

Lactulose synthesis from whey lactose by  
immobilized  $\beta$ -galactosidase and glucose isomerase

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In most studies, lactulose was synthesized using  $\beta$ -galactosidase as the sole biocatalyst and purified lactose and fructose as the substrate. The purified lactose is an expensive raw material for lactulose synthesis. Application of milk whey that contains 4.5–5% (w/v) lactose is much more cost effective. In this study, commercially available whey was used as a lactose source, and the immobilized  $\beta$ -galactosidase and glucose isomerase were used for lactulose synthesis from whey lactose without the supply of fructose. To improve lactulose synthesis, the optimal reaction conditions, such as lactose concentration, temperature, ionic strength of the buffer and ratio of immobilized enzymes, were determined. When the lactulose synthesis was carried out at 53.5 °C using 20% (w/v) whey lactose, 12 U/ml of immobilized  $\beta$ -galactosidase and 60 U/ml of immobilized glucose isomerase in 100 mM sodium phosphate buffer at pH 7.5, the lactulose concentration and specific productivity were 7.68 g/l and 0.32 mg/U•h, respectively. In addition, when the immobilized enzymes were reused for lactulose synthesis, its catalytic activity was 57.1% after 7 reuses.