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Editorial Note

Special Issue: Progress in Membrane Engineering for Food and Biotechnology Industries

Enrico Drioli, Alfredo Cassano, Lidietta Giorno

Editors

Institute on Membrane Technology, ITM-CNR, Italy
Email: e.drioli@itm.cnr.it (E. Drioli); a.cassano@itn.cnr.it (A. Cassano); l.giorno@itm.cnr.it (L. Giorno)

The last years have shown a continuous interest of membranes in food and biotechnological applications. The combination of membranes and biotechnology, new materials design, new processes with membranes, including hybrid processes and membrane reactors, are key factors for addressing future investigations and a continuous industrial sustainable growth in these sectors.

This special issue is oriented to the recent progresses made so far and future perspectives on membranes and membrane processes for food and biotechnology industries. It covers original research papers and a comprehensive/critical review. A short note to celebrate the 100th anniversary of pervaporation (PV) has been also introduced by Yave, highlighting its key role as promising technique for separating mixtures as alternative to energy intensive separation processes. In this field the performance of polyelectrolyte multilayer composite membranes (PEMCMs) fabricated by depositing chitosan (CS) and alginate (Alg) solutions onto a hydrolyzed porous poly (acrylonitrile) (PAN) substrate has been reported in the work of Zhang et al.. Experimental results showed that the sorption behavior of the resulting CS/Alg PEMCMs was dependent on the number of deposition layer.

A new approach for fabricating crosslinkable asymmetric membrane suitable for PV dehydration has been proposed by Jiang and Li. In their work integrally-skinned asymmetric polyetherimide/poly (vinyl alcohol) (PEI/PVA) hollow fiber membranes were fabricated by non-solvent induced phase inversion. The prepared membranes exhibited good stability during a 200-hr PV test, while the separation factor of neat PEI hollow fiber gradually deteriorated in the same test.

The great demand of beverages with low alcohol content is a great challenge for the production of beverages with controlled alcohol content through the use of sustainable enological practices. In their work Mira et al. addressed this challenge by processing grape must by reverse osmosis (RO) for must reconstitution with different sugar contents prior to the alcoholic fermentation. The must reconstitution was carried out to obtain beverages with an alcohol volume content of 5%, 7%, 10% and 13% (v/v).

The use of 2 kDa ultrafiltration (UF) membrane for color removal from cane molasses has been reported in the work of Qi et al.. It was found that the dilution-concentration-diafiltration mode led to an average permeate flux of 13.00 L/m^{2}h while a slightly higher permeate flux of 13.80 L/m^{2}h was obtained for dilution-diafiltration-concentration mode. In order to further increase the flux and reduce the membrane fouling during UF decoloration, five pretreatments including centrifuge, chemical precipitation, ceramic microfiltration (MF) and loose ceramic UF, were employed to remove the suspended matters before color removal. 50 kDa UF membrane demonstrated the best performance compared to 0.2 μm MF membrane and 150 kDa UF membrane, in terms of highest permeate flux during clarification stage.

Razavi et al. evaluated the effect of different conditions including pH, NaCl content, transmembrane pressure (TMP), temperature, and feed flow rate (FR) on total hydraulic resistance during milk UF. Based on the characteristic shape of hydraulic resistance-time profile observed in the UF of skim milk, a mathematical model was developed to describe dynamic hydraulic resistance in UF processes of colloidal system.

The quality of kiwifruit juice clarified by modified poly (etheretherketone) (PEEK-WC) hollow fiber membranes prepared through the phase inversion process has been evaluated in the work proposed by Conidi et al.. The prepared membranes exhibited a steady-state permeate flux of about 26 L/m^{2}h in selected operating conditions and a good restore of the initial hydraulic permeability after chemical cleaning. The UF treatment allowed to remove totally the suspended solids of the fresh juice. On the other hand, bioactive compounds, including ascorbic, succinic, malic and citric acids as well as polyphenols were well preserved in the clarified juice. Accordingly, the total antioxidant activity of the ultrafiltered juice (14.6 mM Trolox) was comparable to that of the fresh depectinised juice (15.1 mM Trolox). The recovery of organic acids in the clarified juice increased linearly with the volume reduction factor as expected on the basis of the low retention of HF membranes towards these compounds.

Trojanowska et al. reviewed methods used in food chemistry for microcapsules preparation. Encapsulation involves the incorporation of food ingredients, enzymes, cells, or other materials in small capsules offering a means to protect sensitive food components, ensure against nutritional loss, utilize otherwise sensitive ingredients, incorporate unusual or time-release mechanisms into the formulation, mask or preserve flavors and aromas, and transform liquids into easily handled solid ingredients. Recent developments on various techniques employed to form microcapsules, including spray

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drying, extrusion coating, fluidized-bed coating, coacervation, layer-by-layer, and interfacial polymerization method are reviewed and discussed.

The effect of ethylene glycol as pore former on polyphenylsulfone hollow fiber membranes for crude palm oil deacidification through membrane contactor has been reported in the study of Othman et al.. It was proven that the presence of ethylene glycol promoted the formation of a more uniform interconnected finger-like structure of membrane internal layer and a reduced hydrophobicity. The presence of ethylene glycol reduced the membrane contactor performance from 16.54% free fatty acid removal to less than 5% in the treated crude palm oil permeate.

The overall contribution on membrane systems in food technology will be more and more address not only to the extraction, purification and downstream processing but also in the final formulation due to the potentialities of innovative membrane operations such as membrane emulsifier and the development of innovative membrane-assisted distillation and membrane-assisted crystallization.

The editors would like to take this opportunity to thank authors which contributed to this Special Issue. Hopefully, the readers will obtain an updated contribution on the use of membrane separation technology in food and biotechnological applications as well as useful information for further investigations in this area.