### UNIVERSITI TEKNOLOGI MARA

# EFFECT OF TEMPERATURE ON TUBER STARCH (TACCA LEONTOPETALOIDES) PRETREATMENT AND INCUBATION FOR GLUCOSE PRODUCTION FROM RAGI TAPAI

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#### ABSTRACT

The high demands for sugars and the development of enzymatic technology have increased the production of sweeteners, especially for glucose. The aim of this work is to maximize the glucose production for the fermentation of Tacca leontopetaloides with ragi *tapai* by optimizing the temperature of the tuber starch processes. This research work describes the process of glucose production from tuber starch of Tacca leontopetaloides which is commonly found in tropical Africa, South Asia, Southeast Asia, Australia, Samoa, New Guinea and Fiji. In this research work, four different types of ragi tapai from Sabah, Johor, Perlis and Kelantan were obtained and used to identify the best ragi tapai in the production of glucose. The different types of ragi tapai were first undergo identification and characterization process in order to determine selection of ragi tapai. This study was conducted to achieve the objective of the research: (1) To study the effect of pretreatment temperature towards the production of glucose by ragi tapai. (2) To study the optimum incubation temperature of the ragi tapai in the glucose production from tuber starch. A series of fermentation process of tuber starch were performed by varying the pretreatment temperature at  $30^{\circ}C - 70^{\circ}C$  at fixed incubation temperature of 30°C and incubation temperature at  $30^{\circ}C - 50^{\circ}C$  at fixed pretreatment temperature of 70°C with constant 5% (w/v) of starch slurry and 10% (w/v) of ragi tapai concentration for 180 minutes. DNSA test were performed via spectrophotometer at 540nm to quantify the production of glucose. In the fermentation at various pretreatment temperature, the lowest glucose yield obtained was at 30°C (7.333 g/L) and the highest glucose yield was at 70°C (46.760 g/L). Meanwhile in the fermentation at various incubation temperature, the lowest glucose yield obtained was at 30°C (7.333 g/L) and the highest was at 50°C (62.764 g/L). When the temperature increases, the glucose yield increases. From the results studied shows that Tacca leontopetaloides starch is a promising feedstock to produce glucose.

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#### **CHAPTER ONE**

#### **INTRODUCTION**

#### **1.1 RESEARCH BACKGROUND**

Glucose has been produced commercially as artificial food addictive and acts as a renewable resource especially in production process of the biofuels. In the production process of the biofuels that uses glucose as the raw material provide the world the alternative energy for crude oil. Biofuel such as bioethanol has the potential to be used as a promise fuel as it is more volatile than water, flammable, burns with a light blue flame and has good fuel properties for spark ignition internal combustion engines. There are two pathways to produce bioethanol which are reaction of ethylene with water and fermentation of simple sugar from starch materials. Since the reaction process of ethylene with water is considered to be more expensive, the fermentation process is preferred to be choose as the pathway of bioethanol production. The bioethanol can be produced from low cost raw material which contain high starch content such as corn, potato and tuber starch which can be found abundant in Malaysia. This pathway is considered to be the best option because it promotes to safe the nature by reducing the consumption of petroleum and less pollution to the environment.

In the production of biofuel such as bioethanol via conventional method, raw material of starch is required. Starch is one type of complex sugar which known as polysaccharide. Similar to cellulose, starch molecule are glucose polymers linked with  $\alpha$ -1,4 and  $\alpha$ -1,6 glucosidic bonds. In the production of glucose from starch, it is necessary to break down the chain of this carbohydrate. Hydrolysis process is required in the process of break down the carbohydrate chain in the starch structure. Hydrolysis is a reaction of starch with water, which is normally used to cleave the starch to fermentable sugar (glucose).

In general, the starch material will be convert into glucose which will be used in the production of bioethanol. It is important to select the best raw material to produce a high yield of production. A numerous aspect need to be take into consideration in the selection of raw material such as the cost of the raw material, its availability and the