams. In addition, the requirements for support layer for a successful DCMD process has been extensively discussed. (c) 2013 Elsevier B.V. All rights reserved.

作者关键词: Direct contact membrane distillation (DCMD); Desalination; PTFE; Membrane characteristics; MD module design; Support layer

KeyWords Plus: WATER; SEPARATION; SYSTEMS

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第 122 条, 共 145 条

标题: A novel thin film composite forward osmosis membrane prepared from PSf-TiO₂ nanocomposite substrate for water desalination

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摘要: In this work, polysulfone (PSf)-titanium dioxide (TiO₂) nanocomposite substrates were prepared by incorporating different amounts of TiO₂ nanoparticles (ranging from zero to 1 wt%) into PSf matrix. The nanocomposite substrates so prepared were then characterized with respect to hydrophilicity, overall porosity, surface roughness and cross-sectional morphology. It was found that both hydrophilicity and porosity of the substrate were increased upon addition of TiO₂. In addition, long finger-like structures were developed by increasing the TiO₂ loading, leading to water permeability enhancement. In order to fabricate thin film nanocomposite (TFN) membranes for forward osmosis (FO) application, a thin polyamide layer was formed by interfacial polymerization of 1,3-phenylenediamine and 1,3,5-benzenetricarbonyl trichloride on the top surface of PSf-TiO₂ nanocomposite substrates. Under the conditions for FO performance evaluation (10 mM NaCl concentration in feed solution, 0.5 and 2.0 M NaCl concentration in draw solution, and both active layer facing the feed solution (AL-FS) and active layer facing the draw solution (AL-DS) orientations), the TFN membrane prepared using PSf substrate embedded with 0.5 wt% TiO₂ nanoparticles (denoted as TFN0.5) exhibited the most promising results by showing high water permeability and low reverse solute flux. In comparison with control TFC membrane, the water flux of TFN0.5 membrane was improved by 86-93%, depending on the membrane orientation and draw solution

concentration. The increase in water permeability can be attributed to decrease in structural parameter which resulted in decreased internal concentration polarization (ICP). Although further increase in TiO₂ nanoparticles loading to 0.75 and 1 wt% could result in higher water permeability, their FO performances were compromised by a significant increase in reverse solute flux. Based on the results obtained in this work, it can be concluded that adding an appropriate amount of TiO₂ nanoparticles into PSf substrate could potentially improve the performance of TFC membrane during FO applications. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Thin film nanocomposite membrane; Forward osmosis; TiO₂ nanoparticles; Substrate; Water desalination

KeyWords Plus: PRESSURE-RETARDED OSMOSIS; ENHANCED PERFORMANCE; TIO2 NANOPARTICLES; HYBRID MEMBRANES; REVERSE-OSMOSIS; CARBOXYLIC-ACID; FLUX BEHAVIOR; RO MEMBRANES; POLYAMIDE; LAYER

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第 123 条, 共 145 条

标题: Optimal Design of Split Partial Second Pass Reverse Osmosis Network for Desalination Applications

作者: Saif, Y (Saif, Yousef); Almansoori, A (Almansoori, Ali); Elkamel, A (Elkamel, Ali)

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摘要: Reverse osmosis (RO) network design problem is presented in this study for seawater desalination. The RO pressure vessel is multiple spiral wound modules connected in series. We exploit in this study the RO pressure vessel operation by considering stream property variations within the pressure vessel itself. The design problem allows extraction of high-quality permeates from different locations along the pressure vessel length. Superstructure optimization is adopted to model the RO network in order to find: (1) optimal arrangement of the process units, (2) optimal permeate extraction locations, and (3) production of several permeate streams with different qualities. Several case studies are presented to show the applications of the proposed mathematical programming model. In general, lower treatment cost and higher permeate recovery can be achieved by allowing permeate extraction streams from the RO pressure vessels. (c) 2013 American Institute of Chemical Engineers AIChE J 60: 520-532, 2014

作者关键词: membrane separations; mathematical modeling; process synthesis

KeyWords Plus: WASTE-WATER TREATMENT; SEAWATER DESALINATION; OPTIMIZATION; SUPERSTRUCTURE; REDUCTION; SYSTEMS

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第 124 条, 共 145 条

标题: Nitrate reduction of brines from water desalination plants by membrane electrolysis

作者: Bosko, ML (Bosko, M. L.); Rodrigues, MAS (Rodrigues, M. A. S.); Ferreira, JZ (Ferreira, Jane Z.); Miro, EE (Miro, E. E.); Bernardes, AM (Bernardes, A. M.)

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摘要: The disposal of the saline effluent generated during membrane water desalination by electro dialysis (ED) or reverse osmosis (RO) is an increasing problem worldwide, especially for the desalination of inland brackish water. Electrolysis can be an alternative to the denitrification of brines by the reduction of nitrates to the desired product (N₂). Nevertheless, in a paired electrolysis cell the reduced products could be re-oxidized in the anode by the reverse reactions; for example, nitrite could be again converted to nitrate. Membrane electrolysis can avoid these reactions. The aim of this study was to assess the efficacy of the membrane electrolysis technique in the reduction of nitrate in water. The experiments were performed in an electrochemical cell with two compartments separated by a cation-exchange membrane, the cathode being made of copper and the anode of titanium oxide and ruthenium oxide (70TiO₂/30RuO₂). Nitrite, ammonium and nitrogen containing gases (most of them N₂) were the reaction products. The best value was achieved with a cell voltage of 9 V and an initial concentration of 526 mg/L of NO₃. Under these conditions, high conversion to nitrite and gaseous compounds was registered with the formation of just 7.8 mg/L of ammonium. (C) 2013 Elsevier B.V. All rights reserved

作者关键词: Membrane electrolysis; Nitrate reduction; Electrodialysis

KeyWords Plus: INNOVATIVE BENEFICIAL REUSE; DRINKING-WATER; ELECTRODIALYSIS PROCESS; PAIRED ELECTROLYSIS; REMOVAL; ELIMINATION; DENITRIFICATION; BIOREACTOR

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第 125 条, 共 145 条

标题: A preliminary study on the volume reduction of pre- treatment sludge in seawater desalination by forward osmosis

作者: Liyanaarachchi, S (Liyanaarachchi, S.); Jegatheesan, V (Jegatheesan, V.); Shu, L (Shu, L.); Muthukumaran, S (Muthukumaran, S.); Baskaran, K (Baskaran, K.)

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摘要: Forward Osmosis (FO) can be applied to recover water from the pre-treatment sludge of seawater reverse osmosis process. This study investigated the effect of the concentration of two draw solutions (MgCl₂ and NaCl) in the reduction of Fe(OH)₃ sludge volume and the effect of cross flow velocity on flux through FO membrane. Higher the concentration of NaCl and MgCl₂ higher the water flux observed. However, the percentage increase was not significant due to the occurrence of internal concentration polarisation. MgCl₂ draws marginally increased water flux than NaCl, when the conditions of feed and draw solutions were similar. Increase in cross flow velocity (from 0.25 to 1.0m/s) marginally changed the flux with both draw solutions as higher cross flow velocities were unproductive to beat the external CP effect along the membrane surface. However, at 1m/s, highest fluxes were obtained for both draw solutions.

作者关键词: Concentration polarisation; Desalination; Forward osmosis; Pre-treatment; Sludge

KeyWords Plus: AMMONIA-CARBON DIOXIDE; REVERSE-OSMOSIS; PROCESS PERFORMANCE; RO

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第 126 条, 共 145 条

标题: Applicability of flashing desalination technique for small scale needs using a novel integrated system coupled with nanofluid-based solar collector

作者: Kabeel, AE (Kabeel, A. E.); El-Said, EMS (El-Said, Emad M. S.)

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摘要: The present study introduces an attempt for the application of flash desalination technique for small scale needs. An integrated system uses a flashing desalination technique coupled with nano-fluid-based solar collector as a heat source has been made to investigate both the effect of different operating modes and that of the variation of functioning parameters and weather conditions on the fresh water production. The flashing unit is performed by similar construction design technique of commercial multi-stage flashing (MSF) plant. The thermal properties of working fluid in the solar collector have been improved by using different concentrated nano-particles. Cu nanoparticle is used in the modeling to determine the proper nano-fluid volume fraction that gives higher fresh water productivity. An economic analysis was conducted, since it affects the final cost of produced water, to determine the cost of fresh water production. Although a system may be technically very efficient, it may not be economical. The effect of different feed water and inlet cooling water temperatures on the system performance was studied. The mathematical model is developed to calculate the productivity of the system under different operating conditions. The proposed system gives a reasonable production of fresh water up to 7.7 l/m²/day under the operation conditions. Based on the cost of energy in Egypt, the estimated cost of the generated potable water was 11.68 US \$/m³. The efficiency of the system is measured by the gained output ratio (GOR) with day time. The gained output ratio (GOR) of the system reaches 1.058. The current study showed that the solar water heater collecting area is considered a significant factor for reducing the water production cost. Also, the produced water costs decrease with increasing the collecting area of the solar water heater. The volume fractions of nano-particle in solar collector working fluid have a significant impact on increasing the fresh water production and decreasing cost. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Flashing desalination; Solar collector; Nano-fluid

KeyWords Plus: CONVECTIVE HEAT-TRANSFER; WATER; DEHUMIDIFICATION; HUMIDIFICATION

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第 127 条, 共 145 条

标题: The control of MSF desalination plants based on inverse model control by neural network

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摘要: In this paper, a nonlinear inverse model control strategy based on neural network is proposed for MSF desalination plant. Artificial neural networks (ANNs) can handle complex and nonlinear process relationships, and are robust to noisy data. The designed neural networks consist of three layers identified from input-output data and trained with a descent gradient algorithm. The set point tracking performance of the proposed method was studied when the disturbance is present in the MSF system. Three controllers are designed for controlling the top brine temperature, the level of last stage and salinity. These results show that a neural network inverse model control strategy (NNINVMC) is robust and highly promising to be implemented in such nonlinear systems. Also the comparison between the top brine temperature of the proposed model and NN predicted data from the literature supports the accuracy of the model. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: MSF desalination; Neural network; Inverse model control

KeyWords Plus: SEAWATER

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第 128 条, 共 145 条

标题: Analysis of a single-effect mechanical vapor compression desalination system using water injected twin screw compressors

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摘要: The mechanical vapor compression (MVC) desalination system is very attractive and competitive for small and medium scale water production. This paper presents a comprehensive analysis of a single-effect MVC desalination system using water injected twin screw compressors. The operational characteristics of the twin screw compressor including inlet volume flow rate, compressor pressure ratio, and mass fraction of injected water are investigated. The specific power consumption and the specific heat transfer area of the MVC system are then analyzed based on these characteristics. The results are comparable with data reported in literature for similar single-effect MVC desalination systems. Further comparison is performed for a single-effect MVC system using a twin screw compressor with/without water injection. The results demonstrate that the single-effect MVC desalination system using water injected twin screw compressor is a very promising technology for water production capacities less than 600 m³/d. It also shows that the temperature difference between boiling vapor and compressed vapor at compressor exit can be as high as 10 degrees C. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Twin screw compressor; Mechanical vapor compression (MVC); Desalination; Water injection

KeyWords Plus: PLANTS; PERFORMANCE; ECONOMICS

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第 129 条, 共 145 条

标题: Preparation and characterization of silicon nitride hollow fiber membranes for seawater desalination

作者: Zhang, JW (Zhang, Jiang-Wei); Fang, H (Fang, Hong); Wang, JW (Wang, Jun-Wei); Hao, LY (Hao, Lu-Yuan); Xu, X (Xu, Xin); Chen, CS (Chen, Chu-Sheng)

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摘要: Porous silicon nitride hollow fiber membranes have been successfully prepared by a combined phase inversion and sintering method. First, stable Si₃N₄ suspensions were prepared by correlating the rheological properties with the type and concentration of dispersant, powder pretreatment and solids loading. Then the powders/binder ratio was optimized, considering the morphology, structure, permeation and mechanical properties of the hollow fiber membranes. When the ceramic powders/binder ratio was fixed at 7/1, the hollow fiber membranes showed a good combination of gas and water flux, bending strength, porosity and average pore size, which is very suitable for membrane distillation (MD) application. After the obtained membranes were chemically modified from hydrophilic to hydrophobic by grafting fluoroalkylsilane (FAS), their water desalination performances were tested using vacuum membrane distillation (VMD) and direct contact membrane distillation (DCMD). Both methods lead to satisfactory membrane distillation performances with a high flux and a salt rejection rate of 99-100%. The membranes also exhibited superior long-term stabilities in terms of the water flux and salt rejection rate. The novel Si₃N₄ hollow fiber membranes developed in this paper are promising for industrial applications. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Silicon nitride; Suspension; Hollow fiber; Membrane distillation; Desalination

KeyWords Plus: HYDROPHOBIC CERAMIC MEMBRANES; RHEOLOGICAL PROPERTIES; MASS-TRANSFER; DISTILLATION; SUSPENSIONS; FABRICATION; CONFIGURATIONS; POWDER

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第 130 条, 共 145 条

标题: Experimental investigation of a two-stage solar humidification-dehumidification desalination process

作者: Zamen, M (Zamen, M.); Soufari, SM (Soufari, S. M.); Vahdat, SA (Vahdat, S. Abbasian); Amidpour, M (Amidpour, M.); Zeinali, MA (Zeinali, M. A.); Izanloo, H (Izanloo, H.); Aghababaie, H (Aghababaie, H.)

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摘要: This paper experimentally evaluates a two-stage technique to improve the humidification-dehumidification process in fresh water production from brackish water. According to modeling results of multi-stage process and on the basis of construction cost estimation, using a two-stage process is the most suitable choice that can improve important parameters such as specific energy consumption, productivity and daily production per solar collector area and thus, investment cost. A pilot plant was designed and constructed in an arid area with 80 m² solar collector area to evaluate the two-stage process. This unit was tested on cold and hot days. The

effect of main parameters on fresh water production of the unit is studied. Experimental results show that two-stage HD desalination unit can increase heat recovery in condensers and hence, reduce thermal energy consumption and investment cost of the unit. Moreover, productivity can be increased by 20% compared with the single-stage unit. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Solar desalination; Humidification-dehumidification; Two-stage process

KeyWords Plus: PERFORMANCE OPTIMIZATION; UNIT; CYCLE

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第 131 条, 共 145 条

标题: Feasibility study and performance assessment for the integration of a steam-injected gas turbine and thermal desalination system

作者: Esfahani, IJ (Esfahani, Iman Janghorban); Yoo, C (Yoo, ChangKyoo)

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摘要: This study proposes a systematic approach for retrofitting a steam-injection gas turbine (SIGT) with a multieffect thermal vapor compression (METVC) desalination system. The retrofitted unit's product cost of the fresh water (RUPC) was used as a performance criterion, which comprises the thermodynamic, economic, and environmental attributes when calculating the total annual cost of the SIGT-METVC system. For the feasibility study of retrofitting the SIGT plant with the METVC desalination system, the effects of two key parameters were analyzed using response surface methodology (RSM) based on a central composite design (CCD): the steam air ratio (SR) and the temperature difference between the effects of the METVC system (ΔT -METVC) on the fresh water production (Q (freshwater)) and the net power generation (W -net) of the SIGT-METVC system. Multi-objective optimization (MOO) which minimizes the modified total annual cost (MTAC) and maximizes the fresh water flow rate was performed to optimize the RUPC of the SIGT-METVC system. The best Pareto optimal solution showed that the SIGT-METVC system with five effects is the best one among the systems with 4-6 effects. This system under optimal operating conditions can save 21.07% and 9.54% of the RUPC, compared to the systems with four and six effects, respectively. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Desalination; Feasibility study; METVC; RSM; Optimization; Retrofitting; SIGT

KeyWords Plus: MULTIOBJECTIVE OPTIMIZATION; POWER-SYSTEM; CYCLE; COMBUSTION; ANN; EXERGY; UNIT; TOOL

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第 132 条, 共 145 条

标题: The effect of spiral wound membrane element design characteristics on its performance in steady state desalination - A parametric study

作者: Karabelas, AJ (Karabelas, A. J.); Koutsou, CP (Koutsou, C. P.); Kostoglou, M (Kostoglou, M.)

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摘要: The spiral-wound membrane (SWM) element design variables include retentate- and permeate-spacer characteristics and number of membrane envelopes (or sheet width) for constant total area, in addition to membrane surface properties. The effect of these parameters (varying within realistic ranges) on the operating variables, comprising two-dimensional distribution of permeate flux, trans-membrane pressure (TMP), retentate- and permeate-side pressures and velocities, is systematically assessed. Advanced software is employed, capable of simulating SWM desalination performance with no recourse to empirical parameters. The parametric study involves typical cases of desalinating brackish and sea-water with 2000 mg/L and 40,000 mg/L TDS, respectively, in pressure vessels with seven 8-inch SWM-elements. The results show that low-pressure desalination modules are most sensitive to variations of geometric parameters. The effect of permeate-side fabric is significant, directly affecting TMP and module productivity. In both low- and high-pressure desalination, the effect of retentate-side spacer manifests itself mainly in the pressure drop across the element. The results confirm that the membrane width is very important, with short sheets exhibiting the best overall performance. Noteworthy is the insensitivity of high-pressure SWM-module productivity to significantly different design parameter-values, including envelope width. These results are helpful in guiding SWM element optimization and in setting priorities for related R&D work. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: SWM module; Parametric study; Brackish and sea-water desalination; Geometric design parameters; Retentate- and permeate-side spacer; Membrane envelope width

KeyWords Plus: SPACER GEOMETRICAL CHARACTERISTICS; REVERSE-OSMOSIS; SEAWATER DESALINATION; FILLED CHANNELS; MASS-TRANSFER; MODULES; SIMULATION; MODEL; FIELD; FLOW

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第 133 条, 共 145 条

标题: Use of beach galleries as an intake for future seawater desalination facilities in Florida and globally similar areas

作者: Missimer, TM (Missimer, Thomas M.); Maliva, RG (Maliva, Robert G.); Dehwah, AHA (Dehwah, Abdullah H. A.); Phelps, D (Phelps, Daniel)

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摘要: Desalination of seawater using the reverse osmosis process can be made less costly by the use of subsurface intake systems. Use of conventional open-ocean intakes requires the addition of a number of pretreatment processes to protect the primary RO process. Despite using the best designs possible for the pretreatment, seawater RO membranes tend to biofoul because of the naturally-occurring organic material and small bacteria present in seawater. These materials are not completely removed by the pretreatment system and they pass through the cartridge filters into the membranes, thereby causing frequent and expensive cleaning of the membranes. Quality of the raw water can be greatly improved by the use of subsurface intakes which can substantially reduce the overall treatment cost. There are a number of possible subsurface designs that can be used including conventional vertical wells, horizontal wells, collector wells, beach galleries, and seabed filters. The key selection criteria for the type of subsurface intake most suited and most cost-effective for a site are based on the required volume of raw water and the local geology. The active shorelines of Florida are very well-suited for the development of beach gallery intake systems. These systems are installed beneath the active beach between the high and low tide zones of the beach. Since they are constructed with a depth to the screens between 3 and 5m, they cannot be observed at surface and persons using the beach would be unaware of their existence. These galleries are simple to construct and they tend not to clog because the active wave action within the intertidal zone provides mechanical energy that continuously cleans the filter face. They also have other advantages, including: the water quality is seawater unaffected by substances present in freshwater aquifers occurring landward of the shoreline, the salinity of the water is generally constant, and there are no impacts on water users located inland from the shoreline. A comprehensive study of the grain size characteristics of Florida beaches has allowed an assessment to be made of the hydraulic conductivities of the Florida beach sands. Hydraulic conductivity values generally range from 1.8 to 24m/day, which is more than sufficient to allow the design and construction of high-capacity galleries at a reasonable cost. This type of intake is particularly relevant to the northeast Florida shoreline adjacent to an area being considered for development of a large-capacity seawater desalination system.

作者关键词: Seawater reverse osmosis; Desalination; Intake; Beach gallery; Design; Florida

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第 134 条, 共 145 条

标题: Thermal desalination in GCC and possible development

作者: Darwish, MA (Darwish, Mohamed Ali)

来源出版物: DESALINATION AND WATER TREATMENT 卷: 52 期: 1-3 页: 27-47 DOI: 10.1080/19443994.2013.808401 出版年: JAN 2 2014

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摘要: The Water Desalination and Reuse Center in King Abdulla University of Science and Technology, in Saudi Arabia, held a workshop on thermal desalination on the 11th and 12th of March, 2013. This paper was presented as part of a lecture at the workshop. It presents the status and possible developments of the two main thermal desalination systems processing large quantities of seawater in the Gulf Cooperation Council, multi-stage flash, and thermal vapor compression systems. Developments of these systems were presented to show how these systems are competing with the more energy-efficient seawater reverse osmosis desalting.

作者关键词: Multi-stage flash desalting systems; Desalination; Multi-effect; Thermal vapor compression; Falling film evaporators; Top brine temperature; Pumping energy; Gain ratio; Performance ratio; Equivalent work; Feed salinity; Brine salinity

KeyWords Plus: NANOFILTRATION; MSF

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第 135 条, 共 145 条

标题: Dual-stage nanofiltration seawater desalination: water quality, scaling and energy consumption

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摘要: A dual-stage nanofiltration (NF) seawater desalination process was investigated as a novel seawater desalination technology, focusing not only on the permeate water quality, but also on the scaling possibility and energy consumption. Dow Filmtec(TM) NF90 was used in the experiment for its high rejection of total dissolved solids (TDS). The results show that the permeate TDS from the second stage could be as low as 200mg/L under an optimized condition. The operating pressures were only 3.5MPa in the first stage and 2.0MPa in the second stage. Operation pressure had the most significant effects on water permeate flux and TDS. Several indices were calculated to investigate scaling probability. The results indicate that scaling could occur in the first stage. Thus, a prevention method would be needed. The effects of the operating parameters on the energy consumption were also examined. The results indicate that dual-stage NF seawater desalination is a feasible technology in the view of water quality and energy consumption.

作者关键词: Dual-stage nanofiltration (NF); Seawater desalination; Scaling; Energy consumption

KeyWords Plus: DEWVAPORATION TECHNIQUE; PERFORMANCE; TECHNOLOGIES; PRETREATMENT; MEMBRANE

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第 136 条, 共 145 条

标题: Dispersion of desalination plant brine discharge under varied hydrodynamic conditions in the south of Gran Canaria

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摘要: Brine discharged directly into the sea from desalination processes, forms a very dense plume that spreads out over the sea floor following the steepest slope due to its greater density than ambient sea water. Because the large difference in density slows down brine dilution processes in ambient sea water, hypersaline plumes spread out over broad areas and affect the benthic communities in their path. The Maspalomas II desalination plant, in the south of the island of Gran Canaria (Canary Islands-Spain), discharges brine through an underwater outfall over a wide sandy bottom with a mild slope. The behavior of this brine discharge was characterized under various hydrodynamic conditions. A higher degree of hydrodynamic exposure favored dilution of the outer edges of the plume, helping to reduce the area of influence.

作者关键词: Desalination; Brine; Discharge; Outfall; Plume; Hydrodynamic conditions; Dilution; Dispersion

KeyWords Plus: SEAGRASS POSIDONIA-OCEANICA; SALINITY; SURVIVAL; ISLANDS; GROWTH

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第 137 条, 共 145 条

标题: Water desalination using humidification/dehumidification (HDH) technique powered by solar energy: a detailed review

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摘要: Water and energy are two of the most important topics on the international environment and development agenda. The social and economic health of the modern world depends on sustainable supply of both energy and water. Many areas worldwide that suffer from fresh water shortage are increasingly dependent on desalination as a highly reliable and nonconventional source of fresh water. So, desalination market has greatly expanded in recent decades and expected to continue in the coming years. In the developing world, water scarcity led to the pressing need to develop



inexpensive, decentralized small-scale desalination technologies that use renewable resources of energy. This study reviews one of the most promising of these technologies, humidification-dehumidification (HDH) desalination powered by solar energy. The different types of HDH cycle design and its constituents (humidifier, solar heaters, and dehumidifiers) have been investigated. The review also includes water sources, demand, availability of potable water and purification methods. It is concluded that HDH technology is a promise process for decentralized small-scale water production applications, but it needs additional research and development to enhance the system efficiency and economy.

作者关键词: Water desalination; Humidification-dehumidification; Solar-driven

KeyWords Plus: HUMIDIFICATION-DEHUMIDIFICATION CYCLE; SEAWATER DESALINATION; PERFORMANCE; UNIT; DISTILLATION; SYSTEM; DRIVEN; PLANT; TECHNOLOGIES; OSMOSIS

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第 138 条, 共 145 条

标题: Salt recovery from brine generated by large-scale seawater desalination plants

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摘要: Water shortages in the Middle East and North Africa (MENA) region countries mandate the installation of large-scale desalination plants. Concentrate management requires properly operated cost-effective technologies to reduce the environmental impacts arising from brine discharge. Significant improvement in economics may be obtained by the recovery of chemicals from brines. This study addresses the management of modular brine streams generated from large-scale reverse osmosis desalination plants with microfiltration and nanofiltration (NF) as pretreatment stages. Appropriate salt recovery schemes have been identified and analyzed from the performance and environmental points of view. The economics of salt recovery schemes from NF and reverse osmosis (RO) brine based on evaporation ponds, brine evaporator and membrane crystallizer (MCR) are analyzed and compared. Phased application of the salt recovery program is considered. The results indicate that using NF as pretreatment and adopting salt recovery schemes provide higher water recovery in addition to producing valuable products. The adoption of MCR has high prospects for application in salt recovery from desalination brine. Increasing the capacities of salt recovery systems offers both technical and economic merits.

作者关键词: Salt recovery; Brine; Desalination; Membrane crystallizer; Evaporator; Techno-economics

KeyWords Plus: AIDED INTENSIFIED EVAPORATION; NANOFILTRATION MEMBRANES; INTEGRATED-SYSTEM; SWRO; WAIV; PRETREATMENT; PERFORMANCE; OPERATIONS; REDUCTION; VOLUME

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第 139 条, 共 145 条

标题: Brackish water desalination in the Algerian Sahara-Plant design considerations for optimal resource exploitation

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摘要: A huge geothermal aquifer is located in the northern Algerian Sahara, with brackish water free from toxic inorganic compounds and organic matter. Therefore, this water is appropriate for good quality potable water production after partial desalination. This paper deals with the basic desalination plant design considerations in the context of overall optimal aquifer exploitation. The main types of criteria for such optimization are economic and environmental. Implementing the concept of "blending" reservoir water (at appropriate proportion) with desalinated water, allows cost-effective and environmentally attractive resource exploitation; the latter would be achieved by reinjecting the retentate (after desalination) free from any chemicals that may degrade the reservoir water quality by accumulation over the years. Results are summarized of a typical case study based on low pressure reverse osmosis (RO) membrane desalination. Key RO membrane performance data from a pilot unit are employed in support of this study. The results highlight the main features and the constraints in plant design and desalinated water recovery; constraints are mainly imposed by the need to avoid membrane scaling with no use of undesirable synthetic anti-scalants. The proposed cost-effective plant configuration and operating mode are in accord with the overall optimum resource exploitation. A cost analysis is also performed for a typical potable water production plant. Finally, possibilities are outlined of integrated exploitation of this geothermal reservoir, whereby energy is extracted in addition to potable water production.

作者关键词: Brackish water membrane desalination; Albian geothermal aquifer; Optimization of reservoir exploitation; Retentate reinjection; Membrane scaling restrictions

KeyWords Plus: SPACER GEOMETRICAL CHARACTERISTICS; RENEWABLE ENERGIES; FILLED CHANNELS; POLICY; RO

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第 140 条, 共 145 条

标题: Development strategies and solar thermal energy utilization for water desalination systems in remote regions: a review

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来源出版物: DESALINATION AND WATER TREATMENT 卷: 52 期: 22-24 页: 4053-4070 DOI: 10.1080/19443994.2013.808394 出版年: 2014



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摘要: This paper reviews the current solar thermal desalination research activities with systems production in the range of 10-150 liter/day for remote or arid regions. A comparative study between different sustainable efforts in such solar thermal desalination systems as well as economics has been done. Throughout the review, the results indicated that most of the reviewed systems are in research stage and have not clear economical feasibility such as the price per cubic meter of water which may stimulates the decision-maker to direct these studies into the actual commercial applications. Also, the review showed that although many developed systems have several novel and valuable features, more efforts are required to further investigate more efficient, economical, and applicable solar thermal energy-driven desalination systems. Small production systems as solar stills and HDH can be used if fresh water demand is low and the land are available at low cost. The economical analyses carried out so far have not been able to provide a strong basis for comparing economic viability of each desalination technology. It is difficult, if not impossible, to assess the economic performance of a particular technology and compare it with others because of the differences of system capacities, locations, system technologies, and water sources.

作者关键词: Solar energy; Solar thermal desalination; Remote regions

KeyWords Plus: HUMIDIFICATION-DEHUMIDIFICATION DESALINATION; SMALL-SCALE DESALINATION; SEAWATER DESALINATION; HEAT-RECOVERY; ARID AREAS; PERFORMANCE EVALUATION; ECONOMIC-EVALUATION; DRINKING-WATER; STORAGE; UNIT

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第 141 条, 共 145 条

标题: Recent Progress of Research and Development of Adsorption Desalination

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摘要: The large carbon footprint' of traditional desalination technologies has spurred interest in several potential alternative technologies that exploit low-grade heat such as waste heat or solar energy. This paper is concerned with one of these alternatives: adsorption-based desalination (AD), which generates potable water and, depending on the cycle details, cooling as well. In this paper, the recent progress on the research and development of the AD technology at the University of Adelaide has been reviewed. Theoretical studies on AD performed there include the development of thermodynamic and kinetic mathematical models, which elucidate the effect of operational and design parameters (e. g., operating heating/cooling water temperatures and cycle times) on the nature of the thermodynamic cycles and performance (i.e., system water productivity and specific energy consumptions) of AD. A series of experiments has been designed and undertaken to validate these models. In addition, the current development status in the AD area in the world is also briefed in the paper.

作者关键词: Adsorption Desalination; Research and Development; Cycles; Silica Gel; Cooling

KeyWords Plus: COOLING SYSTEM; HEAT-RECOVERY; MASS-TRANSFER; PERFORMANCE; CHILLER; MODEL; SIMULATION; MACHINE; CYCLE

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第 142 条, 共 145 条

标题: Simulation of a forward feed multiple effect desalination plant with vertical tube evaporators

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摘要: In recent years, vertical tube falling film evaporators have been widely used in desalination industries. In this paper mathematical modeling of a multiple effect evaporators (MEE) system has been carried out for brackish water desalination. The system includes a set of forward feed vertical tube evaporators with thermal vapor compression (TVC) and a condenser. Modeling has led to calculation of several parameters such as overall heat transfer coefficients, entrainment ratio and recovery of the process which is restricted by scale formation. A scaling prediction chemical model has been employed to calculate the allowable rate of recovery for prevention of scale formation. Physical properties of streams have been assumed as functions of temperature and salinity. A code has been developed for simulation of the process based on mass and energy balance equations. Results showed maximum allowable recovery of 74% for the treated brackish water sample with total dissolved solid (TDS) of 14,761 ppm is achievable. Dealing with mentioned sample under specified set of conditions, it was concluded that changing the number of effects from 3 to 8, enhances gained output ratio (GOR) value from 3.8 to 7.5. However, specific heat transfer surface is increased from 215 to 1052. (C) 2013 Elsevier B.V. All rights reserved.

作者关键词: Forward feed; Falling film; Entrainment ratio; Fouling; Brackish water; Vertical tube evaporator

KeyWords Plus: ZERO LIQUID DISCHARGE; BOILING HEAT-TRANSFER; STEAM JET EJECTORS; MED-TVC; REVERSE-OSMOSIS; WATER; SYSTEMS; OPTIMIZATION; RECOVERY; DESIGN

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第 143 条, 共 145 条

标题: Ultrafiltration as a pretreatment for seawater desalination: A review

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摘要: Reverse Osmosis (RO) desalination has gained wide and increasing acceptance around the world as a straightforward undertaking to alleviate the alarming water crisis. An enhanced monitoring of the quality of the water feeding in seawater RO (SWRO) plant through the application of an effective pretreatment option is one of the keys to the success of RO technology in desalination plants. Over the past 10 years, advances in ultrafiltration (UF) membrane technologies in application for water and wastewater treatment have prompted an impetus for using membrane pretreatment in seawater desalination plants. By integrating SWRO plant with UF pretreatment, the rate of membrane fouling can be significantly reduced and thus extend the life of RO membrane. With the growing importance and significant advances attained in UF pretreatment, this review



presents an overview of UF pretreatment in SWRO plants. The advantages offered by UF as an alternative of pretreatment option are compared to the existing conventionally used technologies. The current progress made in the integration of SWRO with UF pretreatment is also highlighted. Finally, the recent advances pursued in UF technology is reviewed in order to provide an insight and hence path the way for the future development of this technology.

作者关键词: reverse osmosis; desalination; pretreatment; ultrafiltration; integrated membrane system; fouling; seawater

KeyWords Plus: NATURAL ORGANIC-MATTER; THIN-FILM COMPOSITE; REVERSE-OSMOSIS; FUTURE-PROSPECTS; CARBON NANOTUBES; WATER-TREATMENT; COMB COPOLYMER; MEMBRANE; PERFORMANCE; TECHNOLOGY

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第 144 条, 共 145 条

标题: Utilization of solar energy for direct contact membrane distillation process: An experimental study for desalination of real seawater

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摘要: Membrane distillation (MD), a non-isothermal membrane separation process, is based on the phenomenon that pure water in its vapor state can be extracted from aqueous solutions by passing vapor through a hydrophobic microporous membrane when a temperature difference is established across it. We used three commercially available hydrophobic microporous membranes (C02, C07 and C12; based on the pore size 0.2, 0.7 and 1.2 μm respectively) for desalination via direct contact MD (DCMD). The effects of operating parameters on permeation flux were studied. In addition, the desalination of seawater by solar assisted DCMD process was experimentally investigated. First, using solar power only short-term (one day), successful desalination of real seawater was achieved without temperature control under the following conditions: feed inlet temperature 65.0 A degrees C, permeate inlet temperature 25.0 A degrees C, and a flow rate of 2.5 L/min. The developed system also worked well in the long-term (150 days) for seawater desalination using both solar and electric power. Long-term test flux was reduced from 28.48 to only 26.50 L/m(2)hr, indicating system feasibility.

作者关键词: Direct Contact Membrane Distillation; Solar Energy; Permeation Flux; Salt Rejection

KeyWords Plus: WATER DESALINATION; MICROPOROUS MEMBRANES; SYSTEM; EVAPORATION; EFFICIENCY; TRANSPORT; COST

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标题: Synthesis of a Polyaminophosphonate and Its Evaluation as an Antiscalant in Desalination Plant

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摘要: The cationic monomer, N,N-diallyl-3-(diethylphosphonato)propylammonium chloride, was cyclopolymerized in aqueous solutions using t-butylhydroperoxide (TBHP) or ammonium persulfate (APS) as initiators to afford a cationic polyelectrolyte (CPE) having a (diethylphosphonato)propyl pendent. The CPE on acidic hydrolysis of the diester groups gave pH-responsive polyzwitterionic acid (PZA) which on treatment with one and two equivalents NaOH gave zwitterionic/anionic polyelectrolyte (ZAPE) and dianionic polyelectrolyte (DAPE), respectively. The solution properties of the CPE, PZA, ZAPE, and DAPE were investigated in detail by viscometric technique. For the purpose of comparison, the solution properties of the polymers were correlated to a structurally similar polyzwitterion (PZ) having monoethylphosphonate and NH⁺ groups. When performance evaluation was carried out for application in reverse osmosis (RO) plants, DAPE at a concentration of 10 ppm in brackish water feed proved very effective as an inhibitor against calcium sulfate scale. POLYM. ENG. SCI., 54:166-174, 2014. (c) 2013 Society of Plastics Engineers

KeyWords Plus: PH-RESPONSIVE POLYMER; FAST-ION CONDUCTION; ZWITTERIONIC POLYMERS; ACID-RESIDUES; POLYAMPHOLYTE; CYCLOPOLYMERIZATION; POLYMERIZATIONS; CHLORIDE; CHAIN; WATER

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