MEMORIAL UNIVERSITY

Chemistry Departmental Seminar

Tuesday, September 10th at 1:00 p.m. (Room: CSF-1302)

Water and Light: Breaking Down Biofilms with Greener Materials and Chemicals

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Abstract

Water insecurity affects over two-thirds of the global population at some point in every year, with extreme weather events driven by climate change amplifying the extent of this challenge. Challenges that limit availability of clean, safe abundant water for drinking and sanitation happen throughout the water cycle, and are amplified by social and environmental justice inequalities. These need to be addressed at a systems level that includes not only appropriate water treatment technologies, but also decisions about what materials are permitted to enter our waterways.

While the scope of this challenge is broader than chemistry and technology, as green chemists and engineers we have access to many tools through which we can contribute to sustainable water solutions and prevent the introduction of hazardous chemistries and materials in our waterways while still achieving the goal of safe drinking water for all.

In my first seminar (Chemistry), I will focus on green chemistry-inspired methods of targeting unwanted microbial growth, using covalent tethering of active molecules onto surfaces. Visible light in-situ production of short-lived reactive oxygen species offers effective prevention and removal of biofilms without the common hazardous chemical residuals of disinfection. This research combines small molecule synthetic chemistry, surface functionalization, photochemistry, diverse spectroscopies, and microbiological assays to provide a promising new class of antimicrobial materials.

In my second seminar (Engineering), I will focus on prevention of biofouling in the context of reverse osmosis (RO) water treatment, recognizing that fouling is responsible for 10% of the cost of RO system operation, and is therefore a barrier to access. Through the design of greener alternative non-oxidizing biocides using hazard assessment and efficacy screening in well-plates, a CDC reactor, and a bench-scale RO “pilot” system, we have both developed a protocol for screening of potential novel biocides, and identified promising candidates for further exploration.

Biosketch

Prof. Heather L. Buckley (she/her), Ph.D., P.L.Eng. is an Associate Professor in Canada's Greenest Civil Engineering Program, and Associate of the Chemistry Department at the University of Victoria, BC, Canada. Her interdisciplinary research team, the Green Safe Water Lab, tackles challenges at the interface of green chemistry, civil engineering, and public health, centering their efforts around the design of safer alternative technologies in water treatment, biofouling prevention, and sustainable materials, and creating tools for better monitoring of drinking water contaminants.

Dr. Buckley holds a PhD in Inorganic Chemistry from the University of California Berkeley, where she was an International Fulbright Science & Technology Fellow. She then served as the Associate Director of International Partnerships at the UC Berkeley Center for Green Chemistry, working with industrial partners in the US and India, was a Green Talents Fellow at the Fraunhofer Institute for Solar Energy in Freiburg, Germany and subsequently was an ITRI Rosenfeld Postdoctoral Fellow at the Lawrence Berkeley National Laboratory.

Dr. Buckley is actively engaged in Green Chemistry and Environmental Justice curriculum development (2024 ACS-CES Award for Incorporation of Sustainability into Education), as well as serving as a co-facilitator of the UVic Faculty of Engineering and Computer Science's year-long ***Engagement Circles for Developing our Faculty Truth and Reconciliation Strategy*** process in 2023-2024.

Her team has active research collaborations with four industrial partners, as well as academic collaborations around the world (including Germany, Poland, USA, and Colombia), providing opportunities for current and prospective members of the Green Safe Water Lab for international exchange and practical experience.