

ULTRAFILTRATION-BASED ENZYME RECOVERY IN THE BATCH PRODUCTION OF GALACTO-OLIGOSACCHARIDES

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ABSTRACT:

Galacto-oligosaccharides (GOS) -containing foods are becoming increasingly popular due to its prebiotic properties. At industrial-scale, GOS is produced from lactose by enzymatic synthesis in batch fashion using stirred-tank reactors (STR). Due to its high purchase price, the biocatalyst is considered as a major contributor to the overall raw material costs. Once the transgalactosylation reaction is completed, the enzymes are inactivated by heat treatment and removed from the resulting products by downstream operations. In this study, we investigate the feasibility of recycling the enzymes by ultrafiltration (UF) and reusing them in multiple cycles of transgalactosylation reactions. Laboratory experiments were carried out by following a protocol involving 3 operational steps. In the first step, a soluble β -galactosidase of *Bacillus circulans* origin was used to convert lactose with a concentration of 30 w/w% into GOS in a conventional STR operating under fixed conditions of pH 6 and 50°C. In the second step, the reaction liquor was ultrafiltered to obtain an enzyme-free permeate consisting of the reaction products. Finally, a fresh substrate solution was added to the UF concentrate. This 3-step procedure was repeated in 5 consecutive cycles. The progress of GOS formation during the reaction in each cycle was monitored with HPLC, and enzyme activity losses were quantified by correlating the observed conversion rates with those measured in a series of STR tests with varying enzyme loads. Our results indicate that a considerable amount of enzyme activity can be recovered by UF, implying that the proposed approach may be a promising option in intensifying the current manufacturing procedure.

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KEYWORDS: galacto-oligosaccharides (GOS), enzyme membrane reactor (EMR), ultrafiltration (UF), lactose, prebiotics