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Optimization of milk-based medium for efficient cultivation of bifidobacterium pseudocatenulatum g4 using face-centered central composite-response surface methodology

Abstract

This study was undertaken to optimize skim milk and yeast extract concentration as a cultivation medium for optimal Bifidobacteria pseudocatenulatum G4 (G4) biomass and β-galactosidase production as well as lactose and free amino nitrogen (FAN) balance after cultivation period. Optimization process in this study involved four steps: screening for significant factors using 2^3 full factorial design, steepest ascent, optimization using FCCD-RSM, and verification. From screening steps, skim milk and yeast extract showed significant influence on the biomass production and, based on the steepest ascent step, middle points of skim milk (6% wt/vol) and yeast extract (1.89% wt/vol) were obtained. A polynomial regression model in FCCD-RSM revealed that both factors were found significant and the strongest influence was given by skim milk concentration. Optimum concentrations of skim milk and yeast extract for maximum biomass G4 and β-galactosidase production meanwhile low in lactose and FAN balance after cultivation period were 5.89% (wt/vol) and 2.31% (wt/vol), respectively. The validation experiments showed that the predicted and experimental values are not significantly different, indicating that the FCCD-RSM model developed is sufficient to describe the cultivation process of G4 using skim-milk-based medium with the addition of yeast extract.

Keywords

Animal; Article; Bifidobacterium; Biomass; Biotechnology; Chemistry; Culture Medium; Growth, Development And Aging; Metabolism; Methodology; Milk; Reproducibility; Statistical Model; Yeast