The Influence of Variation in Time and HCl Concentration to the Glucose Produced from Kepok Banana

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Abstract - Kepok banana (Musa paradisiaca) is a plant that has many advantages from its fruit, stems, leaves, flowers and cob. However, we just tend to take benefit from the fruit. We grow and harvest the fruit without taking advantages from other parts. So they would be a waste or detrimental to animal nest if not used. The idea to take the benefit from the banana crop yields, especially cob is rarely explored. This study is an introduction to the use of banana weevil especially from the glucose it contains. This study uses current methods of hydrolysis using HCl as a catalyst with the concentration variation of 0.4 N, 0.6 N and 0.8 N and hydrolysis times variation of 20 minutes, 25 minutes and 30 minutes. The stages in the hydrolysis include preparation of materials, the process of hydrolysis and analysis of test results using Fehling and titrate with standard glucose solution. HCl is used as a catalyst because it is cheaper than the enzyme that has the same function. NaOH 60% is used for neutralizing the pH of the filtrate result of hydrolysis. From the results of analysis, known that the biggest yield of glucose is at concentration 0.8 N and a reaction time of 30 minutes, it contains 6.25 gram glucose / 20 gram dry sample, and the conversion is 27.22 % at 20 gram dry sample.

Keywords: Kepok Banana, Time and HCl Concentration, Glucose

1. INTRODUCTION

Banana plants are soft-stemmed plants with high trunk and capable of up to 4 m, wide leaves and root fibers. Almost every part of this plant can be used. Stems, leaves, fruit, flowers, and even the cob. Banana fruit has sweet and soft texture. Suitable to be consumed by variety of ages. Can be directly eaten or cooked into other foods. wide leaves can be used as food wrap, or as decoration. Soft stems can be used as decoration, planting media, fodder and others. Before bananas are really old, bud resembles a heart, called cardiac bananas. Some varieties of banana can be used as processed food and has a good taste. cob is immersed parts of the plants in the ground where the discharge of roots. cob can be used as the banana weevil chips, shredded banana cob, and flour banana weevil.

Many advantages can be exploited from every part of the banana plant, but we tend to get benefit from the fruit only. We grow and harvest the fruit without taking the advantages from other parts. So they would be a waste or detrimental to animal nest if not used. Therefore, it takes about a week to maximize yields of banana plants, especially for the most rarely used cob.
Problem Formulation
a. What is the effect of reaction time for glucose resulting from the hydrolysis of banana weevil?
b. What is the effect of the solvent to the concentration of glucose produced by the hydrolysis of banana weevil?

Limitation Problem
a. Researchers only compare the effect of reaction time and solvents the concentration of the glucose content in the banana weevil.
b. Weevil banana plant tuber crops studied is kepok banana (Musa Paradisiaca)
c. Flour banana weevil is not determined its scale mesh
d. The solvent used is a solvent HCL The concentration variation is 0.4 N, 0.6 N and 0.8 N
e. Variations on the hydrolysis time is 20 minutes, 25 minutes and 30 minutes after boiling
f. Hydrolysis process used did not consider the speed stirrerrotation
g. Room temperature practicum ignored
h. Not using the average volume of filtrate

Research Objectives
The aim of this study is:
a. Analyzing the glucose content in the banana weevil with hydrolysis
b. Knowing the influence of reaction time and the concentration of solvent to the content of glucose obtained from hydrolysis of banana weevil.
c. Utilizing the banana weevil crop waste into products that have a commercial value

Benefits Research
The benefits of this research are:
a. Making waste banana weevil as economically valuable goods
b. Contributing as a useful knowledge to be reference for further research

2. RESEARCH METHODOLOGY
Secondary data and reference are collected from the internet, books or college textbooks related to the problem being studied. Primary data collected by direct experiments on samples that were analyzed and tested in the laboratory.

Data Sampling
Sample conducted in this study is harvesting of banana weevil starch hydrolysis with hydrochloric acid (HCl) by varying of concentration and reaction time, using a three-neck flask and magnetic stirrer. This research was conducted in the laboratory Introduction to Chemical Engineering, Department of Chemical Engineering, Faculty of Industrial Technology, Islamic University of Indonesia.

Equipment and Materials Used

The materials used

a. Flour tuber Bananas  f. Fehling B
b. HCl 2 N  g. Methyl Blue
c. NaOH 60%  h. Glucose Standard
d. Aquadest
e. Fehling A
**Tools used**

a. Buret  
b. Stoves  
c. Scissors  
d. Mixer  
e. Glass Tubes  
f. The universal pH indicator  
g. The glass beaker (600 ml).  
h. The glass beaker (250 ml)  
i. The glass beaker (100 ml)  
j. Erlenmeyer (250 ml)  
k. Erlenmeyer (50 ml)  
l. GlassFunnel  
m. Flask 1 L  
n. Flask (500 ml)  
o. Heating mantle and stipper  
p. Thermometer

**Research Procedure**

**Hydrolysis Process**

1. Stringing tools such as image
2. Put 20 grams flour banana weevil into a three-neck flask
3. Add 200 ml of HCl (0.4 N), heating while stirring until boiling
4. Stirring for 20 minutes after boiling
5. Cooling down the mixture into room temperature
6. Analyzing the cooled mixture to determine glucose levels
7. Repeating the above steps at concentration 0.6 N and 0.8 N and 25 minutes and 30 minutes time
8. Neutralizing the resulting solution after cold hydrolysis with 60% NaOH
9. Diluting with aquadest to 250 ml
10. Filtering and enter filtrate into buret
11. filling Fehling A (5 ml) and Fehling B (5 ml) into Erlenmeyer, then heat it
12. Fehling titration with filtrate (to brown), and add 2 drops of methyl blue (when a brown color change), continue titration until the point equivalent (brown)
13. Titrate with standard glucose solution

**Figure 2.1 Flowchart of hydrolysis process**
3. EXPERIMENT RESULTS
This experiment uses materials derived from banana weevil is made such that intangibles such as flour, but not the same mesh uniformity. Observation temperature is 105°C, but is not so considered. Results from this study is shown in tabular form as shown below. The average temperature of the experiment: 105°C

Sample weight: 20 g
Total volume: 250

Table 3.1 Results of experiment

| waktu (menit) | V NaOH (ml) | V filtrat (ml) | V larutan glukosa standart (ml) | jumlah glukosa total C (gr) |
|---------------|-------------|---------------|--------------------------------|----------------------------|
| 20            | 6.5         | 13            | 12                             | 1.1538                     |
| 25            | 6.4         | 13.9          | 13                             | 1.1691                     |
| 30            | 6.7         | 15            | 15                             | 1.2500                     |

Table 3.1 Results of experiment (continued)

| waktu (menit) | V NaOH (ml) | V filtrat (ml) | V larutan glukosa standart (ml) | jumlah glukosa total C (gr) |
|---------------|-------------|---------------|--------------------------------|----------------------------|
| 20            | 5.3         | 11            | 9                              | 1.0227                     |
| 25            | 5.5         | 12.8          | 10.8                           | 1.0547                     |
| 30            | 5.5         | 13            | 11.2                           | 1.0769                     |

Figure 3.1 Graph relationship variation concentration and reaction time for glucose produce

4. DISCUSSION
This hydrolysis reaction is very slow. Catalyst should be added to accelerate the reaction. Catalysts which can be used are acids and enzymes. Banana weevil hydrolysis into glucose in stirred tank is
used as an acid catalyst, because the acid is more economical in terms of time and cost than the use of enzymes as catalysts. Used catalyst HCl grading 0.4 N, 0.6 N and 0.8 N. In addition to the catalyst, the assumption that reducing the size can speed up the process of hydrolysis, because the reaction will be distributed evenly throughout the surface of the banana weevil. But in this study does not emphasize the mesh size of the banana weevil hydrolyzed.

Broadly speaking, this study include raw material preparation, hydrolysis and analysis of the results of hydrolysis. At the stage of raw material preparation, banana weevil cleaned and diced, washed and the sap is removed. The sap is removed because it may become caramel when hydrolysis takes place. In this case, the removal of sap by using boiling method within 1 hour. Results boiling in the form of tubers which are more tender texture and water are turned into purple, then hump is aerated to cool. After the hump cool, then cut into small, after it is inserted into the juicer, the aim is downsizing, resulted in the slurry, a mixture of smooth hump of water, so the water must be separated to get the weight of dry matter. Separation done with extortion using a cloth. Once separated, the devastated solids banana weevil dried manually using sunlight to avoid the formation of caramel when using a drying oven.

Once dried, the tubers then destroyed again in order to obtain a finer texture. However, at the time of destruction, not all materials can be smoothed with a same level of refinement. This is because the results of the first destruction is chewy. Once crushed, tubers with 20 mg weight were 9 samples.

Once the raw material preparation banana weevil, researchers prepare research tools and other materials. Among create a solution HCl 0.4 N, 0.6 N and 0.8 N using 2 N HCl using the dilution method, namely by dilution using distilled water and making mix Fehling Fehling A and B each 5 ml. Once the tool is installed hydrolysis, rare-step hydrolysis is carried out at the time of entering material 20 mg banana weevil and 0.4 N HCl solution into the 200 ml three neck flask, heating and stirring using a magnetic stirrer. After boiling record the time and let the reaction continues until 20 minutes. After 20 minutes, the hydrolysis process is stopped. Then dirolisa result is cooled to room temperature. Hydrolysis results in the form of orange-red colored solution. Then the focus in this research is on a variety of HCl and hydrolysis time.

After hydrolysis is complete, the resulting solution is analyzed for levels of glucose hydrolysis. Hydrolysis resulting solution pH neutralized using 60% NaOH solution. NaOH alkaline is added to make this solution becomes neutral. Selection of neutralization using NaOH as the conditions under which it is definitely acidic hydrolysis, likely due to the influence of a catalyst HCl. It can be seen from the table, the greater HCl concentration given, the more also NaOH used to neutralize the pH of the solution. From the table and graph shows that the more HCl concentration of acid used as a catalyst, the more the volume of sodium hydroxide used as a neutralizing acid. This shows that the acidic hydrolysis process is strongly influenced by HCl concentration.

Parameters that this solution is at neutral pH universal indicator shows the number 7. Once the neutral solution was filtered using filter paper. Once filtered, the filtrate was added to the burette. The aim of filtering by filter paper is to filter the solution from the solid particles, so it does not make burette clogged.

At the stage of the analysis of glucose, hydrolysis resulting solution which has been neutralized, diluted and filtered and then used to titrate Fehling Fehling A and B which have been mixed and heated to boiling using the Erlenmeyer. Dilution goal is uniformity filtrate thus simplifying the calculation of the analysis. The purpose of the test is to determine the carbohydrate Fehling reduced. Fehling titrated using the filtrate to brown, after titration continued until the chocolate brown color equivalent (no color change), but if the color changes, add 2 drops of methyl blue and titration was continued until completely brown equivalent. The amount of volume of filtrate that is used to titrate Fehling. The greater HCl concentration, the greater the volume needed to titrate Fehling, nor with the hydrolysis time. The longer the time of hydrolysis, the more volume of filtrate needed to titrate Fehling until it reaches a equivalent point. The relationship between the volume and concentration of HCl of the filtrate to variations and temperature hydrolysis can be seen in the table results of the research.
The next step is to get the glucose Fehling titrate titration results with the filtrate using a standard glucose solution. This is almost the same as the Fehling test. However, to determine more specific results from the monosaccharides resulting from the hydrolysis of carbohydrates. Results of analysis attached to the table. At the concentration variation is given in this study, the higher the HCl concentration, the higher the glucose produced. This is because acid serves as a catalyst for the destroyer of carbohydrates, making them easier to hydrolyzed. This is because destructed carbohydrates will have a large cross-sectional area and the more experience a reaction, so the more glucose is generated.

Variations in the reaction time of this study also affect the results of glucose produced. Shown in the table, the longer the reaction time, the greater the glucose results generated from the hydrolysis process of the banana weevil.

5. CONCLUSION
The conclusions that can be drawn from this study is that the banana weevil hydrolysis into glucose in stirred tank can be done by using HCl as a catalyst. In addition, the results of this study are influenced by variables of concentration and duration of hydrolysis catalyst. The greater concentration of the catalyst, the greater the glucose levels resulted. This is due to the increasingly sour nature of the catalyst, the higher The concentration, it would be destructive to the composition of the polysaccharide carbohydrate. Thus, the same treatment to the higher levels of catalyst, then the sooner the destruction of carbohydrates into sugar. So that within the same hydrolysis, rise more quickly obtain a catalyst The concentration of glucose.

In addition to the catalyst concentration, duration of hydrolysis also affects glucose levels generated. The longer hydrolysis time, until the optimum point, the higher the glucose produced. In this study, the determination of the time variation of hydrolysis is still in optimal time range, i.e. from 1 minute to 1 hour. So that changes can still be seen hydrolysis time effects on glucose levels generated. In this study, the largest yield obtained catalyst 0.8 N The concentration and reaction time of 30 minutes with a yield of 6:25 grams of glucose / 20 grams of material, as well as the conversion of 27.22% at 20 grams of dry matter.

Suggestions
This research of glucose levels of banana weevil is conducted to get a comparison of glucose levels with variable concentrations of catalyst and duration of hydrolysis. So it suggests further research using different variables like the use of different varieties of banana weevil, the use of different catalysts, variable of temperature and variable of different catalysts concentration.

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