



Project Title Pilot scale production of L-lactic acid from raw cassava pulp by *Rhizopus oryzae*

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#### Abstract

This research studied the possibility of using cassava pulp to produce L-lactic acid by filamentous fungus *R. oryzae*. Firstly, the optimal operating condition required in scale up calculation was determined during lactic acid fermentation by glucose. The result showed that the best suited operating condition was at 700 rpm and 0.5 vvm air. At this operating condition, the highest lactic acid yield and productivity were accomplished. The other experiment performed in this research was to determine the appropriate pretreatment process prior to the enzymatic hydrolysis of cassava pulp in order to achieve high glucose recovery from cassava pulp. It was found that only steam pretreatment under high temperature and pressure was sufficient for pretreating cassava pulp. Using steam pretreatment with the addition of NaOH did not ease enzymatic hydrolysis of the pretreated pulp. More glucose was recovered from the hydrolysis of steam pretreated cassava pulp. The highest glucose recovery yield achieved was 0.6 g glucose per g dry pulp when pretreated the cassava pulp with steam for 15 min followed by hydrolyzing with cellulase (33.15 unit per g dry pulp) for 6 h and amylase (16.8 unit per g dry pulp) for 15 min. Pilot scale pretreatment and hydrolysis of fresh cassava pulp were also carried out using the optimal conditions obtained from the laboratory scale test. Later the cassava pulp hydrolysates prepared by different techniques were used as the carbon source in lactic acid fermentation. The fermentation results were compared with those using glucose and soluble starch as the carbon source. It was observed that the hydrolysates obtained from steam pretreatment followed by enzymatic hydrolysis and the enzyme treated hydrolysate gave the comparable lactic acid yield and productivity to glucose and soluble starch. In addition, scale up calculation was performed for predicting the operating condition in the large scale culture using the data obtained from glucose fermentation in the 5 L bioreactor. 4 criteria were used in the calculation. Those included Reynolds' number ( $Re_p$ ), impeller tip speed ( $u_i$ ), power input per unit volume ( $P/V$ ), and mixing time ( $F/V$ ).