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Foreword

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Foreword

Membrane technology continues to emerge and adapt to meet the growing needs of industry. Interesting new areas include nanotube membranes (1), advanced modules (2), and mixed matrix gas separation membranes (3). The North American Membrane Society (NAMS) serves as a conduit for the newest membrane technology and applications, and has done so since its founding in 1985. This special issue entitled "New Frontiers in Membrane Science: New Research Presented at the North American Membrane Society 2006 Annual Meeting" is a sample of some of the new technology presented at NAMS 2006 in Chicago, IL. This issue details work in three distinct areas: ultrafiltration, high value separations dealing with food and pharmaceutical streams, and new advances in pervaporation and electrodialysis.

The use of ultrafiltration for fractionation of proteins and like components is an emerging field. Some of the most important work in this field came out of the Zydney (4, 5) and Pouliot (6) groups. Thir work showed that protein charge and solution ionic strength complement size exclusion, resulting in higher protein fractionation selectivity. This work and other key contributions (7, 8) have led to a whole new field of study. In this issue, 4 papers probe protein and other smaller molecule separations using ultrafiltraion and nanofiltration: Rao and Zydney, Grzenia et al., Cowan and Ritchie, and Chay Pak Ting et al. These studies, including protein fractionation, peptide fractionation, and virus purification, give the very latest in protein and peptide purification technology.

The second topic area covered in this issue is high value separations dealing with food and pharmaceuticals. Ultrafiltration membrane separations of food streams have been taking place in the Maubois group since the late 1970s (9, 10). Membrane uses in biotechnology have been around since at least the 1960s with advances in cellulose acetate dialysis membranes (11) and the extraordinary efforts of Alan Michaels (12, 13). In the past 30 years, several advancements have taken place including major work in cell recycle (14) and hemodialysis (15), just to name a few. There are three contributions from this subject area in this special issue including: Geens et al., Datta et al., and Nelson et al. These studies range from the purification of very high value pharmaceutical products to the treatment of wastewater from vegetable plants.

The final topic covered in this special issue is new advances in pervaporation and electrodialysis. These technologies have been around for some time and have demonstrated success in dehydration and deionization, respectively. Pervaporation has been explored for ethanol-water separation since at least the late 1950s (16). Modeling of this process was detailed in a fundamental paper published by Wijmans and Baker in 1995 (17). Although pervaporation has enjoyed success in Europe for azeotrope breaking of ethanol and water, new advances in materials, especially zeolites (18, 19), are opening up many new applications. The study by Ramprasad and Palmer in this issue uses microchannels, made in a commercial membrane, to improve ethanol/water separation. Some of the earliest advances in electrodialysis were for use in brackish water (20). Today, electrodialysis has found niches in tartaric acid stabilization of wine (21) and whey demineralization (22). Recent advances in bipolar membranes (23) and wafers for leak free electrodeionization (24) have allowed for new potential applications in food and pharmaceuticals. The work by Bazinet et al. explores using ultrafiltration membranes in electrodialysis stacks to open up new applications. The contribution by Arora et al. looks at using electrodeionization to make a separative bioreactor enabling fermentations in low or no media whatsoever.

Again, this issue only contains a brief sampling of some of the new and exciting areas in membrane research. However, we believe this work is some of the most cutting edge and we do hope you enjoy this issue of SS&T.

Sincerely
Guest Editors
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