Kofi S.S. Christie

kofi.christie@vanderbilt.edu

Dept. of Civil and Environmental Engineering
Jacobs Hall 261
400 24th Avenue South
Nashville, TN 37212
(615) 322-2697

879 Granada Avenue
Nashville, TN 37206
(678) 468-9593

Education

Vanderbilt University, Nashville, TN
Doctor of Philosophy, Environmental Engineering **May 2020**
Dissertation Title: *Toward Using Membrane Distillation for Brine Treatment: Understanding Energy Efficiency and the Challenge of Mineral Scaling*
Vanderbilt University, Nashville, TN
Master of Science, Environmental Engineering December 2016
Morehouse College, Atlanta, GA
Bachelor of Science, Physics (with honors) May 2014

Technical Skills

Laboratory
- Polymer film fabrication (NIPS, electrospinning)
- Microscopic analysis (optical, SEM)
- Interfacial analysis (goniometry, zeta potential, surface tension)
- Electrochemical analysis (CV, EIS)
- Material strength analysis

Computer
- Matlab
- AutoCAD
- EC-Lab
- OriginPro

Selected Publications and Presentations

Journal Publications:

Christie, K. S.S., Yin, Y., Lin, S., & Tong, T. (2019). Distinct Behaviors between Gypsum and Silica Scaling in Membrane Distillation. *Environmental Science & Technology, 54(*1*),* 568-576.

Christie, K.S.S., Horseman, T., Lin, S. (2020). Energy Efficiency of Membrane Distillation: Simplified Analysis, Heat Recovery, and the use of Waste-Heat. *Environmental International*, 105588

Christie, K.S.S., Horseman, T., Su, C., Wang, R., Lin, S. (2020) Decoupling the Effects of Feed Temperature and Flux on Gypsum Scaling in Membrane Distillation. *Desalination* (Manuscript in Preparation)

Horseman, T., Su, C., **Christie, K.S.S.**, & Lin, S. (2019). Highly Effective Scaling Mitigation in Membrane Distillation Using a Superhydrophobic Membrane with Gas Purging. *Environmental Science & Technology Letters*, *6*(7), 423-429.

Hou, D., **Christie, K. S.S.**, Wang, K., Tang, M., Wang, D., & Wang, J. (2019). Biomimetic superhydrophobic membrane for membrane distillation with robust wetting and fouling resistance. *Journal of Membrane Science*, 117708.

Su, C., Horseman, T., Cao, H., **Christie, K.S.S.**, Li, Y., & Lin, S. (2019). Robust Superhydrophobic Membrane for Membrane Distillation with Excellent Scaling Resistance. *Environmental Science & Technology, 53*(20), 11801-11809.

Conference Presentations:

Christie, K.S.S., Lin, S., Gypsum Scaling in Membrane Distillation: The Interplay between Flux and Temperature (Poster). North American Membrane Society (NAMS) 27th Annual Meeting, June 9-13, 2018

Grants and Awards

National Science Foundation (NSF) Innovation Corps Grant — January 2020
Proposal title: *Assessing the Challenges and Market Opportunities for High-Salinity Wastewater Treatment*

National Science Foundation (NSF) Graduate Research Fellowship — August 2015
Proposal title: *Developing Omniphobic Membranes for Membrane Distillation for Shale Gas Wastewater Desalination*

IBM Fellowship — August 2014

Experience

Lin Laboratory – Vanderbilt University, Nashville, TN
Graduate Research Assistant — **August 2014 – May 2020**

- Developed a new understanding of the impact of polarization, species solubility, and membrane wettability on mineral scaling in membrane distillation
- Developed new intuitive metrics for energy efficiency analysis of membrane distillation
- Investigated a novel in-situ membrane monitoring scheme for membrane distillation via electrical impedance spectroscopy

Dept. of Civil and Environmental Engineering – Vanderbilt University, Nashville, TN
Teaching Assistant – Senior Design — January – May 2015/2019

- Facilitated the development of capstone engineering projects (i.e., hospital design, solar desalination system) that were confronted with real-world constraints, budgets, reviews, and deadlines

Teaching Assistant – Intro to Civil Engineering, Laboratory — August – December 2014/2018

- Facilitated the instruction and construction of wind energy-related projects

Programs for Talented Youth – Vanderbilt University, Nashville, TN
Course Instructor – The Water-Energy Nexus: Engineering Solutions — January – April 2019

- Designed and implemented a course curriculum used to introduce middle school and high school students to nanotechnology, water treatment, and energy conversion processes.
- Created hands-on experimental demonstrations to enable the visualization of basic scientific concepts via the scientific method

Course Instructor – Reading and Writing in Engineering — November 2017

- Construction and realization of a lesson plan used to engage middle school students with instruction on effective science communication through brain games, lectures, and hands-on demonstrations

Teaching Assistant – Nanotechnology and Engineering July – June 2016/2017

- Provided instructional and logistical support to instructors to assist in the training of high school students in engineering concepts involving nanotechnology

The School for Science and Math at Vanderbilt – Vanderbilt University, Nashville, TN

Graduate Student Mentor – Flow-Powered UV System December 2016 – December 2017

- Assisted in the development of a flow-powered ultraviolet irradiation system for the control of secondary contaminants in a water distribution system
- Worked extensively with mentee (Tobias Roberts) to organize lab experiments and assist in the drafting and submission of final reports

Summer Science Academy – Morehouse College, Atlanta, GA

Teaching Assistant – Nuclear, Materials, and Space Science May – August 2014

- Provided instructional and logistical support to instructors to assist in the training of high school students in nuclear, materials, and space-related fields

Environmental Microbiology Laboratory – Stanford University, Palo Alto, CA

Visiting Research Assistant May – August 2013

- Developed wastewater runoff restriction recommendations for the City of Palo Alto through the systematic sampling and characterization of the nutrient profiles and nitrification rates in local salt-marsh environments

Solid State Spectroscopy Group – Kyoto University, Kyoto, Japan

Visiting Research Assistant May – August 2012

- Uncovered the correlation between aspect ratio and low frequency phonon absorption in gold nanorods by using terahertz time domain spectroscopy (for use in biomedical applications such as radiation therapy for tumor size reduction)
- Established a correlation between observable color and surface plasmon resonance frequency on gold nanorod surfaces by using ultraviolet-visible-infrared spectroscopy

Professional Development

1st International Conference on Capacitive Deionization and Electrosorption October 25-29, 2015

Workshop Title: *Capacitive Deionization – Electrical Double Layer and Transport Modelling*

Leadership

Org. of Black Graduate and Professional Students – Vanderbilt University, Nashville, TN

Parliamentarian August 2017 – July 2018

Vice President August 2015 – July 2017

Civil and Environmental Engineering Council – Vanderbilt University, Nashville, TN

President August 2016 – July 2017

Vice President August 2015 – July 2016

Affiliations

North American Membrane Society (NAMS) March 2018 – Present

National Society of Black Engineers (NSBE) October 2011 – Present

Society of Physics Students (SPS) January 2012 – May 2014

Coursework

- Transport Phenomena
- Polymer Science and Engineering
- Advanced Chemical Engineering Thermodynamics
- Environmental Chemistry
- Nanoscale Science and Engineering
- Mathematical Methods for Chemical Engineers
- Electrochemistry