Environmental Engineering and Management Journal March 2012, Vol.11, No. 3, Supplement, S123
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

OLIVE MILL WASTEWATER VALORISATION FOR THE PRODUCTION OF PHYTOTHERAPICS BY INTENSIFIED BIOCATALYTIC MEMBRANE REACTOR/MEMBRANE EMULSIFICATOR SYSTEM

Rosalinda Mazzei, Enrico Drioli, Lidietta Giorno

Institute on Membrane Technology, ITM-CNR,Via P. Bucci cubo 17/c 87036 Rende CS

Abstract

Natural products research continues to provide a tremendous variety of lead structures which are used as templates for the development of new drugs by the pharmaceutical industry.

In all industrial production sectors, significant amount of wastes and by-products containing high added value bioactive molecules are produced. If discharged, these wastes represent a serious contamination source of environmental because of their BOD and COD content. On the other hand if properly processed and recovered, they represent a sustainable renewable source of high added value compounds.

The recovery and valorisation of these compounds is of high interest for high quality of stable food formulation as well as for sustainable industrial production approach to zero discharge. This will also respond to the challenges of scarse or limited renewable resources, need for new property food in modern diet requirement, environment protection through waste prevention and minimization.

Olive mill waste water (OMWW), the water produced during olive oil production, is a potentially rich source of a diverse range of biophenols with a wide array of biological activity. Oleuropein, together with hydroxytyrosol, is one of the most abundant biophenols compounds present in OMWW.

A special and important field that gained interest in biotransformation is the enzyme/substrate system β-glucosidase/oleuropein, the interest demonstrated in this enzymatic system is due to the fact that the oleuropein hydrolysis products are phytochemicals (e.g. oleuropein aglycon) that can be potentially used, if obtained in pure form in pharmaceutical and food field.

In this work, we have developed a hybrid membrane operation system able to i) compartmentalize the oleuropein hydrolysis, occurring in aqueous phase within the porous membrane, and ii) the separation and stabilization of the oleuropein aglycon, occurring in organic phase at the membrane lumen side interface, based on the membrane emulsification concept.

The system simulates the biological membrane environmental like, where the enzyme is heterogenized inside the membrane and the passage of the substrate is regulated by controlled fluid dynamic conditions.

Polymeric membranes were heterogenized with a ß-glucosidase. The OMWW, containing oleuropein, passed through the enzyme-loaded membrane where the reaction occurred. The water phase containing reaction products passed through the membrane and met an organic phase recirculated into the lumen side where water-in-oil emulsions were formed drop by drop. Droplets size and stability were adapted so that enough exchange area interface was achieved and once aglycon extraction was completed droplets broke and phases separated spontaneously. The integrated system biocatalytic membrane reactors and membrane emulsification process showed that it is possible to produce and simultaneously isolate the isomer of oleuropein aglycon in one step, starting from OMWW.

Strategies to increase reaction conversion and extraction degree will be discussed. The influence of amount of immobilized enzyme, residence time, organic phase type and fluid dynamic conditions will be presented.