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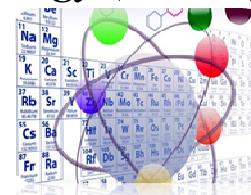
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Electrical Analysis of Fermented Durian Rinds

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ABSTRACT

In this study, Durian rind wastes were fermented using Saccharomyces cerevisiae yeast to break the starch to be smaller sugar molecule. Then, the pH was analyzed using digital pH-meter. The voltage and electric current were analyzed using multimeter. The result showed that the lower the pH value the greater its voltage and its electric current. The pH value influenced by fermentation time. The longer the fermentation time the lower the pH value. The type of microorganism and the composition of durian rind wastes were also affected the pH value. In this study, the fermentation process was set for 24, 48, 72 hours, and the pH value was resulted in the basic range. The highest voltage is 0.094 volt and the highest electric current is 0.058 mA measured in pH 12.3.

Keywords: durian, fermentation, electric current, voltage

1. INTRODUCTION

Durian (*Durio zibethinus Murr*) is a tropical fruit distinguished by its large size and spiky, hard outer shell with pungent smell. Indonesia, one of the countries that produce Durian. Based on the Indonesian Central Bureau of Statistics, the production of Durian fruit increases every year. At 2015, the production of Durian was 995,729 increased become 1,169,804 in year 2019. The increasing of durian production is also in line with the increasing of durian rind wastes. Each Durian fruits contain three parts, the first part is flesh of fruit (20-25%), the second part is seed (5-15%) and the rest is rind (60-70%).¹ It can be concluded that the most part of these Durian fruits is durian rinds, which is categorized as wastes. However, it required to recycle these wastes to minimize environmental pollutions.

Durian rinds composed of cellulose (50-60%), lignin (5%) and starch (5%).² The previous research, utilizing the Durian peels for animal feed¹, bioethanol³, CMC⁴, etc. Khairiah and Destini, R (2017) creates

bio-battery from Durian rind paste, which contain of electrolyte to conduct electricity and voltage.⁵ The electrolyte influenced by pH, the more acidic the pH, the higher its voltage and its electric current.⁶

This research was conducted by fermented the Durian rinds waste from Medan, North Sumatera, Indonesia using *Saccharomyces cerevisiae* yeast. This yeast has been known to have power conversion of sugar into ethanol. Previous research, Irani, et al. (2018) fermented pineapple peel wastes using *Saccharomyces cerevisiae* yeast in combination with *acetobacter acetic*. The result showed that the longer the fermentation time the lower the pH in the acid range (between 3 – 4).⁶ In this research, *Saccharomyces cerevisiae* yeast used as fermenter.

2. EXPERIMENTAL

2.1. Sample Preparation

Durian rinds were cut into cubes with a size of 3x3 cm, then dried in open air. The dried durian rinds were soaked in hot water for 30 minutes. Then, the durian rinds added by 10% NaOH and boiled in water bath for 30 minutes due to delignification process. Finally, the durian rinds were fermented by addition *Saccharomyces cerevisiae* yeast. The fermentation process was varied for 24 h, 48 h and 72 h.

2.2. Electrical Analysis

The pH of fermented durian rinds was analyzed using digital pH meter. Then, the voltage and electrical current was analyzed using multimeter.

3. RESULTS AND DISCUSSION

There are two types of fermentation process, anaerobic condition and aerobic condition. In this research, the fermenter used is *Saccharomyces cerevisiae* yeast. This yeast has an enzyme functioning as a breaker of sucrose into glucose or fructose.⁶ The fermentation process of this yeast occurred in anaerobic condition. Before doing the fermentation process, Durian rinds which contain of 5% lignin, are added by NaOH in boiled water to remove the lignin, called as delignification process. Then, samples were fermented by *Saccharomyces cerevisiae* yeast in anaerobic condition for 24, 48 and 72 hours. The color of the product is black-brownish with the smell of alcohol.

Table 1. pH of fermented Durian rinds.

Samples	Fermentation Time (hours)	pH
Durian rinds	24	13.3
Durian rinds	48	13.0
Durian rinds	72	12.3

The pH of the fermented Durian rinds presented on Table 1. From the data, it can be concluded that increasing the fermentation time will decreasing the pH. However, the result showed that the pH value of fermented durian rinds was in the basic range. Meanwhile, the previous research described that the pH value in the acid range between 3 to 4.⁵ It maybe because the type of microorganism that used in this research.

Saccharomyces cerevisiae yeast were able to convert glucose into ethanol, meanwhile *Azetobacter acetic* are able to convert the ethanol into acetic acid.⁶ Therefore, in this research the pH range in the basic range between 12-14.

Figure 1. described the correlation between pH with its voltage and the correlation between pH with its electric current. Even though, the pH in the basic range, the voltage and electrical current still be measured using multimeter. The lower the pH the greater its voltage and its electric current. The result fitted with the previous research.^{5,6} The highest voltage is 0.96 volt and the highest electric current is 0.058 mA, which is the pH 12.3 with the fermentation time 78 hour. The longer the fermentation time will increase the voltage and electric current value. The more acidic the pH, the higher electricity will be produced. It because the acids are the electrolytes which break into anion and cation when it placed into solutions.⁶

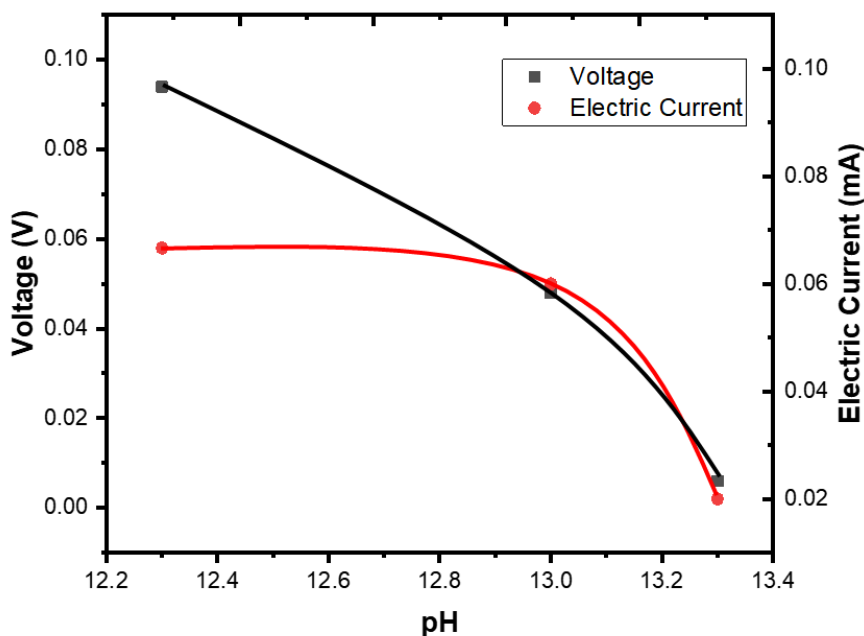


Figure 1. Correlation of pH with Voltage and Electric Current

Durian rinds is hard, therefore to break the component into ethanol or acetic acid requires longer fermentation time and suitable microorganism.

4. CONCLUSION

In this research, the fermented Durian rinds could produce electricity. The voltage produced is 0.096 volt in the pH = 12.3. The electric current produced is 0.058 mA in the pH 12.3. The lower the pH is the greater the amount of voltage and the amount of electric current. The pH influenced by fermentation time and the type of fermenter. The longer the fermentation time is the lower the pH.

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