ABSTRACT

Glucoamylase is an enzyme of considerable commercial and industrial importance. The major application of glucoamylase in the industry is the production of high fructose syrups from starch. The present work deals with the production of glucoamylase by *Aspergillus awamori* NRRL 3112. It has already been found that different physico-chemical parameters influence the glucoamylase fermentation mainly in shake flask cultures. No detailed investigation has been carried out on the optimization of the process variables for glucoamylase production in bioreactors. The morphological changes of the organism and its relation to glucoamylase production are not available in literature. These studies would give a better insight into the glucoamylase fermentation process. An attempt has been made to evaluate the optimum growth and glucoamylase productions in shake flasks using *Aspergillus awamori* NRRL 3112 and concluded that the most suitable pH for maximum enzyme activity and biomass yield was 5.5. The glucoamylase activity obtained was maximum for an initial maltose concentration of 20 g/l.

The optimization of a fermentation process is mainly carried out by varying single parameter at a time keeping the other parameters constant. No information is available on the combined effect of the operational parameters on glucoamylase production. The effect of the process variables viz. aeration, agitation and age of the inoculum on glucoamylase production by submerged fermentation has been carried out by Box-Behnken experimental design. A regression analysis of the experimental data has been conducted and the predicted model has been tested using analysis of variance. Response surfaces so generated indicate the variations in the glucoamylase activity with changes in the process variables in a stirred tank fermenter. The analysis shows that an enhancement

of the enzyme production can be achieved at higher speed of agitation and at lower rates of aeration. Use of response surface methodology for the production of glucoamylase is expected to overcome the problems of conventional single parameter optimization.

Laboratory scale fermentations with *Aspergillus awamori* NRRL 3112 at different process conditions were performed to study the changes in fungal morphology, fragmentation behavior and glucoamylase production. This study has shown that pellet formation was significant at pH 5.5 whereas poor growth was observed at higher pH. The cell growth and glucoamylase production were reduced at higher agitator speed while extensive sporulation of the organism was observed at an agitator speed of 900 rpm. On the other hand, it was found that increased agitation led to higher biomass concentration.

Rheological properties were measured during fermentation of *Aspergillus awamori* NRRL 3112. Non-Newtonian behavior of the broth was observed which followed the power law. The parameters such as flow index (n), consistency index (K) and apparent viscosity (μ_{app}) were correlated with the biomass concentration during fermentation.

The use of a back propagation neural network has enabled both simulation and prediction, if only the initial conditions are given. The disadvantages of conventional modeling have been overcome by the prediction of the biomass concentration for the whole fermentation period.