Figure 1 MS student Brindha Murugesan (University of Cincinnati) is optimizing a bench-scale membrane bioreactor system with the carbon nanotube composite membrane.

Dr. Soryong Chae, Assistant Professor at the Department of Chemical and Environmental Engineering at the University of Cincinnati completed an Ohio Water Resources Center funded project via OWDA subaward. This project titled **"Design of a self-cleaning membrane-assisted bioreactor for enhanced removal of nutrients from wastewater"** aims to fabricate a self-cleaning membrane for the efficient use in wastewater treatment.

Due to the continuously increasing occurrence of HABs in Ohio's lakes and rivers and the inefficient or impractical technologies for the elimination of nutrients, there is a critical need to develop an effective solution for a satisfactory removal of nutrients from wastewater sources in order to achieve clean and safe drinking water supplies and protect human health. Dr, Chae and students build a bench-scale membrane bioreactor (MBR) with self-cleaning carbon nanotube (CNT) membrane (Figure 1). They fed the MBR with synthetic wastewater to investigate organic compounds, total nitrogen and total phosphorous removal and evaluate the membrane durability and fouling potential when heating is used for membrane cleaning. Typical removal efficiencies of chemical oxygen demand, total nitrogen, and total phosphorus by the MBR during 60 days of operation were 95~96%, 83~84%, and 63~65%, respectively. As shown in Figure 2, the CNT composite membrane was able to treat wastewater for 9-10 days without cleaning, while a commercial polytetrafluoroethylene (PTFE) membrane in the same setting could be operated only for 6-7 days before cleaning/replacement. Furthermore, the membrane was effectively recovered from fouling using electric heating. During this period, any physical damage of the CNT composite membrane was not found by the electric heating. The results allow for development of novel engineering solutions for the mitigation of membrane fouling and/or recovery from membrane fouling that eventually increase performance of MBR systems and also reduce HABs' risks to public health and the environment.

<u>Researcher Profile:</u> Dr. Soryong Chae received his Ph.D. from Korea Advanced Institute of Science and Technology (KAIST) in 2004 and he pioneered research in the application of nanotechnology for membrane, water and energy. His research interest includes environmental implications and applications of engineered nanomaterials; membrane technology for drinking water production; and MBR for municipal and industrial wastewater recycling.

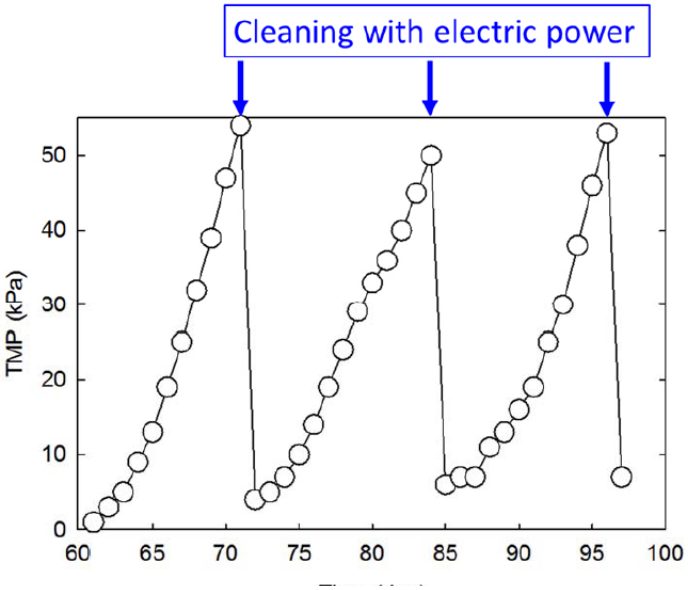

Figure 2 Changes in carbon nanotube membrane fouling (transmembrane pressure) during the experimental period.