ELSEVIER

Journal of Membrane Science 178 (2000) 121–130

journal of MEMBRANE SCIENCE

www.elsevier.nl/locate/memsci

Enzymatic saccharification of olive mill solid residue in a membrane reactor

N. Mameri [a,*], F. Hamdache [a], N. Abdi [a], D. Belhocine [a], H. Grib [a], H. Lounici [a], D.L. Piron [b]

[a] *Ecole Nationale Polytechnique d'Alger, 10 avenue Pasteur, B.P.182, El Harrach, Alger, Algeria*
[b] *Laboratoire TTRL, Département Génie Mécanique, Ecole Polytechnique de Montréal, Case postale 6079, succ. Centre-ville, Montréal, Qué., Canada H3C 3A7*

Received 24 February 2000; received in revised form 6 June 2000; accepted 8 June 2000

Abstract

This paper describes the enzymatic hydrolysis of olive mill solid residue (OMSR) in a continuous membrane bioreactor (CMB) which was equipped with an ultrafiltration membrane (Carbosep M5) of 10 kDa molecular weight cut-off.

Enzymatic hydrolysis of OMSR made it possible to obtain a saccharification yield of about 45% after an experimental time of about 14 h, while a batch reactor required 24 h. It was determined that the *Trichoderma reesei* had a greater affinity for the OMSR substrate in a CMB than in batch mode.

It was also observed that the inhibitory effects were not encountered in CMB with substrate concentrations 2.5 times greater than the concentration obtained in the batch bioreactor in which inhibition was reached.

Keywords: Olive mill; Saccharification; Membrane reactors; Ultrafiltration; Concentration polarization

1. Introduction

Enzymatic hydrolysis is usually performed in batch as well as biological type processes involving high costs due to the large quantity of enzyme required, high energy requirements, long reactions, large volume reactors and the loss of enzymes after the inactivation operation at the end of the procedure [1–3].

The development of membrane technology, particularly mineral membranes, improved the utilization of enzymatic hydrolysis operations in a continuous membrane bioreactor, since these membranes can work in temperatures exceeding 60°C in a large pH range (1–14) and can be sterilized after each operation. In this case, the enzyme is recycled and reused, while the product of the enzymatic hydrolysis is continuously withdrawn as the permeate [4].

Henley et al. [5] studied the enzymatic saccharification process of various lignocellulosic materials using the *Trichoderma viride* enzyme, which was more efficient coupled with an ultrafiltration technique. The results obtained showed that the utilization of ultrafiltration membranes with a cut-off of about 50 kDa made it possible to avoid the inhibitor effect by continuous extraction of the hydrolysis products. Alfani et al. [6] utilized two reactors in series for the enzy- matic saccharification of agricultural solid residues. The first was a membrane reactor in which the

* Corresponding author. Tel.: +1-514-340-4711/4593; fax: +1-514-340-4176.
E-mail address: nabil.mameri@courriel.polymtl.ca (N. Mameri).

0376-7388/00/$ – see front matter
PII: S0376-7388(00)00489-0