Journal of Membrane Science and Research 3 (2017) 118-119

Journal of Membrane Science & Research

journal homepage: www.msrjournal.com

Editorial Note

Special Issue: State of the Art Reviews in Membrane Science and Research

Dipak Rana and Takeshi Matsuura

Editors

Department of Chemical and Biological Engineering, University of Ottawa, 161 Louis Pasteur Street, Ottawa, ON, K1N 6N5, Canada

Email: rana@uottawa.ca (D. Rana); matsuura@uottawa.ca (T. Matsuura)

The membrane separation process was first discovered by Jean-Antoine Nollet, in 1748, who observed the phenomenon of osmosis in an experiment conducted with the natural membrane of animal bladder. In 1855, Adolph Fick reported his work on dialysis using synthetic membrane derived from nitrocellulose. Afterward, many more landmark developments have become known to the world. For example, in 1961 Loeb and Sourirajan announced asymmetric membranes which became a commercial success for use in desalination. In 1970, Cadotte invented the polyamide thin-film-composite membrane which received widespread commercial acceptance around the world.

In this Special Issue of the Journal of Membrane Science and Research the following ten articles are included. Hopefully, the readers will obtain a quick update on the membrane separation technology and its potential use in specific fields for research and possible industrial applications.

Liao et al. reviewed the applications of membrane technology in forest biorefinery (IFBR). IFBR has received much attention recently as a promising solution for the struggling forest industry in North America and Europe to pass through a troublesome financial period and to compete internationally. Recent progresses in the *R&D* of the field have brought about many opportunities for IFBR. Particularly, a number of useful innovations made in the membrane separation processes can be applied for the concentration and recovery of value added chemicals produced in the integrated forest biorefinery, such as, black alcohol concentration, product recovery from Kraft evaporator condensates, tall oil recovery, inorganic and inorganic compounds recovery, fermentation inhibitors expulsion, catalyst recovery, biobutanol and bioethanol generation and recovery.

Gallucci et al. made a review of innovations in membrane processes and indicated that these innovations could possibly address the many downside effects of current advances in the chemical and energy industries. For example, there is a need to capture huge CO_2 emissions from large volume plants. As of late, it has been recognized that many gas separation should be carried out at high temperatures. Therefore, further advancements should be made to develop thermally stable membranes. As well, changes in gas preparation strategies, utilization of new materials and further advancement in reactor design are needed. This review presents a complete survey of the most recent advances in membrane and membrane process development for H_2 separation at high temperatures. Since the need for higher temperature membrane separation has emerged only recently, this survey only covers the references in the literature during the last five years.

Kurihara and Sasaki's review reveals that substantially bigger plants will be required to secure access to the adequate water supply in light of the fact that worldwide water deficiencies and quality issues are a growing concern. The "Mega-ton Water System" venture was completed for the practical administration of water supply featuring a low-carbon path as the key innovation in water treatment. Applied and fundamental research for Reverse Osmosis (RO) employ transmission electron microscopy as well as other functional instruments for designing new innovative RO membranes by evaluating the physicochemical properties of these membranes.

Khulbe and Matsuura reviewed the recent progress made in RO, a water purification technology that uses a semipermeable membrane to expel particles, molecules, and bigger particles for the generation of drinking water. The principal RO membrane for seawater desalination was made of cellulose acetate. At present, the polyamide thin-film composite membrane is the most popular option due to its stability in wide pH ranges, higher temperatures, and harsh chemical environments. To enhance the membrane performance, the current trend in polymer-based membrane research is to develop nanocomposite membranes, in which nano-sized fillers, such as single-walled carbon nano-tubes (SWCNTs), multi-walled carbon nano-tubes (MWCNTs), graphene, graphene oxide, silica, or zeolite are incorporated. However there are many difficulties to address in the commercialization of these membranes. These days, it is a standard practice to characterize membranes by the advanced techniques and to co-relate these properties to the membrane performance.

Upadhyaya et al. reviewed the nanocomposite membranes involving both natural and inorganic materials. These types of materials have become a prime focus for the cutting edge membrane technology. The nanomaterials may consist of hard penetrable or impermeable inorganic nanoparticles. For example, zeolites, carbon molecular sieves, silica and carbon nanotubes, and metal oxide mixed with a polymeric matrix has opened up promising new methodology for enhancing the separation properties of polymeric membranes both for gas and liquid separation. Bolto et al. reviewed the use of organophilic membranes which provide a means for recuperating natural compounds by pervaporation with preferential permeation of organic compounds. The best membranes are hydrophobic in character, and can be completely natural inorganic or natural inorganic/polymer half breeds. For ethanol recuperation, flux rates are best for polydimethylsiloxane (PDMS) when utilized as a thin-layer on a supporting base. Zeolites give the best detachment factors alongside sensible fluxes, and bolstered silicalite performs well. A styrene copolymer membrane gives a sensible outcome for benzene/cyclohexane separation, while metal-organic structures have potential in the separation of natural isomers, where pore geometry is essential.

Eljaddi et al. reviewed the membrane processes which are utilized more

DOI: 10.22079/jmsr.2017.26148

and more in different fields including the environment, agri-business and other types of enterprises. These clean and energy productive strategies are frequently embraced for the procedures including treatment, recovery, valorization and division. In this review article, the authors attempt to review the hypothetical standards and the diverse classifications of these membranes, which include distinctive types of fluid membrane including supported fluid membranes. Likewise, the authors write about the mechanism of facilitated transport and provide a few favorable as well as unfavorable circumstances.

Shirazi et al. reviewed an article that focuses on the present status of and latest improvements in electro-spun nano-fibrous membranes and their potential effects in two noteworthy areas, i.e., desalination and water/wastewater treatment. Particular applications for desalination and high quality water/wastewater treatment, including pressure driven and osmotic membrane processes (MF, UF, NF, FO and so forth.), thermal driven membrane processes, coalescing filtration and adsorptive utilization of nanofibers, are portrayed. Electro-spun layers can assume a basic part in enhancing membrane based desalination and water/wastewater treatment frameworks. Electro-spun layers appear to have fascinating and critical preferences over regular polymeric membranes as far as execution, cost and energy savings are concerned. This article additionally highlights the possibilities of electro-spun membranes to become the best option in the water industry.

Tabe reviewed the electro-spun nanofiber membranes (ENMs) which are a new era of membranes with numerous ideal properties including high flux and low pressure drop. Electro-spinning has provided the way to deliver ultra-thin strands that can be utilized as a part of readily usable membranes with small and characterized pore sizes. This review article addresses the history and laboratory-scale preparation of ENMs, discusses the parameters that impact the properties of the fibers and the final membranes, and presents various applications in which ENMs have shown better performances when analyzed than competing conventional procedures.

Bhattad and Mahanwar reviewed the proton exchange membrane (PEM) for potential use as a direct methanol fuel cell (DMFC). The principal disadvantages for the use of these membranes are methanol penetrability, decreased proton conductivity and the cost of the membrane. In this review, polymeric materials including fluorinated, non-fluorinated, acid-base complex, and composite were examined in detail. At present, the non-fluorinated layer merits a great deal of consideration because of its ease of use. This article presents the electrospinning procedure and its creation of PEM with functionalized polymeric material as a tool to tackle the issues of proton conductivity and methanol permeability. The last portion of the article presents the summary of the recent progresses and the future potential for using PEM as a DMFC.

Bolto et al. reviewed the use of organophilic membranes which provide a means for recuperating natural compounds by pervaporation with preferential permeation of organic compounds. The best membranes are hydrophobic in character, and can be completely natural inorganic or natural inorganic/polymer half breeds. For ethanol recuperation, flux rates are best for polydimethylsiloxane (PDMS) when utilized as a thin-layer on a supporting base. Zeolites give the best detachment factors alongside sensible fluxes, and bolstered silicalite performs well. A styrene copolymer membrane gives a sensible outcome for benzene/cyclohexane separation, while metal-organic structures have potential in the separation of natural isomers, where pore geometry is essential.

The guest-editors hope that the readers of this special issue will be benefitted by gaining better understanding of the research of this area. They also wish that the readers will be able to use this special issue to shape their current and future research activities.