

UNIVERSITI TEKNOLOGI MARA

**LIPASE *PSEUDOMONAS*
AERUGINOSA NR.22 (PS.NR.22) IN
ETHANOL PRODUCTION BY USING
AGRICULTURAL WASTE**

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ABSTRACT

Ethanol is known as the most commonly used in biofuel, chemical solvents and preservatives. The demand of ethanol is rising due to the need for replacing fossil fuels in transportation sector. In this study, pineapple waste is used as an agricultural waste with *Pseudomonas aeruginosa* NR.22 as an active microorganism to produce ethanol. Unit operation that used in the study is Gas Chromatography (GC) and Fourier Transform Infrared Spectroscopy (FTIR). The objectives of the study are to produce ethanol from agricultural waste by lipase *Pseudomonas aeruginosa* NR.22 and to detect the concentration of ethanol. The study is conducted based on several method which is pretreatment of biomass, enzymatic hydrolysis, fermentation and product recovery. The whole fermentation process was carried out for 72 hours at 37°C with initial pH of 6.8. Initial pH of the culture broth indicates as one of the most important environmental parameters that will affect production of lipase and bacterial growth. Initially, 5% (v/v) of 24 hours *Pseudomonas aeruginosa* NR.22 inoculum containing 5×10^6 cell/mL were used in this study. The value of lipase activity was 22.5 ± 0.02 U/mL with the oil removal recorded to be 58.2% with bacterial biomass of 5.95 ± 0.001 g/mL. From the result, it was found that the *Pseudomonas aeruginosa* NR.22 is able to utilize pineapple peels to produce ethanol without the need of supplying other nutrient. Ethanol yield at 72 hours fermentation reached 20.06 g/L with 31% purity. The untreated and treated substrates were analyzed by FTIR to check the modification of the structure appeared after this pretreatment which guides to efficient saccharification. The FTIR spectroscopic analysis of pineapple peels which classified under three conditions: untreated, treated and saccharified samples.

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CHAPTER ONE

INTRODUCTION

1.1 Summary

Ethanol is known as the most commonly used in biofuel, chemical solvents and preservatives. Ethanol becomes important due to climate changes and global warming issue that rising throughout years [1]. Nowadays, the declining fossil fuels, escalating population, rising pollution and global warming due to energy crisis has triggered the society to comprehend the need for renewable sources. The limitation of reserved fossil fuel will affected the import of transport fuel to the world [2]. Thus, renewable sources might be an alternative way to minimize the need of fossil fuels.

Therefore, production of bioethanol from lignocellulosic biomass, especially from agricultural waste is preferred to resolve the food versus fuel issues in the developing countries [3]. Pineapple peel waste has been used in this study as an agricultural waste. Since Malaysia known as one of the major pineapple producers in the world, their residual and disposal have become an environmental interest. This is because there is little or no productive use of these residue thus causing environmental problems such as pollution groundwater and spread of disease [1].

There are various methods involves to produce ethanol from agricultural waste which is pretreatment of biomass, enzymatic hydrolysis, fermentation and product recovery. The pretreatment processes involved in the study are biological and non-biological technique. Non-biological pretreatment techniques of the biomass consist of physical (milling and grinding, microwave), physiochemical (steam explosion) and chemical (acid hydrolysis) where the techniques do not involve any microbial treatments whereas biological pretreatment are carried by microorganisms which is bacterial. There are a many kind of microorganisms that can be used to produce ethanol such as *Neurospora* sp.(Irfan, et al. [4]), *Bacillus subtilis* (Eman [5]), *A. ellipticus* (Ingale, et al. [6]), *Candida shehatae*, *Saccharomyces cerevisiae* (Prema, et al. [7]) and *Enterobacter aerogenes* (Choonut, et al. [8]). However, active microorganism used in the study is *Pseudomonas aeruginosa* NR.22 in the production of ethanol by using agricultural waste. Thus, the main objective of the study is to produce ethanol from