Fall 2021 Department of Biology Seminar

Using Brackish Diatoms for the Treatment of Desalination Wastewater
Squeezing More Usable Water

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Reverse osmosis (RO)-based treatment of brackish water and recycled water is one of the key solutions for solving the global challenge of water scarcity due to excessive drought and population growth in urban areas. While the RO process produces 75% to 85% of fresh water, 15% to 25% of the feed water becomes a waste stream called concentrate or brine. The management and proper disposal of brine is a critical issue in RO-based water reuse and desalination projects. In order to reduce the volume of brine and improve drinkable water recovery, an additional stage of RO process may be added. However, serious scaling due to the presence of inorganic scalants, including silica, phosphate, and hardness metals, becomes a major problem. Also, the impacts of wastewater-derived constituents, such as nutrients and trace organics including disinfection byproducts (e.g., nitrosamines) within the concentrate on the receiving environment is becoming a major concern.

In our research lab, we are developing a new photobiological treatment process for RO concentrate using a brackish diatom *Gedaniella flavovirens* Psetr3 (see the photo). Diatoms, including *G. flavovirens*, take up dissolved silica (SiO_2) to synthesize new cells, which is made of up to 60% silica. As microalgae, they also take up macro-nutrients including ammonia-N, nitrate-N, and orthophosphate. We also discovered that cations, including calcium, barium, strontium, iron, and manganese could be precipitated by the diatom-based photobiological process. The diatom biomass can be harvested and used to produce valuable by-products such as biofuel, fatty acids, fish/animal feed, soil amendment, and other materials. To date, we have demonstrated the technical feasibility of our new process to treat RO concentrate samples obtained from >15 full-scale advanced water purification facilities and brackish water desalination facilities and to recover the additional usable water on a laboratory scale. In this presentation, I will share the recent progress made in our lab at Texas State on this unique photobiological process and discuss some challenges and opportunities in relation to the biology of brackish diatoms.