LACTIC ACID PRODUCTION FROM CASSAVA STARCH AND SUGAR-CANE JUICE AS RENEWABLE RAW MATERIALS

SOPON TANGSAWANGTHAI 4937890 SCBT/M

M.Sc. (BIOTECHNOLOGY)

THESIS ADVISORY COMMITTEE: AMNAT JARERAT, Ph.D. (BIOTECHNOLOGY), PITIPORN RITTHIRUANGDEJ, Ph.D. (AGRO-INDUSTRIAL PRODUCT DEVELOPMENT), THANUT AMATAYAKUL (FOOD SCIENCE), Ph.D., THUNYARAT PONGTHARANGKUL, Ph.D. (AGRICULTURAL AND BIOTECHNOLOGICAL ENGINEERING)

ABSTRACT

Various experimental studies including screening of effective lactic acid-producing strains, optimization of fermentation conditions by response surface methodology (RSM), free cell repeated batch fermentation (RB) and simultaneous saccharification and fermentation (SSF) were carried out for the economical and sustainable lactic acid production from cassava starch and sugar-cane juice as renewable carbon sources. Among the strains of Lactobacilli, Lactobacillus jensenii TISTR 1342 and L. casei TISTR 1340 produced high lactic acid concentration productivity and yield. RSM was used for optimization of temperature and pH. Batch fermentation used for lactic acid production on sugar-cane juice by L. jensenii TISTR 1342 in a 5 l fermenter provided 120 g lactate/l, yield of 0.92 g lactate/g total sugar and productivity of 4.0 g/l.h within 30 h. In addition, RB was applied as the competent and economical process for lactic acid production, due to lower expenditure of fermenter and inoculum preparation. During a long period fermentation (5 cycles), ammonium lactate concentrations, yield and productivity at the end of each cycle were in the range of 113 - 126 g/l, 0.89 - 0.94 g/g and 3.5 - 3.8 g/l.h respectively, with cell dry weight of 9.7 - 10.1 g/l, corresponding to 1.1 x 10^10 - 1.2 x 10^10 cfu/ml. In the case of cassava starch, simultaneous saccharification and fermentation (SSF) was applied for lactic acid production because it can reduce time and steps of bioprocess. After 72 h fermentation, ammonium lactate, yield and productivity of L. casei TISTR 1340 on cassava starch were 149 g lactate/l, 0.92 g lactate/g starch and 2.0 g/l.h, respectively. In addition to a reduction of time and in steps by SSF, RB also decreased the cost of inoculum. Combination of SSF and RB gave ammonium lactate concentrations, yield and productivity at the end of each cycle (3 cycles) in the range of 143 - 150 g/l, 0.91 - 0.94 g/g and 2.0 g/l.h respectively, with cell dry weight of 6.8 - 7.3 g/l, corresponding to 2.7 x 10^9 - 9.3 x 10^9 cfu/ml.

KEY WORDS: CASSAVA STARCH/LACTIC ACID/SUGAR-CANE JUICE

98 pages