

## DAFTAR PUSTAKA

- Agboola, O., Maree, J., Kolesnikov, A., Mbaya, R., & Sadiku, R. (2015). Theoretical performance of nanofiltration membranes for wastewater treatment. *Environ Chem Lett*, 11.
- Ainscough, T. J., Oatley-Radcliffe, D. L., & Barron, A. R. (2021). Groundwater Remediation of Volatile Organic Compounds Using Nanofiltration and Reverse Osmosis Membranes—A Field Study. *Membranes*, 11(1), 61. <https://doi.org/10.3390/membranes11010061>
- Ali, F. A. A., Alam, J., Shukla, A. K., Almutairi, Z. A., & Alhoshan, M. (2022). Assessing the properties of thin-film nanocomposite membrane embedded with GO nanosheets using the DSPM-DE model. *Journal of Materials Research and Technology*, 19, 74–90. <https://doi.org/10.1016/j.jmrt.2022.05.029>
- Anderson, A., & Rezaie, B. (2019). Geothermal technology: Trends and potential role in a sustainable future. *Applied Energy*, 248, 18–34. <https://doi.org/10.1016/j.apenergy.2019.04.102>
- Artuğ, G. (2007). Modelling and Simulation of Nanofiltration Membranes. *Cuvillier Verlag*, 248.
- Artuğ, G., Roosmasari, I., Richau, K., & Hapke, J. (2007). A Comprehensive Characterization of Commercial Nanofiltration Membranes. *Separation Science and Technology*, 42(13), 2947–2986. <https://doi.org/10.1080/01496390701560082>
- Badertscher, Martin, Bühlman, P., & Pretsch, E. (2009). *Structure Determination of Organic Compounds: Tables of Spectral Data*. Springer Berlin Heidelberg. <https://doi.org/10.1007/978-3-540-93810-1>
- Bandini, S., Drei, J., & Vezzani, D. (2005). The role of pH and concentration on the ion rejection in polyamide nanofiltration membranes. *Journal of Membrane Science*, 264(1–2), 65–74. <https://doi.org/10.1016/j.memsci.2005.03.054>
- Bargeman, G. (2021). Recent developments in the preparation of improved nanofiltration membranes for extreme pH conditions. *Separation and Purification Technology*, 279, 119725. <https://doi.org/10.1016/j.seppur.2021.119725>
- Cassano, A., Cabri, W., Mombelli, G., Peterlongo, F., & Giorno, L. (2016). Recovery of bioactive compounds from artichoke brines by nanofiltration. *Food and Bioproducts Processing*, 98, 257–265. <https://doi.org/10.1016/j.fbp.2016.02.004>
- Christmann, P., Gloaguen, E., Labbé, J.-F., Melleton, J., & Piantone, P. (2015). Global Lithium Resources and Sustainability Issues. In *Lithium Process Chemistry* (pp. 1–40). Elsevier. <https://doi.org/10.1016/B978-0-12-801417-2.00001-3>
- Dalwani, M., Benes, N. E., Bargeman, G., Stamatialis, D., & Wessling, M. (2010). A method for characterizing membranes during nanofiltration at extreme pH. *Journal of Membrane Science*, 363(1–2), 188–194. <https://doi.org/10.1016/j.memsci.2010.07.025>
- Dutta, A. (2017). Fourier Transform Infrared Spectroscopy. In *Spectroscopic Methods for Nanomaterials Characterization* (pp. 73–93). Elsevier. <https://doi.org/10.1016/B978-0-323-46140-5.00004-2>
- Efligenir, A., Fievet, P., Déon, S., & Salut, R. (2015). Characterization of the isolated active layer of a NF membrane by electrochemical impedance spectroscopy. *Journal of Membrane Science*, 477, 172–182. <https://doi.org/10.1016/j.memsci.2014.12.044>

- Epsztein, R., DuChanois, R. M., Ritt, C. L., Noy, A., & Elimelech, M. (2020). Towards single-species selectivity of membranes with subnanometre pores. *Nature Nanotechnology*, 15(6), 426–436. <https://doi.org/10.1038/s41565-020-0713-6>
- Fang, J., & Deng, B. (2014). Rejection and modeling of arsenate by nanofiltration: Contributions of convection, diffusion and electromigration to arsenic transport. *Journal of Membrane Science*, 453, 42–51. <https://doi.org/10.1016/j.memsci.2013.10.056>
- FilmTec, T. M. (2022). *FilmTec™ Reverse Osmosis Membranes Technical Manual*. Dupont Water Solutions.
- Gao, L., Wang, H., Zhang, Y., & Wang, M. (2020). Nanofiltration Membrane Characterization and Application: Extracting Lithium in Lepidolite Leaching Solution. *Membranes*, 10(8), 178. <https://doi.org/10.3390/membranes10080178>
- Ghosh, S., Prasanna, V. L., Sowjanya, B., Srivani, P., Alagaraja, M., & David, D. (2013). *Inductively Coupled Plasma–Optical Emission Spectroscopy: A Review*. 3(1), 11.
- Gozálvez-Zafrilla, J. M., & Santafé-Moros, A. (2008). *Nanofiltration Modeling Based on the Extended Nernst-Planck Equation under Different Physical Modes*. 7.
- Haynes, W. M., David, D. R., & Bruno, T. J. (2016). *CRC Handbook of Chemistry and Physics*. 2643.
- He, Z., Cui, H., Hao, S., Wang, L., & Zhou, J. (2018). Electric-Field Effects on Ionic Hydration: A Molecular Dynamics Study. *The Journal of Physical Chemistry B*, 122(22), 5991–5998. <https://doi.org/10.1021/acs.jpcc.8b02773>
- Herdianita, N. R., Sucipta, I. G. B. E., & Kencana, A. Y. (2017). *Lithium in Brine Waters from The Indonesian Geothermal Systems: Could It Meet The National Needs of Making Lithium Batteries?* 7.
- Hubach, T., Pillath, M., Knaup, C., Schlüter, S., & Held, C. (2023). Li<sup>+</sup> Separation from Multi-Ionic Mixtures by Nanofiltration Membranes: Experiments and Modeling. *Modelling*, 4(3), 408–425. <https://doi.org/10.3390/modelling4030024>
- Huotari, H. M., Trägårdh, G., & Huisman, I. H. (1999). Crossflow Membrane Filtration Enhanced by an External DC Electric Field: A Review. *Chemical Engineering Research and Design*, 77(5), 461–468. <https://doi.org/10.1205/026387699526304>
- Ida, S. (2014). PES (Poly(ether sulfone)), Polysulfone. In S. Kobayashi & K. Müllen (Eds.), *Encyclopedia of Polymeric Nanomaterials* (pp. 1–8). Springer Berlin Heidelberg. [https://doi.org/10.1007/978-3-642-36199-9\\_238-1](https://doi.org/10.1007/978-3-642-36199-9_238-1)
- Ji, Y., Choi, Y. J., Fang, Y., Pham, H. S., Nou, A. T., Lee, L. S., Niu, J., & Warsinger, D. M. (2023). Electric Field-Assisted Nanofiltration for PFOA Removal with Exceptional Flux, Selectivity, and Destruction. *Environmental Science & Technology*, 57(47), 18519–18528. <https://doi.org/10.1021/acs.est.2c04874>
- Kowalik-Klimczak, A., Zalewski, M., & Gierycz, P. (2015). Experimental and modelling analysis of the separation of ionic salts solution in nanofiltration process. *Environmental Sciences*, 6.
- Labban, O., Liu, C., Chong, T. H., & Lienhard V, J. H. (2017). Fundamentals of low-pressure nanofiltration: Membrane characterization, modeling, and understanding the multi-ionic interactions in water softening. *Journal of Membrane Science*, 521, 18–32. <https://doi.org/10.1016/j.memsci.2016.08.062>
- Lefrou, C., Fabry, P., & Poignet, J.-C. (2012). *Electrochemistry*. Springer Berlin Heidelberg. <https://doi.org/10.1007/978-3-642-30250-3>
- Li, C., Meckler, S. M., Smith, Z. P., Bachman, J. E., Maserati, L., Long, J. R., & Helms, B. A. (2018). Engineered Transport in Microporous Materials and Membranes for Clean Energy Technologies. *Advanced Materials*, 30(8), 1704953. <https://doi.org/10.1002/adma.201704953>



- Li, Q., Liu, H., He, B., Shi, W., Ji, Y., Cui, Z., Yan, F., Mohammad, Y., & Li, J. (2022). Ultrahigh-efficient separation of  $Mg^{2+}/Li^{+}$  using an in-situ reconstructed positively charged nanofiltration membrane under an electric field. *Journal of Membrane Science*, 641, 119880. <https://doi.org/10.1016/j.memsci.2021.119880>
- Li, Q., Liu, H., Ji, Y., Cui, Z., Yan, F., Younas, M., Li, J., & He, B. (2022). Efficiently rejecting and concentrating  $Li^{+}$  by nanofiltration membrane under a reversed electric field. *Desalination*, 535, 115825. <https://doi.org/10.1016/j.desal.2022.115825>
- Li, X., Zhang, C., Zhang, S., Li, J., He, B., & Cui, Z. (2015). Preparation and characterization of positively charged polyamide composite nanofiltration hollow fiber membrane for lithium and magnesium separation. *Desalination*, 369, 26–36. <https://doi.org/10.1016/j.desal.2015.04.027>
- Li, Y., Zhao, Y., Wang, H., & Wang, M. (2019). The application of nanofiltration membrane for recovering lithium from salt lake brine. *Desalination*, 468, 114081. <https://doi.org/10.1016/j.desal.2019.114081>
- Liu, H., Li, Q., He, B., Sun, Z., Yan, F., Cui, Z., & Li, J. (2021). High-Efficiency Separation of  $Mg^{2+}/Sr^{2+}$  through a NF Membrane under Electric Field. *Membranes*, 12(1), 57. <https://doi.org/10.3390/membranes12010057>
- Liu, Q., Wu, X., Xie, Z., & Zhang, K. (2022). Construction of PPSU-MoS<sub>2</sub>/PA-MIL-101(Cr) Membrane with Highly Enhanced Permeance and Stability for Organic Solvent Nanofiltration. *Membranes*, 12(7), 639. <https://doi.org/10.3390/membranes12070639>
- López, J., Gibert, O., & Cortina, J. L. (2023). The role of nanofiltration modelling tools in the design of sustainable valorisation of metal-influenced acidic mine waters: The Aznalcóllar open-pit case. *Chemical Engineering Journal*, 451, 138947. <https://doi.org/10.1016/j.cej.2022.138947>
- Luo, H., Peng, H., & Zhao, Q. (2022). High flux  $Mg^{2+}/Li^{+}$  nanofiltration membranes prepared by surface modification of polyethylenimine thin film composite membranes. *Applied Surface Science*, 579, 152161. <https://doi.org/10.1016/j.apsusc.2021.152161>
- Marecka-Migacz, A., Mitkowski, P. T., Nędzarek, A., Różański, J., & Szaferski, W. (2020). Effect of pH on Total Volume Membrane Charge Density in the Nanofiltration of Aqueous Solutions of Nitrate Salts of Heavy Metals. *Membranes*, 10(9), 235. <https://doi.org/10.3390/membranes10090235>
- Martin, G., Rentsch, L., Höck, M., & Bertau, M. (2017). Lithium market research – global supply, future demand and price development. *Energy Storage Materials*, 6, 171–179. <https://doi.org/10.1016/j.ensm.2016.11.004>
- Mazzoni, C., Bruni, L., & Bandini, S. (2007). Nanofiltration: Role of the Electrolyte and pH on Desal DK Performances. *Industrial & Engineering Chemistry Research*, 46(8), 2254–2262. <https://doi.org/10.1021/ie060974l>
- Ministry of Energy and Mineral Resources Republic of Indonesia. (2021). *Handbook of Energy & Economic Statistics of Indonesia 2021*. Ministry of Energy and Mineral Resources Republic of Indonesia. <https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-and-economic-statistics-of-indonesia-2021.pdf>
- Mohamed, M. A., Jaafar, J., Ismail, A. F., Othman, M. H. D., & Rahman, M. A. (2017). Fourier Transform Infrared (FTIR) Spectroscopy. In *Membrane Characterization* (pp. 3–29). Elsevier. <https://doi.org/10.1016/B978-0-444-63776-5.00001-2>
- Moliner-Salvador, R., Sánchez, E., Celades, I., Deratani, A., & Palmeri. (2018). *Nanofiltration treatment for boron removal from ceramic industry wastewater*.

- Moura Bernardes, A., Siqueira Rodrigues, M. A., & Zoppas Ferreira, J. (Eds.). (2014). *Electrodialysis and Water Reuse: Novel Approaches*. Springer Berlin Heidelberg. <https://doi.org/10.1007/978-3-642-40249-4>
- Nicolini, J. V., Borges, C. P., & Ferraz, H. C. (2016). Selective rejection of ions and correlation with surface properties of nanofiltration membranes. *Separation and Purification Technology*, 171, 238–247. <https://doi.org/10.1016/j.seppur.2016.07.042>
- Nur, A. I., & Kurniawan, A. D. (2021). Proyeksi Masa Depan Kendaraan Listrik di Indonesia: Analisis Perspektif Regulasi dan Pengendalian Dampak Perubahan Iklim yang Berkelanjutan. *Jurnal Hukum Lingkungan Indonesia*, 7(2), 197–220. <https://doi.org/10.38011/jhli.v7i2.260>
- Oatley, D. L., Llenas, L., Aljohani, N. H. M., Williams, P. M., Martínez-Lladó, X., Rovira, M., & de Pablo, J. (2013). Investigation of the dielectric properties of nanofiltration membranes. *Desalination*, 315, 100–106. <https://doi.org/10.1016/j.desal.2012.09.013>
- Oatley, D. L., Llenas, L., Pérez, R., Williams, P. M., Martínez-Lladó, X., & Rovira, M. (2012). Review of the dielectric properties of nanofiltration membranes and verification of the single oriented layer approximation. *Advances in Colloid and Interface Science*, 173, 1–11. <https://doi.org/10.1016/j.cis.2012.02.001>
- Pal, P., Bhakta, P., & Kumar, R. (2014). Cyanide Removal from Industrial Wastewater by Cross-Flow Nanofiltration: Transport Modeling and Economic Evaluation. *Water Environment Research*, 86(8), 698–706. <https://doi.org/10.2175/106143014X13975035525744>
- Pandyaswargo, A. H., Wibowo, A. D., Maghfiroh, M. F. N., Rezaqita, A., & Onoda, H. (2021). The Emerging Electric Vehicle and Battery Industry in Indonesia: Actions around the Nickel Ore Export Ban and a SWOT Analysis. *Batteries*, 7(4), 80. <https://doi.org/10.3390/batteries7040080>
- Pérez-González, A., Ibáñez, R., Gómez, P., Urtiaga, A. M., Ortiz, I., & Irabien, J. A. (2015). Nanofiltration separation of polyvalent and monovalent anions in desalination brines. *Journal of Membrane Science*, 473, 16–27. <https://doi.org/10.1016/j.memsci.2014.08.045>
- Purkait, M. K., & Singh, R. (2018). *Membrane technology in separation science*. Taylor & Francis.
- Purnomo, B. J., & Pichler, T. (2014). Geothermal systems on the island of Java, Indonesia. *Journal of Volcanology and Geothermal Research*, 285, 47–59. <https://doi.org/10.1016/j.jvolgeores.2014.08.004>
- Ramdani, A., Deratani, A., Taleb, S., Drouiche, N., & Lounici, H. (2021). Performance of NF90 and NF270 commercial nanofiltration membranes in the defluoridation of Algerian brackish water. *Desalination and Water Treatment*, 212, 286–296. <https://doi.org/10.5004/dwt.2021.26680>
- Roy, Y., Warsinger, D. M., & Lienhard, J. H. (2017). Effect of temperature on ion transport in nanofiltration membranes: Diffusion, convection and electromigration. *Desalination*, 420, 241–257. <https://doi.org/10.1016/j.desal.2017.07.020>
- Salafudin, S. (2021). Sumberdaya Alam Lithium Indonesia. *Jurnal Rekayasa Hijau*, 5(2), 178–187. <https://doi.org/10.26760/jrh.v5i2.178-187>
- Shen, Y., & Badireddy, A. R. (2021). A Critical Review on Electric Field-Assisted Membrane Processes: Implications for Fouling Control, Water Recovery, and Future Prospects. *Membranes*, 11(11), 820. <https://doi.org/10.3390/membranes11110820>





- Speight, J. G. (2020). The properties of water. In *Natural Water Remediation* (pp. 53–89). Elsevier. <https://doi.org/10.1016/B978-0-12-803810-9.00002-4>
- Suhalim, N. S., Kasim, N., Mahmoudi, E., Shamsudin, I. J., Mohammad, A. W., Mohamed Zuki, F., & Jamari, N. L.-A. (2022). Rejection Mechanism of Ionic Solute Removal by Nanofiltration Membranes: An Overview. *Nanomaterials*, 12(3), 437. <https://doi.org/10.3390/nano12030437>
- Sun, M., Wang, X., Winter, L. R., Zhao, Y., Ma, W., Hedtke, T., Kim, J.-H., & Elimelech, M. (2021). Electrified Membranes for Water Treatment Applications. *ACS ES&T Engineering*, 1(4), 725–752. <https://doi.org/10.1021/acsestengg.1c00015>
- Sun, S.-Y., Cai, L.-J., Nie, X.-Y., Song, X., & Yu, J.-G. (2015). Separation of magnesium and lithium from brine using a Desal nanofiltration membrane. *Journal of Water Process Engineering*, 7, 210–217. <https://doi.org/10.1016/j.jwpe.2015.06.012>
- Susanto, H., Nur, Rokhati, & Santosa, G. W. (2015). Development of Traditional Salt Production Process for Improving Product Quantity and Quality in Jepara District, Central Java, Indonesia. *Procedia Environmental Sciences*, 23, 175–178. <https://doi.org/10.1016/j.proenv.2015.01.027>
- Tansel, B. (2012). Significance of thermodynamic and physical characteristics on permeation of ions during membrane separation: Hydrated radius, hydration free energy and viscous effects. *Separation and Purification Technology*, 86, 119–126. <https://doi.org/10.1016/j.seppur.2011.10.033>
- Tansel, B., Sager, J., Rector, T., Garland, J., Strayer, R. F., Levine, L., Roberts, M., Hummerick, M., & Bauer, J. (2006). Significance of hydrated radius and hydration shells on ionic permeability during nanofiltration in dead end and cross flow modes. *Separation and Purification Technology*, 51(1), 40–47. <https://doi.org/10.1016/j.seppur.2005.12.020>
- Tkachenko, Y., & Niedzielski, P. (2022). FTIR as a Method for Qualitative Assessment of Solid Samples in Geochemical Research: A Review. *Molecules*, 27(24), 8846. <https://doi.org/10.3390/molecules27248846>
- Tsai, Y.-T., Yu-Chen Lin, A., Weng, Y.-H., & Li, K.-C. (2010). Treatment of Perfluorinated Chemicals by Electro-Microfiltration. *Environmental Science & Technology*, 44(20), 7914–7920. <https://doi.org/10.1021/es101964y>
- Uragami, T. (2017). *Science and Technology of Separation Membranes*. John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781118932551>
- USGS. (2022). Mineral commodity summaries 2022. In *Mineral Commodity Summaries* (2022). U.S. Geological Survey. <https://doi.org/10.3133/mcs2022>
- Vieira, G. S., Moreira, F. K. V., Matsumoto, R. L. S., Michelon, M., Filho, F. M., & Hubinger, M. D. (2018). Influence of nanofiltration membrane features on enrichment of jussara ethanolic extract (*Euterpe edulis*) in anthocyanins. *Journal of Food Engineering*, 226, 31–41. <https://doi.org/10.1016/j.jfoodeng.2018.01.013>
- Wang, L., Lin, Y., Tang, Y., Ren, D., & Wang, X. (2021). Fabrication of oppositely charged thin-film composite polyamide membranes with tunable nanofiltration performance by using a piperazine derivative. *Journal of Membrane Science*, 634, 119405. <https://doi.org/10.1016/j.memsci.2021.119405>
- Wang, R., & Lin, S. (2021). Pore model for nanofiltration: History, theoretical framework, key predictions, limitations, and prospects. *Journal of Membrane Science*, 620, 118809. <https://doi.org/10.1016/j.memsci.2020.118809>
- Watari, T., Nansai, K., & Nakajima, K. (2020). Review of critical metal dynamics to 2050 for 48 elements. *Resources, Conservation and Recycling*, 155, 104669. <https://doi.org/10.1016/j.resconrec.2019.104669>

- Wietelmann, U., & Steinbild, M. (2014). Lithium and Lithium Compounds. In Wiley-VCH Verlag GmbH & Co. KGaA (Ed.), *Ullmann's Encyclopedia of Industrial Chemistry* (pp. 1–38). Wiley-VCH Verlag GmbH & Co. KGaA. [https://doi.org/10.1002/14356007.a15\\_393.pub2](https://doi.org/10.1002/14356007.a15_393.pub2)
- Wu, H., Lin, Y., Feng, W., Liu, T., Wang, L., Yao, H., & Wang, X. (2020). A novel nanofiltration membrane with [MimAP][Tf2N] ionic liquid for utilization of lithium from brines with high  $Mg^{2+}/Li^{+}$  ratio. *Journal of Membrane Science*, 603, 117997. <https://doi.org/10.1016/j.memsci.2020.117997>
- Xu, P., Hong, J., Xu, Z., Xia, H., & Ni, Q.-Q. (2021). Positively charged nanofiltration membrane based on (MWCNTs-COOK)-engineered substrate for fast and efficient lithium extraction. *Separation and Purification Technology*, 270, 118796. <https://doi.org/10.1016/j.seppur.2021.118796>
- Xu, S., Song, J., Bi, Q., Chen, Q., Zhang, W.-M., Qian, Z., Zhang, L., Xu, S., Tang, N., & He, T. (2021). Extraction of lithium from Chinese salt-lake brines by membranes: Design and practice. *Journal of Membrane Science*, 635, 119441. <https://doi.org/10.1016/j.memsci.2021.119441>
- Yang, G., Shi, H., Liu, W., Xing, W., & Xu, N. (2011). Investigation of  $Mg^{2+}/Li^{+}$  Separation by Nanofiltration. *Chinese Journal of Chemical Engineering*, 19(4), 586–591. [https://doi.org/10.1016/S1004-9541\(11\)60026-8](https://doi.org/10.1016/S1004-9541(11)60026-8)
- Yang, Zhou, Feng, Rui, Zhang, & Zhang. (2019). A Review on Reverse Osmosis and Nanofiltration Membranes for Water Purification. *Polymers*, 11(8), 1252. <https://doi.org/10.3390/polym11081252>
- Zhang, Y., Hu, Y., Wang, L., & Sun, W. (2019). Systematic review of lithium extraction from salt-lake brines via precipitation approaches. *Minerals Engineering*, 139, 105868. <https://doi.org/10.1016/j.mineng.2019.105868>
- Zhang, Y., Sun, W., Xu, R., Wang, L., & Tang, H. (2021). Lithium extraction from water lithium resources through green electrochemical-battery approaches: A comprehensive review. *Journal of Cleaner Production*, 285, 124905. <https://doi.org/10.1016/j.jclepro.2020.124905>
- Zhang, Y., Wang, L., Sun, W., Hu, Y., & Tang, H. (2020). Membrane technologies for  $Li^{+}/Mg^{2+}$  separation from salt-lake brines and seawater: A comprehensive review. *Journal of Industrial and Engineering Chemistry*, 81, 7–23. <https://doi.org/10.1016/j.jiec.2019.09.002>
- Ziemann, S., Müller, D. B., Schebek, L., & Weil, M. (2018). Modeling the potential impact of lithium recycling from EV batteries on lithium demand: A dynamic MFA approach. *Resources, Conservation and Recycling*, 133, 76–85. <https://doi.org/10.1016/j.resconrec.2018.01.031>
- Zoski, C. G. (Ed.). (2007). *Handbook of electrochemistry* (1st ed). Elsevier.