Treatment of Olive Mill Washing Water by Ultrafiltration

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live oil production is an important economic activity of the

0 Mediterranean countries which, however, unfortunately produces important liquid and solid pollutant.

The liquid effluent contains a mixture of oil and water, with many (po1y)phenolic compounds. The low oil concentrations and the antimicrobial polyphenols transform the classical biological processes making it impossible to treat the olive mill washing water effectively. In fact, it is very difficult with the most appropriate biotechnology process (i.e., anaerobic digestion) to reach the depuration efficiencies required by national norms over the Mediterranean region. In particular, methanogenesis, which represents the limiting step in the aerobic digestion of soluble compounds, is severely hindered by one or both of the following factors: the buildup of volatile fatty acids and the presence of a high concentration of phenolic compounds and/or oleic acid in the olive mill effluents (Saez et al., ***1992;*** Boari et al., ***1993;*** Tsonis and Crigoxopoulos, ***1993;*** Beccari et al., ***1996;*** Labat et al., ***1996).*** In any case, the active anaerobic system left for an extended period does not exceed an abatement ratio of the chemical oxygen demand *(COD)* in the range of 80% (Tsonis and Crigoxopoulos, ***1993).*** To improve the efficiency and stability of the biological process, a method based on dilution of the olive oil mill effluents has been utilized, although dilution ratios between ***1*** :60 to ***1*** :I 00 and the alkalinity additions in the range of ***60*** equivalents per m3 (Ozturk et al., ***1991;*** Beccari et al., ***1996)*** were required.

To solve this problem, membrane processes could offer great advantages. They are especially suitable for separation of oil-water mixtures without adding solvents, since the membrane technique is a physical separation which can be performed at an ambient temperature. These techniques have already been used to treat oil mill washing water. Earlier studies showed that about ***99%*** of the chemical oxygen demand *(COD)* has been reduced by combining ultrafiltration and reverse osmosis (Rampichini et al., ***1987).*** Canepa et al. ***(1 988),*** who studied the influence of the cut-off of polysulfonated organic membranes on the efficiency of the ultrafiltration membranes to treat the oil mill washing

water, found that between 50% and ***75%*** of the ***COD*** was removed. By adding the reverse osmosis process, this yield was increased to ***99%.***
In the present study, two ultrafiltration modules equipped with an organic and ceramic membranes have been used to treat oil mill washing water under various experimental conditions. The effect of average transmembrane pressure *(Po),* tangential flow rate (U) and the cut-off membrane on the performance of ultrafiltration was measured. Concentration experiments were performed under the optimized conditions and the environmental impact of the membrane process was evaluated.
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590
Olive oil production requires important quantities of washing water containing low oil concentrations, but classical processes used to recover or to eliminate this oil are ineffective. This study presents a membrane technique to treat olive oil mill washing water using different commercial ultrafiltration membranes: one organic (PCI) and two ceramic (Ceraver) membranes. The influence of the hydrodynamic parameters (transmembrane pressure and flow rate) and the cut-off membranes on the efficiency of the ultrafiltration process was evaluated, and it was shown the organic PCI membrane could reduce pollution due to organic matter by decreasing the value of the Chemical oxygen demand by about ***90%.*** Moreover, the nature of the ultrafine pore membrane appeared to be an important parameter which may strongly increase or decrease the capacity of the membrane. The membrane cut-off did not have a strong influence on the performance of the process but if the membrane pores were too large the stability of the dynamically formed membrane decreased at transmembrane pressures greater than 0.2 MPa.
La production d'huile d'olive requiert des quantites importantes d'eau de lavage contenant de faibles concentrations d'huile, mais les procedes classiques utilises pour recuperer ou eliminer cette huile sont inefficaces. On presente dans cette etude une technique membranaire pour le traitement de l'eau de lavage d'une unite de fabrication d'huile d'olive dans laquelle differentes membranes d'ultrafiltration comrnerciales sont employees : une membrane organique (PCI) et deux membranes de ceramique (Ceraver). L'influence des parametres hydrodynamiques (pression et debit transmembranaires) et de la distribution de taille des pores sur l'efficacite du procede d'ultrafiltration a ete evaluee, et on montre que la membrane organique PCi pourrait reduire la pollution due a la matiere organique en diminuant la valeur de la demande chimique en oxygene d'environ ***90%.*** Par ailleurs, la nature de la membrane a pores ultrafines semble un parametre important qui pourrait forternent augmenter ou diminuer la capacite de la membrane. La taille des pores n'exerce pas une grande influence sur la performance du procede mais si les pores de membrane sont larges, la stabilkite de la membrane formee de maniere dynamique diminue a des pressions transmembranaires superieures a *0,2* MPa.
Keywords: ultrafiltration, olive mill water, dynamically formed membranes, water treatment.