

Nisa Saelee 2014: Utilization of High Sugar Sap Squeezed from Oil Palm Trunk for Lactic Acid Fermentation. Doctor of Philosophy (Biotechnology), Major Field: Biotechnology, Department of Biotechnology. Thesis Advisor: Associate Professor Klanarong Sriroth, Dr.Ing. 121 pages.

Oil palm trunk (OPT) juice is considered as a potential substrate for lactic acid fermentation because it is cheap, abundant, renewable and contains high sugar contents. This study attempted to investigate the use OPT juice as a substrate for lactic acid production by *Lactobacillus rhamnosus* TISTR 108. The fermentation processes were optimized in order to achieve the highest lactic acid yield and productivity. OPT had an average moisture content of $67.1 \pm 4.5\%$ and yielded squeezed juice of 24.6% w/w. Undiluted OPT squeezed juice contained total sugars of $104.61 \pm 2.36 \text{ g l}^{-1}$ which was composed of glucose ($56.10 \pm 1.46 \text{ g l}^{-1}$), fructose ($40.43 \pm 4.68 \text{ g l}^{-1}$), sucrose ($3.23 \pm 0.69 \text{ g l}^{-1}$), raffinose ($2.44 \pm 1.28 \text{ g l}^{-1}$) and cellulose ($2.41 \pm 0.71 \text{ g l}^{-1}$). Without nutrient supplementation, fermentation at 10% inoculum, 40°C and pH of 6.5 achieved the highest lactic acid concentration, yield and productivity of 44.86 g l^{-1} , 0.78 g g^{-1} and $1.36 \text{ g l}^{-1} \text{ h}^{-1}$, respectively. The addition of 10 g l^{-1} yeast extract, 5 g l^{-1} peptone and salts as nutrient supplementations in undiluted OPT juice could shorten the fermentation time and complete sugar consumption. The highest lactic acid yields and productivities were $0.82 - 0.85 \text{ g g}^{-1}$ and $2.47 - 3.83 \text{ g l}^{-1} \text{ h}^{-1}$, respectively. The use of Box Behkhen Design to optimize the fermentation process suggested that the addition of 10 g l^{-1} peptone and mineral salts (per liter), containing $0.4 \text{ g MgSO}_4 \cdot 7\text{H}_2\text{O}$, $0.1 \text{ g MnSO}_4 \cdot 4\text{H}_2\text{O}$, $3 \text{ g K}_2\text{HPO}_4$, $3 \text{ g KH}_2\text{PO}_4$ and $3 \text{ g CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$ was the appropriate nutrients for lactic acid production by *L. rhamnosus* TISTR 108. Under the optimized condition with peptone and salt supplementation, the maximum concentration, yield and productivity of 78.46 g l^{-1} , 1.01 g g^{-1} and $3.27 \text{ g l}^{-1} \text{ h}^{-1}$, respectively were obtained in a 2 l fermenter.

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Thesis Advisor's signature

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