הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

תכנית האנרגיה ע"ש
ננסי וסטיבן גרנד
Grand Technion Energy Program

Wolfson Department of Chemical Engineering Seminar

Wolfson Department of Chemical Engineering, Lecture Hall No. 6
Wednesday, November 3th, 2021 at 14:00

Energy Saving Nafion-Based Mixed-Charged Nanofiltration Membranes: Preparation and Performance

Michael Zelner

Grand Technion Energy Program, Technion-Israel Institute for Technology

PhD Seminar

Advisor: Prof. Slava Freger

Wastewater is an important resource of irrigation water in Israel and potential solution for many other water-stressed countries. Unfortunately, currently used solutions are unable to address the problem of growing salinity. Nanofiltration (NF) is an optimal energy-efficient solution for wastewater desalination, however, commercial NF membranes such as NF270 suffer severely form scaling due to high rejection of multivalent ions, which limits water recovery and depletes irrigation water of vital minerals. In our project, we investigate a new approach to preparation of NF membranes, specifically tailored for wastewater desalination. The membrane combines oppositely charged polyelectrolytes, Nafion and polyvinylamine (PVAm), in which the first Nafion layer determines the membrane thickness, while PVAm coating seals the defects in Nafion layer and neutralizes its charge, as confirmed by surface charge measurements. After optimization, a membrane with a symmetrical rejection of $MgCl_2$ and Na_2SO_4 was obtained, much more favorable for reducing propensity to scaling and undesired demineralization, compared to NF270 benchmark. Further, rejection of salts, most importantly undesired NaCl, was increased by varying Nafion thickness. Curiously, ion rejection of the new membrane drops with concentration for salts, which is different form NF270 and points to differences in rejection mechanism. The membrane showed excellent stability in 10% NaCl water solution and examined pH range 2 to 10. The above features make the new mixed-polyelectrolyte membrane attractive in applications, such as treatment wastewater or other water sources with high propensity to scaling. Our next plans included final evaluation of the membrane performance in terms of scaling and fouling and extending our approach to other polyelectrolyte materials.

Refreshments will be served at 13:45