Avner Ronen February 2023

CURRICULUM VITAE

Personal Details

Name: Avner Ronen
Date and place of birth: *May 1st, 1978, Israel*
Date of immigration: NA
Address and telephone number at work: Department of Desalination and Water Treatment
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Education

B.Sc. - 2002-2006, Technion, Civil and Environmental Engineering
M.Sc.- 2006-2008, Technion, Department of Chemical Engineering
 Advisor: Prof. Yachin Cohen
 Title of thesis: "Electrospinning of ultra-high molecular weight polyethylene nanofibers".

Ph.D.- 2009-2014, Technion, Civil and Environmental Engineering
 Advisors: Profs. Carlos Dosoretz and Raphael Semiat
 Title of thesis: "Influence of an Antibacterial Feed Spacer on Biofilm Development in Membrane Filtration Systems"

Employment History

1. 10/2020-present, Senior Lecturer (Tenure-track), ZIWR, BGU, Israel
2. 2016-10/2020, Assistant Professor (Tenure-track), Temple University, PA, USA
3. 2014-2016, Binational Agriculture Research and Development (BARD) Postdoctoral Fellow, University of California, Riverside, CA, USA
4. 2009-2014, Teaching assistant at a graduate level and full-time position as a research assistant at the Faculty of Civil and Environmental Engineering, Technion.
5. 2008-2009, Research and Development Researcher, Rafael, Advanced Defense Systems, Israel
6. 2006-2008, Teaching assistant at a graduate level and full-time position as a research assistant at the Department of Chemical Engineering, Technion.

1. Professional Activities

a) Positions in academic administration

1. 2012-2022, ZIWR weekly seminar organizer
2. 2017-2020, Search committee member, Civil and Environmental Engineering, Temple University, PA, USA
3. 2017-2020, Graduate research committee member, Civil and Environmental Engineering, Temple University, PA, USA

b) Professional functions outside universities/institutions:

1. 2022 - Scientific and technical advisor to Engineers Without Boarders, BGU branch
2. 2018 - Session organizer at Gordon conference
3. 2017 - Session organizer at ACS conference

c) Significant professional consulting:

1. 2022- Israeli ministry of health committee advisor (water quality)
2. 2017-2018, counseling Philadelphia municipality regarding Environmental Engineers hiring

d) <u>Editor or member of editorial board of scientific or professional journal</u>
NA

e) <u>Ad-hoc reviewer for journals</u>

Environmental Science and Technology (ACS Publication), Environmental Science and Technology Letters (ACS Publication), Environmental Science Nano (Royal Society of Chemistry)

Reviews in Chemical Engineering (De Gruyter), Water Research (Elsevier)

Frontiers of Environmental Science and Engineering (Springer), Polymers (MDPI)

Membranes (MDPI), Water (MDPI), Journal of Membrane Science (Elsevier Science), Separation and Purification Technology (Elsevier Science), Science of the Total Environment (Elsevier), Chemosphere (Elsevier)

International reviewed proposals for:

1. Israeli Science Foundation (ISF)
2. National Science Foundation (NSF)
3. Binational Agriculture Research and Development (BARD)
4. The National Academies of Sciences, Engineering, Medicine

f) <u>Membership in professional/scientific societies</u>

1. European Desalination Society, 2011-2016, 2021-Present
2. American Chemical Society (ACS), 2014-2020
3. North America Membrane Society (NAMS), 2014-2020
4. Association of Environmental Engineering and Science Professors (AEESP), 2016-2020

2. Educational activities

a) Courses taught

1. 2021-2022 Membrane processes (3 credits), graduate and undergrade level, BGU
2. 2021-2022 Water pollution (3 credits), graduate and undergrade level, BGU
3. 2022 Micropollutants (2 credits), graduate level, BGU
4. 2017-2019 Introduction to Environmental Engineering (3 credits), Undergraduate level, Temple University
5. 2017-2019 Environmental Engineering (3 credits), Undergraduate level, Temple University.
6. 2019 Chemical Principles of Environmental Systems (2 credits), Graduate level, Temple University.
7. 2018 Advanced Biological Wastewater Treatment (3 credits), Graduate level, Temple University.
8. 2017 Membranes for Water Treatment (3 credits), Graduate level, Temple University.
9. 2016 Advanced Biological Wastewater Treatment (3 credits), Graduate level, Temple University.

b) Research students

MSc students

1. Efrat Zivi, MSc, exp. 2024, BGU – in collaboration with Prof. Edo Bar-Zeev

PhD students

2. Olanrewaju Beyioku, PhD, exp. 2025, BGU.
3. Xiangui Huang, PhD, exp. 2025, BGU – in collaboration with Dr. Gilboa Arye

4. Siyao Qi, PhD, exp. 2026, BGU
5. Rachel Ben Efraim, PhD, exp. 2026, BGU
6. Shamir Badihi, PhD, exp. 2027, BGU – in collaboration with Prof. Dina Zilberg

Postdoctoral students

7. Suman Das, Postdoctoral, BGU (1.5 years)

Former students

8. Zhe Dong, MSc., 2018, Temple University, USA - Graduated
9. Arezou Anvari, PhD, 2020, Temple University, USA - Graduated

Awards, Citations, Honors, Fellowships

a) Honors, Citation Awards (including during studies)

1. 2022, Yahiel Admoni research excellence award
2. 2013, Civil and Environmental Engineering Faculty best doctoral dissertation, Technion

b) Fellowships

1. 2014, US-Israel Bi-national Agricultural R&D (BARD) Post-Doctoral Fellowship (~50k USD)
2. 2012, The Barbara and Jack Kay Doctoral Fellowship, Ph.D. excellence fellowship
3. 2012, Rieger Foundation Fellowship, Ph.D. excellence fellowship
4. 2009, Rieger Foundation Fellowship, Ph.D. excellence fellowship
5. 2007, Harbor Foundation Fellowship, MSc excellence fellowship
6. 2006, Harbor Foundation Fellowship, MSc excellence fellowship

3. Scientific Publications

a) H-index: GS H-index=15, GS i10-index=18, GS; ISI H-index=13.
b) Total number of citations of all articles: GS=1175., ISI= 795
c) Total number of citations without self-citations: ISI=606

Peer-reviewed publication: 24

1. Rein, D.M[C].; Cohen, Y[PI].; **Ronen, A.**[S] Zussman E.[C]; Shuster, E.K[C]. 2008. Electrospinning of ultrahigh-molecular-weight polyethylene nanofibers", Materials Research Society Symposium Proceedings, 1083, 1083-R03-03. (Not ranked)
2. Rein, D.M[C].; Cohen, Y[PI].; **Ronen, A.**[S] Zussman E.[C].; Shuster, E.K[C]., 2009. Application of gentle annular gas veil for electrospinning of polymer solutions and melts Polymer Engineering & Science, 49, 4, 774–782 (19 citations; IF 2.573; 49/90; Q2).
3. **Ronen, A.**[S] Semiat, R[PI].; Dosoretz, C. G.[PI], 2012. Antibacterial efficiency of a composite spacer containing zinc oxide nanoparticles, Procedia Engineering, 44, 581-582. (7 citations; IF 0.784; not ranked)
4. **Ronen, A.**[S], Semiat, R.[PI]; Dosoretz, C. G[PI]. 2013. Antibacterial Efficiency of Composite Nano-ZnO in Biofilm Development in Flow-through Systems. Desalin. Water Treat. 51 (4–6), 988–996. (20 citations; IF 1.23; 109/266; Q2)
5. **Ronen, A.**[S] ; Semiat, R[PI].; Dosoretz, C. G[PI]. 2013. Impact of ZnO Embedded Feed Spacer on Biofilm Development in Membrane Systems. Water Res., 47 (17), 6628–6638. (40 citations; IF 13.4; 10/325; Q1)
6. **Ronen, A**[S]**.**; Lerman, S[S].; Ramon, G. Z[C].; Dosoretz, C. G[PI]. 2015. Experimental Characterization and Numerical Simulation of the Anti-Biofuling Activity of Nanosilver-

Modified Feed Spacers in Membrane Filtration. J. Memb. Sci. 475, 320–329. (34 citations; IF 10.53; 11/143; Q1)

7. **Ronen, A**[PD]**.**; Duan, W[S].; Wheeldon, I.[C]; Walker, S. L[PI].; Jassby, D[PI]. 2015. Microbial Attachment Inhibition through Low Voltage Electrochemical Reactions on Electrically Conducting Membranes. Environ. Sci. Technol., 49, 12741–12750. (124 citations; IF 11.357; 22/279; Q1)
8. **Ronen, A** [S]**.**; Resnick, A[S].; Lerman, S.[S]; Eisen, M. S.[C]; Dosoretz, C. G[PI]. 2016. Biofouling Suppression of Modified Feed Spacers: Localized and Long-Distance Antibacterial Activity. Desalination, 393, 159-165, (15 citations; IF 11.211; 3/100; Q1)
9. Duan, W[S].; **Ronen, A.**[PD]; de Leon, J. V.[S]; Dudchenko, A.[S]; Yao, S.[S]; Corbala-Delgado, J.[S]; Yan, A.[S]; Matsumoto, M.[C]; Jassby, D[PI]. 2016. Treating Anaerobic Sequencing Batch Reactor Effluent with Electrically Conducting Ultrafiltration and Nanofiltration Membranes for Fouling Control. J. Memb. Sci., 504, 104–112. (51 citations; IF 10.53; 11/143; Q1)
10. Duan, W*[S].; **Ronen, A.**[PD, */**]; Walker, S. L[C].; Jassby, D.[PI], 2016. Polyaniline-Coated Carbon Nanotube Ultrafiltration Membranes: Enhanced Anodic Stability for In Situ Cleaning and Electro-Oxidation Processes. ACS Appl. Mater. Interfaces, 8 (34), 22574–22584. (127 citations; IF 10.38; 23/109; Q1, *equal contribution, ** corresponding author).
11. **Ronen, A.** [PD]; Walker, S. L[C].; Jassby, D[PI]. 2016. Electroconductive and Electroresponsive Membranes for Water Treatment. Rev. Chem. Eng., 32 (5). (69 citations; IF 8.742; 15/143; Q1)
12. Duan*, W[S].; Chen, G[S].; Chen, C.[S]; Sanghvi, R.[S]; Iddya, A.[S]; Walker, S.L.[C]; Liu, H.[S]; **Ronen, A.** [PD*, **]; Jassby, D[PI]., 2017. Electrochemical removal of hexavalent chromium using electrically conducting carbon nanotube/polymer composite ultrafiltration membranes, J. Memb. Sci. 531, 160-171. (134 citations; IF 10.53; 11/143; Q1), *equal contribution, ** corresponding author).
13. Thamaraiselvan, C[S].; **Ronen, A**.[C]; Lerman, S.[S]; Dosoretz, C.G.[PI], 2018. Low voltage electric potential as a driving force to hinder biofouling in self-supporting carbon nanotube membranes, J. Memb. Sci. 2018, 129, 143-153. (43 citations; IF 10.53; 11/143; Q1)
14. Anvari, A. [S]; Kekre. K.[S]; Azimi. A.[S]; Yao. Y[S]; **Ronen, A**[PI].,2019. Membrane distillation of high salinity water by induction heated thermally conducting membranes, J. Memb. Sci., 589, 117253. (53 citations; IF 10.53; 11/143; Q1)
15. Anvari, A.[S]; Kekre. K.[S]; **Ronen, A**[PI]., 2020. Scaling mitigation in radio-frequency induction heated membrane distillation, J. Memb. Sci., 600, 117859. (35 citations; IF 10.53; 11/143; Q1)
16. Anvari, A.[S]; Kekre. K.[S]; Yancheshme. A[C].; **Ronen, A**. [PI], 2020. State-of-the-art methods for overcoming temperature polarization in membrane distillation process: A review, J. Memb. Sci., 118413. (79 citations; IF 10.53; 11/143; Q1)
17. Anvari, A.[S]; Kekre. K.[S]; Yancheshme. A.[C]; **Ronen, A.** [PI]. 2020. Enhanced performance of membrane distillation using radio-frequency induction heated thermally conducting feed spacers, Separation and Purification Technology, 250, 117276. (12 citations; IF 9.136; 14/143; Q1)
18. *Bogler A.[S], Packman A.[C], Furman A.[C], Gross A.[C], Kushmaro A.[C], **Ronen A[C].**, Bar Zeev, E.[PI] et al., 2020. Rethinking wastewater risks and monitoring in light of the COVID-19 pandemic, Nature Sustainability, 3, 981–990. (198 citations; IF 27.157; 5/279; Q1)
19. *Shabani E.[S], Azimi Y.A[S], **Ronen A.**[C], Gorga R.E.[PI], 2020. Effect of the Spin-Line Temperature Profile on the Translocation of the Solidification Point and Jet Thinning in Unconfined Melt Electrospinning, ACS Appl. Polym. Mater. (10 citations; IF 4.855; 19/90; Q1)
20. *Kekre K.[S], Anvari A.[S], Kahn K.[S], Yao Y.[S], **Ronen A.** **[PI]**, 2021. Reactive electrically conducting membranes for phosphorus recovery from livestock wastewater effluents, Journal of Environmental Management, 282, 111432. (9 citations; IF 8.91; 34/279; Q1)

21. *Das S[PD]., **Ronen A.** **[PI]**, 2022. A Review on Removal and Destruction of Per-and Polyfluoroalkyl Substances (PFAS) by Novel Membranes, Membranes 12 (7), 662. (4 citations; IF 5.562; 59/160; Q1)
22. *Kekre K.[S], Tiburcio D.[S], **Ronen A.**[C], Suri R.[C], Andaluri G.[C], Yuan H.[PI], 2022. Electrically charged forward osmosis: Promoting reverse salt flux to enhance water recovery and struvite precipitation, Resources Conservation & Recycling 186, 106522. (4 citations; IF 13.716; 4/54; Q1)
23. *Shi J.[S], Zhou J. [S], Fan D. [S], Lin T. [S], Wang J. [C], Zhao J. [C], **Ronen A.[C]**, Li M. [C], You J. [PI], 2022. Enhanced Separation Performance of Hierarchically Porous Membranes Fabricated via the Combination of Crystallization Template and Foaming, Polymers 14 (23), 5160. (0 citations; IF 4.967; 16/90; Q1)
24. *Qi S.[S], Grossman A.D.[S], **Ronen A.[PI]**, Bernstein B.[PI], 2022. Low-biofouling anaerobic electro-conductive membrane bioreactor: The role of pH changes in bacterial inactivation and biofouling mitigation, Journal of Membrane Science 662, 120960. (0 citations; IF 10.53; 11/143; Q1)
25. *Santoro S[S]., Aquino M[S]., Rizza C.[S], Occhiuzzi J.[S], Mastrippolito D.[C], D'Olimpio G. [C], Avci A.H. [C], De Santis J [C]., Paolucci V. [C], Ottaviano L. [C], Lozzi L.[C], **Ronen A.[C]**, Bar-Sadan M.[C], Suk Han D. [C], Politano A. [C], Curcio E. [PI], 2023. Lithium recovery through WS2 nanofillers-promoted solar photothermal membrane crystallization of LiCl", Desalination 546, 116186. (0 citations; IF 11.211; 3/100; Q1)

a) Authored books: NA
b) Editorship of collective volumes: NA
c) Refereed chapters in collective volumes, Conference proceedings, Festschrifts, etc:NA
d) Refereed articles and refereed letters in scientific journals, running numbers: NA
e) Published scientific reports and technical papers: NA
f) Unrefereed professional articles and publications: NA
g) Classified articles and reports: NA

4. Lectures and Presentations at Meetings and Invited Seminars

(a) Invited plenary lectures at conferences/meetings:

1. 2023, (planned December 2023), PFAS adsorption and removal by externally charged carbon materials, Israeli national academy of science, Israel, oral.
2. 2023, (planned March 13), Nutrients recovery from wastewater using electrically conducting membranes, Israeli Desalination Society (IDS) conference

(b) Presentation of papers at conferences/meetings (oral or poster)

1. 2007, **Ronen, A.**, Rein, D.M, Cohen, Y., Electrospinning of UHMW PE nanofibers, Israel polymer & plastic society, Oral presentation.
2. 2011, **Ronen, A.**, Semiat, R., Dosoretz, C.G., Antibacterial efficiency of composite- nano-ZnO on biofilm development in flow-through systems, Israel desalination society conference, Poster presentation.
3. 2012, **Ronen, A**., Semiat, R., Dosoretz, C.G, Antibacterial efficiency of composite nano-ZnO on biofilm development in flow-through systems, 6th European Desalination Society Conference, Barcelona. Oral presentation.
4. 2012, **Ronen, A**., Semiat, R., Dosoretz, C.G., Antibacterial efficiency of composite nano particles ZnO-Ag on biofilm development in membrane filtration systems, Euromembrane Conference, London. Oral presentation
5. 2015, **Ronen, A**., Duan, W., Wheeldon, I., Walker, S.L., Jassby, D., Microbial attachment inhibition through low voltage electrochemical reactions on electrically conducting membranes, North American Membrane Society, Boston, Poster presentation.
6. 2017, Duan, W., Chen, G., Chen, C., Sanghvi, R., Iddya, A. Walker, S.L., Liu, H., **Ronen, A**.; Jassby, D., Electrochemical removal of hexavalent chromium using electrically

conducting carbon nanotube/polymer composite ultrafiltration membranes. International Congress on Membranes and Membrane Processes, San Francisco, Oral presentation.

7. 2017, **Ronen, A**., Duan, W; Walker, S. L.; Jassby, D. , Polyaniline-Coated Carbon Nanotube Ultrafiltration Membranes: Enhanced Anodic Stability for In-situ Cleaning and Electro-Oxidation Processes, International Congress on Membranes and Membrane Processes, San Francisco, Oral presentation
8. 2018, **Ronen, A**., Kekre, K., Nitrogen and Phosphorus Recovery from Agricultural Wastewater Effluents: Role of Electrically Conductive Membranes. American Chemical Society, Boston, Oral presentation
9. 2019, **Ronen, A**., Arezou, A., Bromide oxidation by electroactive membranes, North American Membrane Society, Pittsburgh, Poster
10. 2019, **Ronen, A**., Arezou, A., Induction Heating Based Membrane Distillation, North American Membrane Society, Pittsburgh, Poster
11. 2019, **Ronen, A**., Kekre, K., Nitrogen and Phosphorus Recovery from Agricultural Wastewater Effluents: Role of Electrically Conductive Membranes". North American Membrane Society, Pittsburgh, Oral presentation
12. 2021, **Ronen.A,** Kekre, K, Nitrogen and Phosphorus Recovery from Agricultural Wastewater Effluents: Role of Electrically Conductive Membranes, Tel Hai water conference, Israel, Oral presentation
13. 2022, **Ronen.A,** Kekre, K, Ammonia recovery using externally charged composite membranes, MELPRO, Czech Republic, Oral presentation
14. 2022, **Ronen, A**., Kekre, K., Nitrogen and Phosphorus Recovery from Agricultural Wastewater Effluents by Electrically Conductive Membranes. EDS, Las Palmas de Gran Canarias, Oral presentation
15. 2022, **Ronen, A**., Siyao, Qi, Arezou, A., Membrane Distillation using high frequency electromagnetic waves, EDS, Las Palmas de Gran Canarias, Oral and session chair.

(c) Presentations at informal international seminars and workshops

1. 2013, Influence of a modified antibacterial feed spacer on biofilm development in membrane filtration systems, Membranes for liquid separation and water treatment: environmental applications and future perspectives. Torino, Italy
2. 2022, The impact of PFAS pretreatment prior to SPE and Assessing the parameters controlling adsorption using QCM", SCENARIOS (Horizon 2020) annual meeting, Alessandria, Italy.

(d) Seminar presentations at universities and institutions:

1. 2019, Recovery application of electrically conducting membranes, Membrane workshop by Prof. Bruce Logan, Department of Civil and Environmental Engineering, Penn State University, PA, USA
2. 2022, PFAS interaction and adsorption using QCM, BAM workshop as part of GIF funding, Berlin, Germany.

(e) Patents:

Ronen, A.; Semiat, R.; Dosoretz, C. G., "Biofouling prevention in membrane filtration systems using composite nanoparticles/polymer spacer". (US Patent App. 13/771,219)
Hefetz, M. Issman, L. and Ronen, A., "process". (submitted with TorTech Nano Fibers Ltd, application number GB1504398.7)
Thamaraiselvan, C.; Ronen, A.; Lerman, S.; Dosoretz, C.G., "Carbon nanotubes laminates". (US Patent App. 62/462,432)

5. Research Grants:

1. 2018-2020, USA Bureau of Reclamation, Avner Ronen (Co-PI), Mei Sun (PI), 'Electrochemical oxidation of bromide from industrial wastewater using electrochemical conducting membranes', $75,000, Total $150,000
2. 2019-2020, United States Geological Survey (USGS), Avner Ronen (PI), 'Nutrients recovery from livestock wastewater', Total $80,000.
3. 2020-2023, US Department of Agriculture (NIFA), Avner Ronen (PI), Yuan Heyang (Co-PI) 'Reclaiming Water, Energy, And Nutrients from Livestock Wastewater', Total $800,000 Accepted at TU as PI, *transferred to the Co-PI when moving to BGU*
4. 2021-2025, Horizon 2020 (Green Deal), The SCENARIOS consortium is composed of 19 partners from 11 countries: Cyprus, Denmark, Finland, Germany, Greece, Israel, Italy, Luxemburg, Spain, Sweden and United Kingdom. From BGU: Avner Ronen, Ofer Dahan, Hadar Ben-Yoav and Anat Milo. Coordinator: Francesco Dondero from Universita degli Studi del Piemonte Orientale Amedeo Avogadro.
   'Strategies for health protection, pollution Control and Elimination of Next generation Refractive Organic chemicals from the Soil, vadose zone and water'
   Total 13,000,000 Euro
5. 2022, GIF sustainability (young). Avner Ronen (PI), Christian Vogel (PI). 'Electrically Assisted Adsorption of Perfluoroalkyl Substance (PFAS) by Carbonaceous Nanomaterials'
   Total 75,000 Euro
6. 2022-2025, Ministry of Energy, Avner Ronen (Co-PI), Edo bar Zeev (Co-PI), Eyal Rahav (PI), 'Quantify the impact of crude-oil and gas-condensate on seawater reverse osmosis desalination and test potential mitigation solutions.'
   Total $160,000
7. 2021-2024, BMBF-MOST, Avner Ronen (PI and coordinator), Oded Nir (PI), Christian Vogel (PI), Stefan Panglisch (PI). 'Detection, quantification and treatment of per- and polyfluoroalkyl substances (PFAS) in groundwater'.
   Total $760,000
8. 2022-2025 MOST (Environment program) Avner Ronen (PI), Dina Zilberg (PI). 'Electrochemical nutrient recovery treatment for recirculating aquaculture systems'.
   Total of 600,000 NIS
9. 2022-2025 NSF-BSF, Avner Ronen (PI), Wen Zhang (PI), Joshou Young (PI). 'Electrified Membrane System for Chemical-Free Nitrogen Recovery from Nitrate Contaminated Water'.
   Total $690,000
10. 2023-2025 Jewish Colonization Association (JCA), Avner Ronen (co-PI), Dina Zilberg (PI), 'Electrochemical water treatment system for sustainable aquaculture'.
    Total $55,000

6. Present Academic Activities

Research in progress

a. Fouling mitigation by electrically conductive composite membranes
b. Removal and adsorption of Per- and polyfluoroalkyl substances by electrically conductive composite membranes
c. Adsorption and desorption of Per- and polyfluoroalkyl substances from solids and biosolids: Role of the physicochemical and surface properties
d. Per- and polyfluoroalkyl substances detection using passive samplers
e. Removal and recovery of ammonia from recirculating aquaculture systems using hydrophobic electrically conducting membranes

Books and Articles to be published

In preparation:

a. Mohit Chaudhary, Michal Sela-Adler, Avner Ronen*, Oded Nir*. Mixed matrix composite nanofiltration membrane containing cross-linked β-cyclodextrin polymer in support layer for enhanced PFOA removal

b. Amit Dan Grossman, Si Yao, Tuvia Turkeltaub, Alexander I. Shames, Yoram Oren, Avner Ronen and Roy Bernstein*. Fouling mitigation mechanism of electro-conductive membrane under anaerobic conditions and cathodic operation
c. Suman Das, Avner Ronen*. Photocatalytically-regenerated carbon-based adsorbent materials for pollutant removal from wastewater

7. Synopsis of research

My research addresses removal (and recovery) of contaminants from wastewater and water. Currently this includes removal and recovery of crude oil from seawater, (2) removal and recovery of ammonia and phosphate from wastewater and (3) removal of contaminants of emerging concern (CEC) from wastewater and water. Generally, removal and recovery processes can be performed by separation means (e.g., membranes) or through an adsorption process, and their efficiency is influenced by fundamental aspects of interaction between solid surfaces (e.g., membranes, adsorbers, soil and biosolids) and the contaminants which could include organic, inorganic and biological fractions. Therefore, the synopsis of research includes the use of electrically conducting membrane for filtration and other novel adsorbers for contaminants removal and recovery.

Membrane based filtration has become a common approach worldwide to deal with saline water desalination, removal of contaminants and nutrients recovery. We use modified membranes which couple filtration with electrochemical reaction to enhance separation and reduce limiting phenomena which are common for all membrane processes (publications 7-11,13, 24). The modified membranes are thermally (publications 14-17) and electrically conducting (electrically conducting membranes, ECMs) and developed and fabricated by coating a range of nanomaterials and polymers on the polymeric membrane surface (publications 7,9-17,20,22,24). The ECMs are influenced by externally applied fields such as electrical and magnetic fields and will change properties accordingly (heat, transport, etc.). Fabricated materials are characterized by physical properties (contact angle, roughness, pore size, electrical conductivity) and transport abilities (MWCO, flux). Coupling electrochemical reduction and electrochemical oxidation with filtration leads to significant advantages over flat electrodes as it is not limited by diffusion and do not require external mixing (i.e. lower energy requirement). Due to the high surface area, these systems can be used to perform redox reactions on the surface while filtering the contaminants by conventional sieving mechanism (publications 12,20,22,24. funding 2,38-10). For example, industrial wastewater from energy production contains relatively high concentrations of bromide and may lead to the formation of DBP if present in drinking water. Removal and recovery of bromide by REMs has been funded by US Bureau of Interior (Funding 1). We have shown that through selective electrochemical oxidation, bromide can be removed with high efficiency (>80%). As concentrations of ions are limited in these solutions, the applied current and energy consumption are relatively low.

Additional topics which are addressed include:

ECM and fouling mitigation: Although research efforts drove improvements of membrane separation in several fields including higher salt rejection, high permeate flux, and improved antifouling properties, most filtration processes still suffer from several persistent issues including concentration polarization (CP), and organic and biological fouling. Both resulting in a decline in performance, increased salt passage, high energy consumption, and high operational costs. Therefore, there is a need to address these issues using novel and efficient tools which can be adjusted according to the degree of fouling. Furthermore, fouling is a dynamic process in both temporal and special aspects and therefore, we strive to develop surfaces that can adjust their properties accordingly. My previous work (during my PhD) has addressed biological fouling through modification of polymeric spacers (publications 2-6,8) and led to the ability of mitigating organic and biological fouling using ECMs. We evaluated the mechanisms responsible for fouling mitigation as a result of externally applied electrical potential and conducted systematic experiments to determine the involved mechanisms (publication 7,9,13,24). Our current work evaluates the use of ECM as a tertiary treatment of wastewater, designed to replace the current sand filtration and chlorination step and allow discharge of high-quality effluents fit for irrigation.

ECMs for ions and nutrients removal and recovery: In addition to addressing fouling of membranes, we use ECMs for a range of applications including recovery and removal of nutrients such as ammonia and phosphorus and dissolved heavy metals. Some nutrients are difficult to collect and remove from water and wastewater but can be reused if recovered in a cost-efficient approach. ECMs are used to control pH in proximity to the membrane, leading to formation and precipitation of compounds containing N and P in addition to the recovery of ammonia gas from wastewater or anaerobic digester effluents (publication 20,22. funding 2,3) This electrochemical recovery process has been shown to be highly efficient as it requires low energy and allows the formation of Struvite, an eco-friendly fertilizer. Furthermore, due to the applied electrical potential and surface charge, there is limited fouling and irreversible scaling, leading to high flux. In addition, wastewater containing nitrate (funding 9), or ammonium can be treated using a similar approach to recover ammonia gas (funding 8,10). Ammonia can be further recovered and used for energy (Ammonia fuel cells) and fertilizer production.

ECMs and novel adsorbers for micropollutants removal (and detection)

Micropollutants are contaminants found in water at low concentrations. These include contaminants of emerging concern (CEC) such as Per- and Polyfluoroalkyl Substances (PFAS), PFAS have been proven to be carcinogenic in addition to promoting other health-threatening conditions. Therefore, there is a growing need for removal and treatment worldwide. PFAS are highly stable to redox reaction and found in relatively low concentrations in wastewater and drinking water worldwide. There is limited understanding regarding their fate and transport in the environment (e.g., at biosolids, soil, wastewater treatment process – funding 4). We evaluate the interactions between PFAS and surfaces (adsorbing particles and membranes for adsorption) using column experiments, filtration and QCM. Furthermore, we suggest removing PFAS though controlling the external charge on ECMs and other adsorbers. This will allow adsorption and rejection based on electrostatic interaction. Our preliminary data show up to 95% removal of PFOA and PFOS in one filtration stage using externally charged membranes. (Publication 21, funding 4,5,7)

Membranes and adsorbers for environmental application:

Minimal liquid discharge: highly contaminated wastewater including solutions containing high salt concentration such as landfill leachate and fracking water (i.e., produced water) cannot be treated by RO due to the high osmotic pressure and fouling, therefore membrane distillation (MD) is a promising treatment approach. Nevertheless, MD is limited by temperature polarization, which reduces the driving force and the efficiency of the distillation process. To overcome this issue, we use self-heating radio frequency induced magnetic ECMs. The system uses inductive heating to control surface temperature and eliminates the need to heat the bulk solution, therefore, it mitigates temperature polarization. This approach has shown the ability to produce high flux at low flow velocities and at very high salinity (>100 g/L of NaCl). Due to the high-frequency magnetic field, surfaces are less prone to scaling or other fouling mechanisms (publications 14-17). MD was also shown as a method for crystallization and recovery of valuable compounds such as lithium (publication 25). **Novel adsorbers for crude oil removal:** Crude oil spills in seawater are a growing concern as they are expected to impact the seawater desalination facilities located along the coast of Israel. Prior to reaching the desalination reverse osmosis membrane, intake water goes through several pretreatment steps including sand filtration. But, if crude oil reaches the sand filter, it may lead to further contamination and the need to replace the filtration unit. Therefore, we are evaluating the transport of crude oil from the ocean (as a slick layer) to the filtration unit and developing carbon-based barriers that will adsorb the dissolved crude oil (funding 6).

Statement of Teaching Philosophy

My teaching philosophy has been shaped by my own experiences in the United States and Israel, as a student, researcher, and a lifelong learner. It has been influenced by my undergraduate and graduate professors at the Technion-IIT and further shaped during the last few years as an assistant professor at Temple University and a senior lecturer at BGU.

I'm of the opinion that the greatest learning opportunity exists when students are actively engaged by the subject matter and see the value in learning it. An effective educator is one who is organized, presents course material in a clear and logical fashion, and who has the flexibility to relate important concepts beyond the scope of the lecture. Students are more apt to retain the fundamentals and are more motivated to learn if the instructor is able to provide interesting interdisciplinary examples. Lecture material should work to incorporate problems/examples as well as case studies or current research in the form of journal articles. It is important that students become familiar with reading technical documents, are adept at extracting important theories/ideas from the text, and finally are able to communicate them in both written and oral forms. It has been said that the best way to learn is to teach. I find that when students are assigned the task of instructing their peers, it forces them to take learning into their own hands, while at the same time it allows them to practice their presentation skills. Although a lecture format is useful for auditory learners, other students benefit from more visual and active exercises. Many of my lecture plans use a traditional lecture format, but I frequently include mini break-out sessions as an alternative approach for learning.

These sessions might include solving a computational example, brainstorming possible solutions to a problem, or discussing an article that they researched as homework. I feel that the learning process is enhanced when students are exposed to a variety of instructional methods.

My educational background is rooted within chemical and biological process engineering as well as water quality, water, and wastewater treatment and polymers and material science. Therefore, in the last years I developed and built varying graduate (and undergraduate – 4th year) courses related to core environmental engineering (biological, chemical and process) including: (1) a course related to activated sludge, Biological Nutrients Removal (BNR) and resource recovery; (2) a course related to membrane separation for water and wastewater treatment, addressing membrane theory, separation mechanisms, membrane fabrication and characterization – given at BGU main campus; (3) a course dealing with aquatic chemistry; (4) an introduction course for environmental engineering graduate students on topics such as water and wastewater characterization and treatment – given at BGU main campus; (5) I am currently developing a new graduate course that will be taught next semester (2023) regarding micropollutants in water and wastewater – treatment and characterization.

I try to embed my teaching philosophy in all classes and levels and include an oral presentation given by the students and group projects as part of my curriculum.

Furthermore, as students evaluate the teaching quality following each semester, I am also able to correct myself and learn from student remarks regarding my teaching approach. up to now, I had high ranking for the courses I taught.