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Greener Biofouling Prevention for Reverse Osmosis Systems

Da-Silva-Correa, L.H.; Henriquez, O.-F. K.N.; Thorburn, D.S.G.; Boutouis, F.-Z. K.; Pereira, M.I.; Sanchez Varon, D.R.; Smith, H.A.; Douglas, G.; Godoy, R; Gamm, N.E.; Aasen, K.; Rahmati, N.; Welsh, B.; Thibodeau, M.C.; Buckley, H.L.

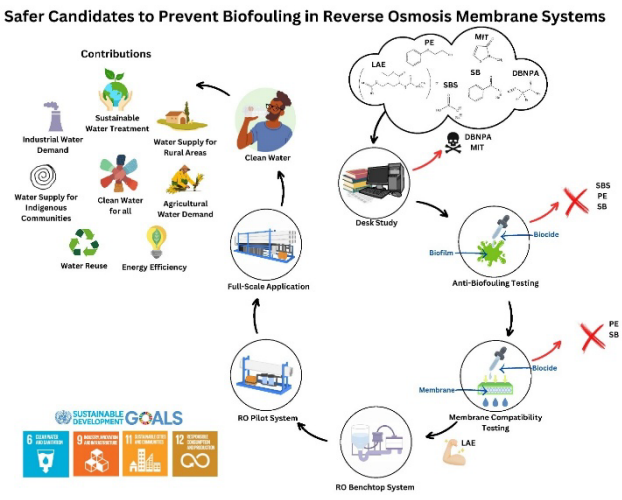
Green Safe Water Lab. University of Victoria. Department of Civil Engineering, Department of Chemistry, Centre for Advanced Materials and Related Technologies, and Institute for Integrated Energy Systems.

Overview and Importance: Safe Drinking Water for All

Currently, many communities around the world are dealing with several challenges due to the lack of access to clean potable water. The application of desalination membrane technologies offers a solution to address the insufficiency in potable water supply. This filtration technology has capability to produce freshwater from diverse water sources including wastewater, brackish water, and seawater. So why can't we just use desalination technologies to solve the clean water shortage worldwide? Well, desalination technology is very expensive, mainly because of this thing called biofouling. Biofouling happens when microorganisms embedded in a jelly-like material (biofilm) clog up the membranes used in the filtering process. It reduces water production, damages the membranes, and increases the energy needed to produce freshwater. To control biofouling, desalination plant operators usually use a ton of harsh chemicals, which only adds to the cost of the application of the technology. Plus, dealing with biofouling makes waste disposal trickier, further increasing the overall operating costs of desalination plants. Finding safer alternatives to prevent biofouling in desalination membrane systems is not an easy task. It is not just a complex issue; it is something that was never done effectively before. So, in my PhD research, I have come up with a method to find greener and safer chemical solutions to prevent biofouling in desalination membrane systems.

Key Discoveries and Intellectual Merit: A Process for Screening Greener Alternative Biocides

The proposed platform has two parts: a screening protocol followed by a validation protocol. I analyzed nine chemicals to see if they could prevent biofouling in desalination membrane systems. The screening protocol had three steps: a literature review study, antibiofouling testing, and membrane compatibility testing. In our literature review, we examined various sources to determine whether the selected chemicals are feasible to be used in desalination membrane technology for producing drinking water. In the antibiofouling testing, we tested if the chemicals prevent the growth of microorganisms on the surface of the membrane. In the membrane compatibility test, we tested if the chemicals damaged the membranes. Out of all the chemicals we studied, LAE (ethyl lauroyl arginate, a food preservative used in baking powders!) was the only biocide to successfully pass all phases of the proposed screening protocol, making it a promising option to prevent biofouling in desalination membrane systems. LAE has shown excellent antimicrobial properties, does not cause damage to membranes, and is considered low in hazard. However, before we start using LAE on a big scale, we've got more tests to run (validation protocol). That's the focus of my postdoctoral research and ongoing work in the Green Safe Water Lab. In conclusion, my PhD project marks the initial step towards an innovative green solution for water scarcity by ultimately optimizing desalination membrane technologies for widespread adoption in freshwater production.



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