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Functional membranes for refinery of bio wastes by green chemical processes

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Abstract

Bio refinery is defined as the sustainable processing of biomass into a spectrum of marketable products and energy. The biomass is any biological material derived from living organisms, such as animals and plants. Whether bio-derived feedstock based on biomass is more environmentally friend is still controversial. It is anyway clear that, in the coming decades, it will play an important role as integrative feedstock source. Drivers for this growth include, carbon emission taxation, development of fast growing plants and with limited water demand, development of low energy demanding separation processes, energy supply to remote off-grid places. Challenges for bio-derived feedstock sustainability include, suitable and efficient transformation processes (such as trans esterification, esterification, hydrolysis), efficient and selective separation techniques for downstream processing, use of less energy for separation and formulation, use of clean technologies to produce co-products, process flexibility and modularity to be adapted for different products of interest, water removal, biodiesel viscosity control.

Membrane-based processes best suit these requirements and can promote breakthroughs in the implementation of bio refinery. In this lecture, advances of membranes and membrane devices in terms of chemical, physical, mechanical and fluid dynamics properties will be discussed. Their use in integrated membrane operations for the sustainable processing of agro-food wastes into valuable marketable products and energy will be presented. Pressure driven membrane operations have been applied to purify water and recover enriched fractions of biophenols. These valuable components have been further processed by membrane contactors, i.e. they have been concentrated by osmotic distillation and used to formulate water-in-oil emulsions by membrane emulsification. Bio catalytic membrane reactors have been used to produce a powerful anti-inflammatory, i.e. oleuropein aglycon. The organic biomass recovered in the first steps of pre-treatment and in the microfiltration retentate was suitable for production of biogas via anaerobic digestion. The biogas can be processed by membrane operations to obtain methane suitable for the energy grid and food grade CO_2.

Biography

Lidietta Giorno has served as the Director of the Institute on Membrane Technology of the National Research Council of Italy, ITM-CNR since 2009 until February 2019. She awarded The International Awards “Guido Dorso” for Research in 2011, sponsored by the Italian Senate and the University of Naples Federico II. She awarded the Sapio Red Carpet Award in 2016 among the female scientists of the highest scientific profile who are engaged for the development of the Country. Lidietta Giorno is co-author of several books, over 100 peer reviewed scientific papers in international journals, and co-editor of the Encyclopedia of Membranes, Springer, 2016. She is member of editorial board of scientific journals, member of the referee pool of scientific journals and research agencies, member of international committees and several scientific societies. Her research expertise includes membranes bioengineering, biocatalytic membrane reactors, integrated membrane systems for bioseparations and bioconversions, downstream processing based on molecular separation, membrane chirotechnology, membrane emulsifier, integrated membrane operations for water treatment. She has been involved in membrane science, engineering research and development some 25 years, being involved in research co-operations at European and international level.

Publications

1. Biocatalytic membrane reactors: applications and perspectives
2. Introduction to membrane science and technology
3. Comprehensive membrane science and engineering
4. Process intensification in lactic acid production: a review of membrane based processes
5. Fractionation of olive mill wastewaters by membrane separation techniques
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