

Exponent®
Engineering & Scientific Consulting

Craig Ayres, Ph.D.

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Professional Profile

Dr. Ayres has a background in environmental engineering with an emphasis on drinking water treatment processes, microbial pathogens in drinking water, engineered water systems, nanomaterial applications, and contaminant fate and transport. He has extensive laboratory experience cultivating bacteria and analyzing tolerance to treatment applications.

At Exponent, Dr. Ayres has applied his knowledge of drinking water disinfection and water distribution systems to various projects, including microbial contamination in the process water of an industrial facility and failed microbial quality control testing during installation of new drinking water service lines. He has also been involved in projects related to per- and polyfluoroalkyl substances (PFAS) in both the consumer product regulatory space and evaluation of capacity for removal at drinking water treatment facilities.

His doctoral thesis focused on the development of a point-of-use drinking water treatment strategy for the waterborne pathogen Legionella pneumophila and associated free-living amoebae that provide a replicative niche and increased treatment resistance. To overcome this resistance, he coupled microwave radiation with silver in the nanoparticulate or ionic form to induce localized heating or cellular membrane stress. In addition to his work on microbial inactivation, he specialized in the complex parasitic relationship between Legionella and free-living amoebae such as Acanthamoeba castellanii. Intracellular growth of Legionella within amoebae has been shown to enhance virulence and Dr. Ayres also investigated the drivers of this phenomenon and how infectivity related to treatment resistance.

He performed additional doctoral research with community water systems and incorporating nanotechnology into familiar and readily available technologies for point-of-use treatment. He was involved in research relating perceived and actual water quality through community survey responses and water quality testing, respectively. Dr. Ayres co-authored a review paper of existing and potential nanomaterial applications for the treatment of PFAS in drinking water. Dr. Ayres also studied SARS-CoV-2 detection in wastewater, assisting in the development of a routine monitoring strategy using digital polymerase chain reaction (dPCR).

Dr. Ayres earned his Ph.D. in Civil Engineering and M.S. in Environmental Engineering from the University of Texas at Austin. He earned his B.S. in Environmental Engineering from The Ohio State University. Prior to joining Exponent, Dr. Ayres also had three years of experience as an engineering consultant, focusing primarily on combined sewer overflow mitigation, stormwater and hydraulic modeling, and asset management.

Academic Credentials & Professional Honors

Ph.D., Civil Engineering, University of Texas, Austin, 2022

M.S., Environmental and Water Resources Engineering, University of Texas, Austin, 2018

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B.S., Environmental Engineering, Ohio State University, Columbus, 2013

Prior Experience

Teaching Assistant, Introduction to Environmental Engineering, University of Texas at Austin, 2018-2022

Graduate Research Assistant, University of Texas at Austin, 2016-2022

Design Engineer, AECOM, 2013-2016

Professional Affiliations

American Water Works Association

Publications

Cambronne ED, Ayres C, Dowdell KS, Lawler DF, Saleh NB, and Kirisits MJ. Protozoan-Priming and Magnesium Conditioning Enhance Legionella pneumophila Dissemination and Monochloramine Resistance. Environmental Science & Technology 2023; 57:14871-14880

Ayres C, Lawler DF, Kirisits MJ, Saleh NB. Synergy between Microwave Radiation and Silver Ions or Nanoparticles for Inactivating Legionella pneumophila. Environmental Science & Technology Letters 2021; 8:581-588

Saleh NB, Khalid A, Tian Y, Ayres C, Sabaraya IV, Pietari J, Hanigan D, Chowdhury I, Apul OG. Removal of poly- and per-fluoroalkyl substances from aqueous systems by nano-enabled water treatment strategies. Environmental Science: Water Research & Technology 2019; 5:198-208

Rowles III LS, Alcalde R, Bogolasky F, Kum Soyoon, Diaz-Arriaga FA, Ayres C, Mikelonis AM, Toledo-Flores LJ, Alonso-Gutierrez MG, Perez-Flores ME, Lawler DF, Ward PM, Lopez-Cruz JY, Saleh NB. Perceived versus actual water quality: Community studies in rural Oaxaca, Mexico. Science of the Total Environment 2018; 622: 626-634

Presentations

Ayres, C; Cambronne, E.; Lawler, D; Kirisits, M; Saleh, N. Inactivation of Legionella pneumophila harbored by amoeba with a synergistic silver and microwave treatment. Sustainable Nanotechnology Organization Conference, Austin, TX. November 2022.

Ayres, C; Saleh, N; Lawler, D; Kirisits, M; Cambronne, E. Effectiveness of various treatments toward infectious forms of Legionella pneumophila and their amoebal hosts. American Water Works Association ACE22 Conference, San Antonio, TX. June 2022.

Ayres, C; Saleh, N; Lawler, D; Kirisits, M; Cambronne, E. Synergy between Microwave Radiation and Silver Ions or Nanoparticles for Inactivating Legionella pneumophila and Amoebae Hosts. American Water Works Association Water Quality Technology Conference, Tacoma, WA. November 2021.

Project Experience

Assessed microbial contamination at an industrial facility. Analyzed lab results and sampling methodologies for microbial identification, evaluated in-house water treatment process for biofilm growth

potential, and recommended improvements to the water treatment operations and quality control microbial testing methods.

Supported commercial manufacturer by assessing extractable organic fluorine (EOF) and potential presence of per- and poly-fluoroalkyl substances (PFAS) in product line. Developed a sampling plan for specific products, processed samples by unique components, and collaborated with third-party research laboratory to analyze samples.