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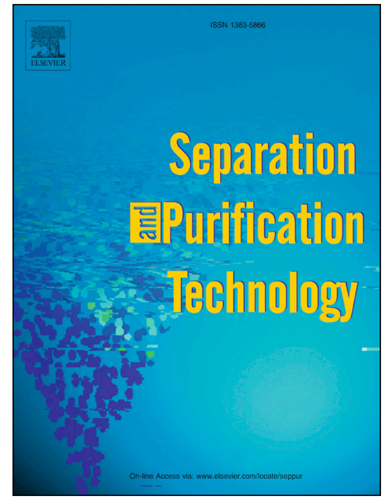

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OPTIMAL DESIGN OF INDUSTRIAL SCALE CONTINUOUS PROCESS FOR FRACTIONATION BY MEMBRANE TECHNOLOGIES OF PROTEIN HYDROLYSATE DERIVED FROM FISH WASTES

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Highlights

- Fractionation process by UF and NF membrane cascades of a fish protein hydrolysate

- Basic integrated cascade identified as the most convenient configuration

- Freshwater consumption was avoided by implementation of water recovery and reuse system

- Product valued above the 95-212 $/m^3$ range compensate the costs of the fractionation process

Abstract
The fractionation in an industrial-scale continuous process of a protein hydrolysate obtained from tuna wastes has been proposed. A model based on membrane transport equations, mass balances and economic equations to calculate the main costs of the process was developed. This model was applied to the evaluation of the main technical, environmental and economic aspects of the process and their optimization. The basic cascade configuration resulted better than alternative options like the linear or dual cascades. The freshwater consumption was minimized to improve the environmental and economic performance of the process. Indeed, the implementation of a water recovery and reuse system was the most effective solution. This system was based on the installation of an additional tight nanofiltration stage that reduced the environmental impact of the process (avoiding the need of auxiliary freshwater streams) and increased its economic competitiveness.

Keywords: Fish protein hydrolysate, Ultrafiltration, Nanofiltration, Fractionation process, Membrane cascades

1. Introduction

Both the extractive fishing (the harvesting of wild seafood) and the aquaculture (the cultivation of seafood) require posterior fish processing. The term fish processing refers to the processes associated with seafood products from the moment fish and shellfish are extracted from water to the moment the final products are delivered to the customers. Fish processing wastes can be defined as the fish material left over from primary processing during the fish manufacturing processes and include large quantities of substandard muscles, viscera, heads, skins, fins, frames, trimmings, and shell wastes [1]. These wastes account generally for a range from 30 to 50% of the total weight of the starting material [2].

The management of the wastes generated by fish processing industry poses environmental, economic, and logistic problems. Until recent times, these wastes have been discarded to landfilling or only used for very low value-added purposes, such as organic soil amendments. Nevertheless, novel alternatives have been developed to transform these undervalued wastes into more valuable by-products (Figure 1). Fish wastes can be seen as a resource to be used for energy generation. Although waste fish oil can be directly employed as combustible in boilers or furnaces, it results in