

Performance of a two-stage membrane system for bromelain separation from pineapple waste mixture as impacted by enzymatic pretreatment and diafiltration

ABSTRACT

Membrane technology has been successfully applied for the purification of bromelain, a protease enzyme from pineapple. However, the current system operates less optimally in terms of flux and separation primarily due to properties of the feed, such as viscosity. Hence, in this study, enzymatic pretreatment and diafiltration operation were employed in a two-stage ultrafiltration (UF) system to enhance the performance of the purification and concentration process of bromelain enzyme from an extract of pineapple crude waste mixture (CWM). Pretreatment of the CWM extract using either pectinase or cellulase, or the combination of both, was applied and compared regarding the apparent viscosity reduction. Diafiltration step was introduced in UF stage 2 and observations on the flux performance, enzyme recovery and enzyme purity were made. A 12% apparent viscosity reduction was achieved when the CWM extract was pretreated with pectinase which led to 37-38% improvement in the flux performance of both UF stages, as well as higher enzyme recovery in UF stage 1. The introduction of diafiltration mode in UF stage 2 managed to sustain high flux values while yielding 4.4-fold enzyme purity (higher than a 2.5-fold purity achieved in our previous work); however, high diluent consumption was needed. The outcomes of this study showed that the flux performance and bromelain separation can be enhanced by reducing the viscosity with the employment of enzymatic pretreatment and diafiltration operation. Thus, both techniques can be potentially applied in a large-scale membrane-based process for bromelain production.

Keyword: Bromelain; Diafiltration; Enzymatic pretreatment; Pineapple waste; Purification; Ultrafiltration