Statistical optimization of alginate immobilization process of candida stauntonica strain MY1 for bioethanol production

ABSTRACT

In this study a new yeast strain was isolated from Egyptian sugarcane molasses for its high capability of bioethanol fermentation,under anaerobic conditions.It was identified on the basis of its 18S rDNA to be Candida stauntonica MY1 (Accession No.KM657091). The central composite face centered design CCFD matrix and response surface methodology were applied in designing and optimizing the process of calcium-alginate immobilization of MY1 yeast cells to maximize its bioethanol productivity from glucose and evaluate the influence and interactive effect of three critical immobilization parameters; bead size (diameter,mm),initial inoculum size (g/L) and alginate concentration (g/L) on the bioethanol yield. Three quadratic model equations have been predicted ending out how statistically significant the effects of these variables (factors) and their interactions are in practice. The validity of the predicted models was confirmed. The optimum conditions for cell immobilization were found to be 2.5mm, 2.5 g/L and 5.5g/L,respectively. That produced 4.4 g/L bioethanol,with actual yield of 41.9% i.e. YP/S0.42g ethanol/g glucose, which was about 2.3 fold higher than that produced with free cells batch fermentation operated under the same conditions;48 h, pH5.5, 30oC and 100rpm. The immobilized cells showed good stability, with long storage time 21d and can be used for four successive batches with maximum bioethanol productivity.

Keyword: Isolation; Identification; Yeast; Cell immobilization; Optimization; Calcium alginate; Bioethanol