SIMULTANEOUS SACCHARIFICATION AND FERMENTATION OF LIQUEFIED STARCH IN RICE FLOUR TO ETHANOL AND THE RECYCLING OF YEAST CELLS

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At present, most industries use a two step process in which the liquefied starch is first saccharified to glucose followed by its fermentation to ethanol. This technology is not only time consuming but also results in high concentration of glucose which inhibits the metabolism of yeast. Hence the simultaneous saccharification and fermentation of liquefied starch in rice flour to ethanol was investigated. Starch in rice flour ($200gl^{-1}$) was suspended in tap water and liquefied by thermostable alpha amylase ($2.5KNUg^{-1}$,DS) at pH 7.0 and 90°C. The total and reducing sugars obtained at 1h were $220gl^{-1}$ and $140gl^{-1}$ respectively. To the liquefied syrup (DE 63.6%) glucoamylase (Spiritamylase, $2.3AGUg^{-1}$ of initial DS) and yeast (Fermipan, 10^8 cells ml^{-1} medium) were added and allowed for simultaneous saccharification and fermentation at pH 5.0 and 35°C. At 48h, $65gl^{-1}$ ethanol was obtained. When the glucoamylase concentration added was reduced to half of its origanal concentration ($1.15 AGUg^{-1}$ of intial DS) for the simultaneous saccharification and fermentation process, $5gl^{-1}$ and $65gl^{-1}$ ethanol was respectively obtained at 48h and 72h. When the commercial glucoamylase (Spiritamylase) was replaced by glucoamylase preparation from our laboratory (obtained by solid state fermentation), similar result were obtained. A study was performed to recycle the yeast cells for ethanol production by manually decanting the spent medium and replacing the spent medium with fresh liquefied sugar syrup and glucoamylase. The ethanol production remained constant for first four cycle ($65gl^{-1}$, at 72h) and started to reduce to $59gl^{-1}$ and $41gl^{-1}$ in the 5^{th} and 6^{th} cycles respectively. From the results it can be concluded that the locally produced glucoamylaase can be used instead of the commercial enzyme preparation and the yeast cells can be recycled for 4 batches without decreasing the ethanol production.