Stanford

William Abraham Tarpeh

Assistant Professor of Chemical Engineering, by courtesy, of Civil and Environmental Engineering and Center Fellow, by courtesy, at the Woods Institute for the Environment

Curriculum Vitae available Online

Bio

BIO

Reimagining liquid waste streams as resources can lead to recovery of valuable products and more efficient, less costly approaches to reducing harmful discharges to the environment. Pollutants in effluent streams can be captured and used as valuable inputs to other processes. For example, municipal wastewater contains resources like energy, water, nutrients, and metals. The Tarpeh Lab develops and evaluates novel approaches to resource recovery from “waste” waters at several synergistic scales: molecular mechanisms of chemical transport and transformation; novel unit processes that increase resource efficiency; and systems-level assessments that identify optimization opportunities. We employ understanding of electrochemistry, separations, thermodynamics, kinetics, and reactor design to preferentially recover resources from waste. We leverage these molecular-scale insights to increase the sustainability of engineered processes in terms of energy, environmental impact, and cost.

ACADEMIC APPOINTMENTS

- Assistant Professor, Chemical Engineering
- Assistant Professor (By courtesy), Civil and Environmental Engineering
- Center Fellow (By courtesy), Stanford Woods Institute for the Environment
- Member, Bio-X

PROFESSIONAL EDUCATION

- PhD, University of California, Berkeley , Environmental Engineering (2017)
- MS, University of California, Berkeley , Environmental Engineering (2013)
- BS, Stanford University , Chemical Engineering (2012)

LINKS

- Tarpeh Research Group: https://www.tarpehlab.com/

Teaching

COURSES

2023-24

- Chemical Engineering Plant Design: CHEMENG 180 (Spr)
- Graduate Practical Training: CHEMENG 299 (Win, Spr)
- Introduction to Chemical Engineering: CHEMENG 20, ENGR 20 (Win)

2022-23

- Chemical Engineering Plant Design: CHEMENG 180 (Spr)
- Introduction to Chemical Engineering: CHEMENG 20, ENGR 20 (Win)
- Special Topics in Electrochemistry and Water Treatment: CHEMENG 524 (Aut)

2021-22

- Chemical Engineering Plant Design: CHEMENG 180 (Aut)
- Electrochemical Water Treatment: Materials and Processes: CEE 271C, CHEMENG 175X, CHEMENG 475 (Spr)
- Introduction to Chemical Engineering: CHEMENG 20, ENGR 20 (Win)
- Special Topics in Electrochemistry and Water Treatment: CHEMENG 524 (Aut, Win, Spr)

2020-21

- Chemical Engineering Plant Design: CHEMENG 180 (Aut)
- Graduate Practical Training: CHEMENG 299 (Sum)
- Introduction to Chemical Engineering: CHEMENG 20 (Win)
- Special Topics in Electrochemistry and Water Treatment: CHEMENG 524 (Aut, Win, Spr, Sum)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Ashton Aleman, Eddie Barks, Michael Beckinghausen, Gabriel Crane, Gaurav Kamat, Genni Liccardo, Daniela Marin, Alexandra Ringsby, Laura Roldan, Alex Shearer

Postdoctoral Faculty Sponsor

Woonghee Lee, Kindle Williams

Doctoral Dissertation Advisor (AC)

Kristen Abels, Edward Apraku, Sam Bunke, Brandon Clark, Orisa Coombs, Jinyu Guo, Anna Kogler, Matthew Liu, Lorelay Mendoza Grijalva, Dean Miller, Anita Shao, Wrayzene Willoughby

Doctoral Dissertation Co-Advisor (AC)

Joyce An, Chi Cao, Valerie Niemann, Alexis Voulgaropoulos

Doctoral (Program)

Edward Apraku, Emmanuel Kayiwa

Postdoctoral Research Mentor

Kindle Williams

Publications

PUBLICATIONS

- **Electrochemical sulfate production from sulfide-containing wastewaters and integration with electrochemical nitrogen recovery.** *Journal of hazardous materials*
  Shao, X., Huang, Y., Wood, R. M., Tarpeh, W. A.
  2024; 466: 133527

- **Meta-omic profiling reveals ubiquity of genes encoding for the nitrogen-rich biopolymer cyanophycin in activated sludge microbiomes.** *Frontiers in microbiology*
  Farmer, M., Rajasabhai, R., Tarpeh, W., Tyo, K., Wells, G.
  2023; 14: 1287491

- **Cation Incorporation into Copper Oxide Lattice at Highly Oxidizing Potentials.** *ACS applied materials & interfaces*

Ostervold, L., Smerigan, A., Liu, M. J., Filardi, L. R., Vila, F. D., Perez-Aguilar, J. E., Hong, J., Tarpeh, W. A., Hoffman, A. S., Greenlee, L. F., Clark, E. L., Janik, M. J., Bare, et al
2023

- **Electrochemical Wastewater Refining: A Vision for Circular Chemical Manufacturing.** *Journal of the American Chemical Society*
  Miller, D. M., Abels, K., Guo, J., Williams, K. S., Liu, M. J., Tarpeh, W. A.
  2023

- **Understanding the Catalytic Active Sites of Crystalline CoSbxOy for Electrochemical Chlorine Evolution.** *ACS applied materials & interfaces*
  Dong, H., Shao, X., Hancox, S., McBeath, S. T., Tarpeh, W. A., Hoffmann, M. R.
  2023

- **X-ray Absorption Spectroscopy Reveals Mechanisms of Calcium and Silicon Fouling on Reverse Osmosis Membranes Used in Wastewater Reclamation** *ACS ES&T WATER*
  Niemann, V. A., Huck, M., Steinrueck, H., Toney, M. F., Tarpeh, W. A., Bone, S. E.
  2023

- **Reports from the Frontier: Electrifying Chemical Transformations and Separations to Valorize Wastewater Nitrogen** *ELECTROCHEMICAL SOCIETY INTERFACE*
  Liu, M. J., Tarpeh, W. A.
  2023; 32 (2): 29-31

- **Reactive Separation of Ammonia from Wastewater Nitrate via Molecular Electrocatalysis** *ENVIRONMENTAL SCIENCE & TECHNOLOGY LETTERS*
  Liu, M. J., Miller, D. M., Tarpeh, W. A.
  2023; 10 (5): 458-463

- **Mass Transport Modifies the Interfacial Electrolyte to Influence Electrochemical Nitrate Reduction** *ACS SUSTAINABLE CHEMISTRY & ENGINEERING*
  Guo, J., Brimley, P., Liu, M. J., Corson, E., Munoz, C., Smith, W., Tarpeh, W. A.
  2023

- **Co-designing Electrocatalytic Systems with Separations To Improve the Sustainability of Reactive Nitrogen Management** *ACS CATALYSIS*
  Niemann, V. A., Benedek, P., Guo, J., Xu, Y., Blair, S. J., Corson, E. R., Nielander, A. C., Jaramillo, T. F., Tarpeh, W. A.
  2023; 13 (9): 6268-6279

- **A Unit Process Approach to Nontarget Screening of Organic Contaminants during Urine Treatment** *ACS ES&T ENGINEERING*
  Tarpeh, W. A., Du, Y., Carpenter, C. G., Rodriguez, E. E., Helbling, D. E., Aga, D. S., Love, N. G., Wigginton, K. R.
  2023

- **Electrifying climate change mitigation** *NATURE ENERGY*
  Tarpeh, W. A.
  2022

- **Electrified Ion Exchange Enabled by Water Dissociation in Bipolar Membranes for Nitrogen Recovery from Source-Separated Urine.** *Environmental science & technology*
  Dong, H., Laguna, C. M., Liu, M. J., Guo, J., Tarpeh, W. A.
  2022

- **QSDsan: an integrated platform for quantitative sustainable design of sanitation and resource recovery systems** *ENVIRONMENTAL SCIENCE-WATER RESEARCH & TECHNOLOGY*
  Li, Y., Zhang, X., Morgan, V. L., Lohman, H. C., Rowles, L. S., Mittal, S., Kogler, A., Cusick, R. D., Tarpeh, W. A., Guest, J. S.
  2022

- **Advanced ion transfer materials in electro-driven membrane processes for sustainable ion-resource extraction and recovery** *PROGRESS IN MATERIALS SCIENCE*
  Zhao, Y., Mamrol, N., Tarpeh, W. A., Yang, X., Gao, C., van der Bruggen, B.
  2022; 128

- **Taking Earth's Pulse with Low-Cost Sensors** *ACS SENSORS*
  Bakker, E., Ward, C. P., Tarpeh, W., Wang, Z.
  2022; 7 (6): 1613

- **Recovery of Clean Water and Ammonia from Domestic Wastewater: Impacts on Embodied Energy and Greenhouse Gas Emissions.** *Environmental science & technology*
  Shin, C., Szczuka, A., Liu, M. J., Mendoza, L., Jiang, R., Tilmans, S. H., Tarpeh, W. A., Mitch, W. A., Criddle, C. S.
  2022
- **Diurnal Variability of SARS-CoV-2 RNA Concentrations in Hourly Grab Samples of Wastewater Influent during Low COVID-19 Incidence.** *ACS ES&T water*
  Mendoza Grijalva, L., Brown, B., Cauble, A., Tarpeh, W. A.
  2022; 2 (11): 2125-33
- **Catalytic Performance and Near-Surface X-ray Characterization of Titanium Hydride Electrodes for the Electrochemical Nitrate Reduction Reaction.** *Journal of the American Chemical Society*
  Liu, M. J., Guo, J., Hoffman, A. S., Stenlid, J. H., Tang, M. T., Corson, E. R., Stone, K. H., Abild-Pedersen, F., Bare, S. R., Tarpeh, W. A.
  2022
- **Resin-Mediated pH Control of Metal-Loaded Ligand Exchangers for Selective Nitrogen Recovery from Wastewaters.** *ACS applied materials & interfaces*
  Clark, B., Gilles, G., Tarpeh, W. A.
  2022
- **Quantifying and Characterizing Sulfide Oxidation to Inform Operation of Electrochemical Sulfur Recovery from Wastewater** *ACS ES&T ENGINEERING*
  Shao, X., Johnson, S. R., Tarpeh, W. A.
  2022
- **Application of plasma for the removal of pharmaceuticals in synthetic urine** *ENVIRONMENTAL SCIENCE-WATER RESEARCH & TECHNOLOGY*
  Rodriguez, E. E., Tarpeh, W. A., Wigginton, K. R., Love, N. G.
  2022
- **Systematic Evaluation of Emerging Wastewater Nutrient Removal and Recovery Technologies to Inform Practice and Advance Resource Efficiency** *ACS ENVIRONMENTAL SCIENCE AND TECHNOLOGY ENGINEERING*
  Kogler, A., Farmer, M., Simon, J. A., Tilmans, S., Wells, G. F., Tarpeh, W. A.
  2021; 1 (4): 662-684
- **An Evolving Insight into Metal Organic Framework-Functionalized Membranes for Water and Wastewater Treatment and Resource Recovery** *Industrial & Engineering Chemistry Research*
  Le, T., Chen, X., Dong, H., Tarpeh, W., Perea-Cachero, A., Coronas, J., Martin, S. M., Mohammad, M., Razmjou, A., Esfahani, A. R., Koutahzadeh, N., Cheng, P., Kidambi, et al
  2021; 60 (19): 6869–6907
- **Making wastewater obsolete: Selective separations to enable circular water treatment.** *Environmental science and ecotechnology*
  Tarpeh, W. A., Chen, X.
  2021; 5: 100078
- **Selective aqueous ammonia sensors using electrochemical stripping and capacitive detection** *AIChE Journal*
  Lalwani, A., Dong, H., Mu, L., Woo, K., Johnson, H. A., Holliday, M. A., Guo, J., Senesky, D. G., Tarpeh, W. A.
  2021
- **Electro-assisted regeneration of pH-sensitive ion exchangers for sustainable phosphate removal and recovery.** *Water research*
  Dong, H., Wei, L., Tarpeh, W. A.
  2020; 184: 116167
- **Selective recovery of ammonia nitrogen from wastewaters with transition metal-loaded polymeric cation exchange adsorbents.** *Chemistry (Weinheim an der Bergstrasse, Germany)*
  Clark, B., Tarpeh, W.
  2020
- **Novel two-chamber tubular microbial desalination cell for bioelectricity production, wastewater treatment and desalination with a focus on self-generated pH control** *Desalination*
  Jafary, T., Al-Mamun, A., Alhimali, H., Baawain, M., Rahman, S., Tarpeh, W. A., Dhar, B., Kim, B.
  2020; 481

- **The role of intraparticle diffusion path length during electro-assisted regeneration of ion exchange resins: implications for selective adsorbent design and reverse osmosis pretreatment** *Chemical Engineering Journal*
  Dong, H., Wu, Z., Liu, M. J., Tarpeh, W. A.
  2020
- **Validation and mechanism of a low-cost graphite carbon electrode for electrochemical brine valorization** *ACS Sustainable Chemistry & Engineering*
  Mu, L., Wang, Y., Tarpeh, W. A.
  2020; 8 (23): 8648-8654
- **Process design tools and techno-economic analysis for capacitive deionization.** *Water research*
  Hasseler, T. D., Ramachandran, A. n., Tarpeh, W. A., Stadermann, M. n., Santiago, J. G.
  2020; 183: 116034
- **Building an operational framework for selective nitrogen recovery via electrochemical stripping.** *Water research*
  Liu, M. J., Neo, B. S., Tarpeh, W. A.
  2019; 169: 115226
- **Selective Hydrogenation of Furfural in a Proton Exchange Membrane Reactor Using Hybrid Pd/Pd Black on Alumina** *CHEMELECTROCHEM*
  Carl, S., Waldrop, K., Pintauro, P., Thompson, L. T., Tarpeh, W. A.
  2019
- **Sanitation for Low-Income Regions: A Cross-Disciplinary Review.** *Annual review of environment and resources*
  Hyun, C., Burt, Z., Crider, Y., Nelson, K. L., Sharada Prasad, C. S., Rayasam, S. D., Tarpeh, W., Ray, I.
  2019; 44 (1): 287-318
- **Quantitative Evaluation of an Integrated System for Valorization of Wastewater Algae as Bio-oil, Fuel Gas, and Fertilizer Products** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Li, Y., Tarpeh, W. A., Nelson, K. L., Strathmann, T. J.
  2018; 52 (21): 12717–27
- **Effects of operating and design parameters on ion exchange columns for nutrient recovery from urine** *ENVIRONMENTAL SCIENCE-WATER RESEARCH & TECHNOLOGY*
  Tarpeh, W. A., Wald, I., Wiprachtiger, M., Nelson, K. L.
  2018; 4 (6): 828–38
- **Electrochemical Stripping to Recover Nitrogen from Source-Separated Urine** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Tarpeh, W. A., Barazesh, J. M., Cath, T. Y., Nelson, K. L.
  2018; 52 (3): 1453–60
- **Evaluating ion exchange for nitrogen recovery from source-separated urine in Nairobi, Kenya** *Development Engineering*
  Tarpeh, W. A., Wald, I., Omollo, M. O., Egan, T., Nelson, K. L.
  2018; 3: 188-195
- **Life-Cycle Cost and Environmental Assessment of Decentralized Nitrogen Recovery Using Ion Exchange from Source-Separated Urine through Spatial Modeling** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Kavvada, O., Tarpeh, W. A., Horvath, A., Nelson, K. L.
  2017; 51 (21): 12061–71
- **The sanitation and urban agriculture nexus: urine collection and application as fertilizer in Sao Paulo, Brazil** *JOURNAL OF WATER SANITATION AND HYGIENE FOR DEVELOPMENT*
  Chrispim, M. C., Tarpeh, W. A., Salinas, D. P., Nolasco, M. A.
  2017; 7 (3): 455–65
- **Comparing Ion Exchange Adsorbents for Nitrogen Recovery from Source-Separated Urine** *ENVIRONMENTAL SCIENCE & TECHNOLOGY*
  Tarpeh, W. A., Udert, K. M., Nelson, K. L.
  2017; 51 (4): 2373–81