ABSTRACT
Membrane distillation (MD) has a great potential in the desalination of high salinity wastewaters where RO treatment is not feasible and traditional thermal technologies are very expensive. MD can achieve complete rejection of ions and non-volatile organics as long as the membrane pores are not wetted. It can serve as a cost effective method to treat produced water from unconventional oil and gas extraction or brackish water RO reject due to the potential to use of low-quality (i.e., waste) heat.

Our experimental results show that direct contact membrane distillation (DCMD) can concentrate the produced water from Marcellus Shale Play to near halite saturation with minimal scaling issues due primarily to the presence of iron in the feed solution. ASPEN Plus model of DCMD process was developed and calibrated using the experimental results to gain insight into heat and mass transfer processes and enable scale-up of this treatment technology. Techno-economic assessment revealed quite favorable comparison with currently available treatment options. Polarization effects in DCMD include both temperature and concentration polarization. While temperature polarization has been studied extensively in the past, the concentration polarization has been mostly neglected.

Modeling studies have shown the concentration of salts at the membrane surface can be 30-40% higher than that in the bulk. Hence, a novel in-situ optical technique was developed to probe the solute concentration in the concentration polarization layer as a function of feed temperature, hydrodynamic conditions and solute concentration to enable accurate assessment of DCMD performance under a variety of operating conditions.

Radisav D. Vidic, Professor
Department of Civil and Environmental Engineering
University of Pittsburgh

Radisav D. Vidic is a William Kepler Whiteford Professor of Environmental Engineering and Chair of the Department of Civil and Environmental Engineering at the Swanson School of Engineering. His professional expertise is in the area of physical/chemical unit processes for water, wastewater and air treatment and his research is focused on advancing the applications of surface science in environmental engineering by providing fundamental understanding of molecular-level interactions at interfaces. His current research focuses on the application of membrane technologies for water and wastewater treatment, optimizing water and solid waste management for the development of unconventional (shale) gas resource and reuse of impaired waters. Dr. Vidic published over 300 journal papers, conference proceedings and reports on these topics with more than 7,000 citations in scientific literature.

His professional recognition includes Professional Research Award from the Pennsylvania Water Environment Federation for his research accomplishments and dedication to the profession, Fulbright Scholar, Professor of the Year Award by the Pittsburgh section of American Society of Civil Engineers, US EPA Science Advisory Board for the Review of Hydraulic Fracturing Study, Who’s Who in Energy by Business Times, Water Environment Federation Award in Graduate Division and SSOE Board of Visitors Faculty Award. His research on the reuse of impaired waters for cooling systems in coal-fired power plants was awarded 2013 University Research Grand Prize by the American Academy of Environmental Engineers and Scientists.