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Energy recovery from wastewater streams utilizing Pressure Retarded Osmosis in the State of Kuwait

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The discharge from desalination plants in the State of Kuwait returns brine of high salinity to the Gulf that contains contaminants causing harmful impact to the environment of the coastal region. However,the wastewater discharge to the Gulf is of low salinity andmay driveeutrophication of coastal waters. The present study investigates the application of pressure retarded osmosis (PRO) technology, as a promising source of green energy and an emerging membrane-based technology for recovering energy from concentration differences between water streams. The proposed work examines the feasibility of using PRO to generate energy from wastewater and desalination plants in Kuwait by calculating the power density using a PRO zero and one dimensional models. The zero model accounts for the effects of concentration polarization (CP) and salt leakage (B') to produce realistic results. Case studies on the potential re-use of treated wastewater effluent (TWE) and brine reject streams from wastewater treatment plants (WWTPs) in Kuwait were studied to determine the power generated from each of the WWTPs. The PRO power density (W) was studied as a function of hydraulic pressure (ΔP) at different feed and draw solution concentrations. The results showed that the power densities were higher at higher concentration. This increase in power density values was attributed to the higher driving forces acting on the system. Concentration polarization (CP) and salt leakage (B') reduce the driving forces across the membrane. The effects of CP and (B') vary depending on the concentration difference of the draw and feed solutions across the membrane. Also, the present work includes the study of PRO one dimensional model equations to predictthe membrane area required to achieve high permeation using actual operational data of Kuwait.

Biography:

Dr. Bader Al-Anzi is the chairman of Environmental Technology & Management Department at Kuwait University and research affiliate in mechanical engineering department at MIT, Boston, USA. He joined MIT nuclear & engineering department as a full time visiting scientist in 2013 until 2014. He pursued his graduate studies in chemical engineering from various reputed universities majoring in water & wastewater treatment utilizing unconventional processes. His research experience includes wastewater treatment, desalination, two phase flow/aeration, corrosion, bioengineering and air pollution control. He has also worked in several governmental organizations that focus on water desalination and wastewater treatment. He has completed several projects in the area of water treatment, and currentlyhe is the Principal Investigator of a prestigious project worth 5.5 million dollars. He supervises PhD& MSc students in chemical engineering exploring unconventional wastewater treatment processes. His desire to explore innovative processes and creativity led him to obtain more than 14 US and 2 European patents that resulted in manufacturing and certifying one of his inventions by American Aerators Company in USA to be used globally to treat contaminated seawater. He has received many outstanding awards both internationally and locally. He has several papers published in peer reviewed journals in various environmental areas.