CHAPTER I

INTRODUCTION

Proteases are protein hydrolyzing enzymes which have been used to transform milk into products such as cheese, used in leather industry for all stages of leather preparation --initial soaking, dehairing and bating of hides-- and as presoak detergents, they were also used in baking industry to provide flour with a sufficiently low protein content and thus render the dough more workable including enhancement of flavor and taste [1]. In brewing industry, proteases were needed in malt preparation step to achieve sufficient breakdown of protein and in chillproof process to prevent undesirable haze. Other existing or potential applications for proteases include desizing textiles, meat tenderization, animal feed preparation and pharmaceutical and clinical usage as digestive aids. There are many industrial usage of proteases as illustrated in Table 1-1 that makes them account for nearly 60% of the industrial enzyme market [2].

Table 1-1 Value and market share of proteases in many industries

Industry	Value (millions$)	Market Share (%)
Detergents	140	89.2
Microbial rennets	12	7.6
Baking proteases	3	1.9
Leather	1	0.6
Miscellaneous	1	0.7
Total	157	100

Proteases are improtant commercial enzymes which can be produced from animal, plant and microbial. But for various technological and economic reasons [3] microorganisms are replacing the other sources of supply. Microbial proteases are produced extracellularly from high yielding strains such as Bacillus sp. by fermentation under controlled conditions in surface or submerged culture.

Normally, glucose is the best carbon source in fermentation process, but it is expensive raw material. Therefore, the utilization of glucose from cassava starch as raw material for fermentation process will lower the product cost of protease.

Regarding to bioprocess of microbial protease production, batch fermentation in a large cylindrical bioreactor is typically used with various sensing devices for controlling fermentation condition. Theoretically, product productivity can be improved by continuous fermentation, especially in continuous fermentation coupling with microfiltration unit in which the microbial cell is highly retained and accumulated in the fermenter.

Therefore, this research will focus on microbial protease production in continuous fermentation coupling with microfiltration unit by employing cassava hydrolysate as raw material.

Thesis objectives

1. To clarify the optimum conditions for protease production from cassava hydrolysate based medium in batch fermentation.
2. To apply microfiltration with the protease production from cassava hydrolysate based medium in continuous fermentation.
3. To investigate parameters affected the continuous fermentation coupling with microfiltration

Thesis scopes

1. Employ Bacillus subtilis TISTR 25 for fermentation process
2. Study pH effect on growth and protease production in batch fermentation together with investigation of maximum specific growth rate from varying cassava hydrolysate concentration at 37 °C and maximum aeration rate.
3. Study dilution rate effect on the protease production in continuous fermentation coupling with microfiltration at 37 °C and maximum aeration rate.
4. Compare the continuous fermentation coupling with microfiltration to the batch fermentation.