

## The Production of Enzyme Bio-Cleaner Using Lemon, Lime and Pineapple through Fermentation Process

Nuramirah Juma'at \*<sup>1</sup>, Nurul Fatin Hidayah Mohd Lazim<sup>1</sup>,  
Nurul Husna bt Mohd Adan<sup>1</sup>, Norain Ahmad Nordin<sup>1</sup>

<sup>1</sup>Department of Science and Mathematics, Centre for Diploma Studies,  
Universiti Tun Hussein Onn Malaysia, Pagoh Higher Education Hub,  
KM1, Jalan Panchor, Pagoh, 84600 JOHOR

DOI: <https://doi.org/10.30880/mari.2021.02.01.015>

Received 11 November 2020; Accepted 01 January 2021; Available online 03 February 2021

**Abstract:** Enzyme bio-cleaner is a natural cleaning agent that contains specific quantities and qualities of bacteria along with enzymes and microbial nutrients that essentially digest chemical and organic waste. The bacteria consumed by this cleaners are converted into two basic compounds which is carbon dioxide and water. Based on past research, some of organic waste that have been used to produce enzyme bio-cleaner were orange and pineapple compared to other fruit waste. The main goal of this research is to produce a natural cleaning agent from citrus fruit using a different rate of acidity which is lemon, lime and pineapple through fermentation method. The waste of this fruits was prepared by cutting and washing using ionized water. A 500 ml of ionized water was mixed with 50g of sugar solution and 150g of fruit waste. This solution was left at room temperature for 30, 45 and 60 days to identify the effectiveness of the product. The fermentation was done after the solution filtered and analysed using Refractometer HI97801 Digital Brix and Benchop Meter HQ440d for its sugar content and pH respectively. The pH of enzyme bio-cleaner of lemon, lime and pineapple were found to be 3.84 pH, 4.02 pH and 4.28 pH. Whereas, the sugar content of the bio-cleaner were The most effective cleaning agent is at range between 2.0 pH to 3.17 pH. The results indicated that lemon waste showed the most effectiveness among the 3 fruits waste.

**Keywords:** Fermentation, Enzyme bio-cleaner , Citrus fruits, pH value, Sugar level

### 1. Introduction

Cleaning products are commonly used in day to day life, whether it be to clean a home, clean clothes, or for industrial purposes. Most common cleaning products use relatively toxics to health and environment, mix of chemicals as many such products contain certain ingredients derived from petrochemicals [1]. This cleaning product releases toxic chemicals, unstable pH and exhibit a slow rate of biodegradation which can harm the environment [2].

Natural products are replacement to toxic petroleum based cleaning products. Examples of natural cleaning products include fermented fruit solutions. The natural cleaning agents are cheaper and less harmful to the environment. One of the advantage enzyme based detergents is the level cleaning properties are par to the synthetic detergents. A solution of fruit enzyme could be favourable for removal of ammonia nitrogen and phosphorus in wastewater treatment [3]. Natural cleaning agents also can ease global warming by minimizing the environmental pollution and safe for the environment by produce the solution to remove dirt, oil and stain [4]. Thus, this study had led to produce a cleaning agent which is natural, good for the environment and biodegradable. Enzyme bio-cleaner solution has been able to act as effective cleaning agent like synthetic cleaning agent in market without contributing to any pollutions (Ways to Save Energy, 2008). It is because this cleaner has high potential as a multipurpose cleaning agent from fruit waste such as lemon, pineapple and lime. In term of science, lime fruit contains a high quantity of citric acid which is the acidity of the fruit is probably in the range of 1 to 3 pH [5]. Lemon also has a pH value between 2 and 3 which means it is acidic. The pH of the pineapple is about 3 and 5.2 which means lemon is acidic than pineapple. The weight percent of the fermented fruit solution used for cleaning can be higher than or equal to 5% fermented fruit solution.

Fermentation is a process that produces chemical change in organic substrates through the action of enzyme. In terms of biochemistry, fermentation also called as anaerobic process which means the extraction of energy from carbohydrates in the absence of oxygen. Carbohydrate in the form of sugar helps in activating the enzyme from fruits. Enzyme bio-cleaner are produced through fermentation process to creates microorganism that have greater yielding, faster growing, less oxygen and able to use in medium that have more concentrated. Thus, high sugar content is desirable to provide more energy for the microorganism to grow and thus increasing the amount of enzyme that is beneficial for its ceaning properties. This cleaner has a lot of application include usage in home, agriculture, animal husbandry and many other areas. It is a very excellent household agent such as laundry cleaner and organic fertilizer. Enzyme bio-cleaner solution also help to control environmental pollution because this solution does not have any addition of chemical.

The benefits of enzymes bio-cleaner is to improve the stability of sludge and dispose the stain in dewatering and reduction in biological method [6]. Also, enzyme bio-cleaner can be able to act as a natural pesticide which reduces the chemical pesticide. Thus, enzyme bio-cleaner can save environment and replace the synthetic cleaner solution in daily life [4]. It is very effective, safe and specificity in activity and environmental as well as cheaper preparation method. As a result, enzyme bio-cleaner can save money by convert kitchen waste such as orange, lemon, and pineapple into natural "homemade enzyme" cleaner instead of buying expensive and synthetic cleaner agent [2].

## **2. Materials and Methods**

In order in making the production of Bio-Cleaner using lemon, lime and pineapple through fermentation process are involving many process. The method were involved preparation of material, preparation of sugar solution and fermentation process, filtration process and analysis.

### **2.1 Preparation of materials**

Three different citrus fruit are using for this research such as lime, lemon and pineapple. The source of raw materials was chosen based on the availability of the raw materials. For the sugar solution 50 gram of palm sugar is needed. Apparatus that undergoes this process including 9 units of 2000 ml beaker, 3 units of 250 ml beaker, 3 units of dropper, 3 units of stirrer and 10 pieces of aluminum foil in a square sizes. For the analysis process required Refractometer HI96801 Digital Brix to read sugar level and Benchtop Meter HQ440d that is used to measure the acidity of the fermentd solution.

## 2.2 Preparation of Sugar Solution and Fermentation Process.

To prepare 500 ml of sugar solution, the palm sugar has been weighed for 50 gram and blended to obtain a granular-size. It was to increase the rate of solubility in a water solution. Then, the palm sugar was added into 500 ml of ionized water in a beaker and mixed until it was completely dissolved. The raw materials that have been weighed earlier were mixed with sugar solution and poured into 9 units of 2000ml beaker. The solutions are put into 9 different units based on types of fruits and duration of fermentation process. The beakers then were covered with aluminum foil to enable anaerobic process to occur. All of the solutions were being kept in the dark place at a room temperature (27 °C) within 30, 45 and 60 days.

## 2.3 Filtration Process

Before analysis, each samples were filtered filter paper to remove all of sediment from the solution producing a total of 400ml to 500ml of fermented solution from this process.

## 2.4 Analysis

### 2.4.1 Refractometer HI96801 Digital Brix for Sugar Analysis

Refractometer HI96801 Digital Brix was used to read the sugar content in the fermented solution as shown in Figure 1. High sugar content reading has shown that the fermentation process has been successful. It is because a high sugar value capable to produce a good product of cleaning agent with superior cleaning capabilities. The procedure to measure the sugar level is by dropping the sample solution by using pipette onto the prism surface and press the button to read the result.

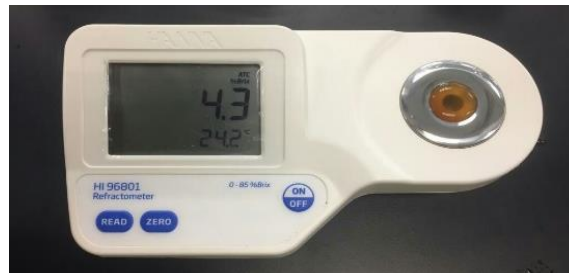


Figure 1: Refractometer HI96801 Digital Brix

### 2.4.2 pH Analysis

Figure 2 shows the measurement of acidity of the fermented solution using pH Meter. The pH value was taken to determine the most effective fermented solution that acts as a cleaning agent. The lowest pH level is a key characteristic of cleaning products. Thus, the characteristics of a good cleaning agent are those with the lowest pH value.



Figure 2 : pH Meter

### 3. Results and Discussion

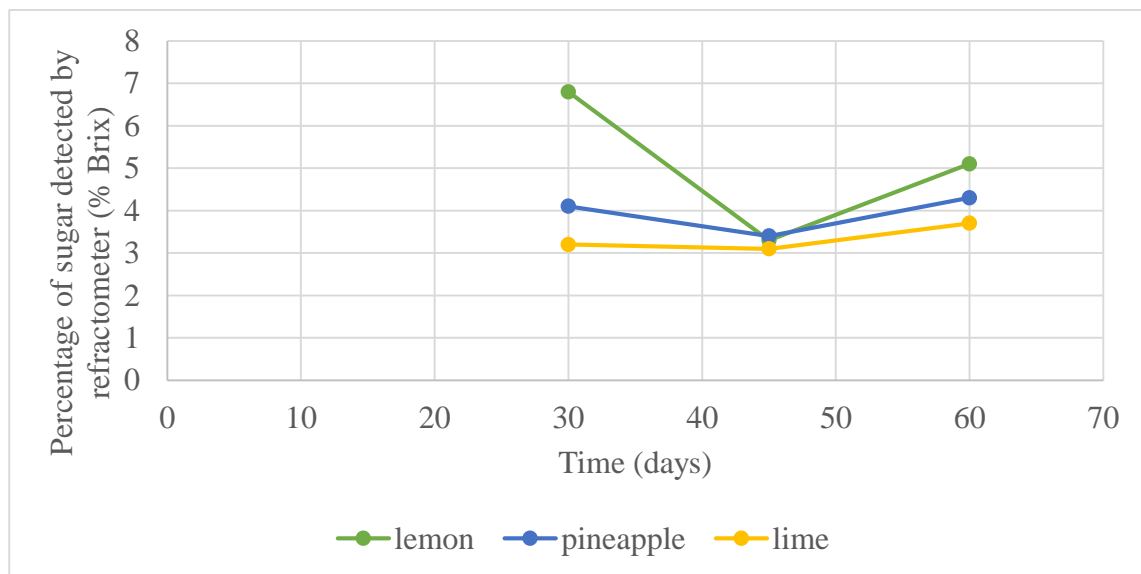
In this section the results of the study are presented and discussed with reference to the aim of the study, which was to identify the effectiveness of these cleaning agents by performing a pH meter and a sugar content test. The first test was run to compare the acidity of all the fermented solutions while the second test was done to estimate the sugar content for each of the fermented solution. These tests were being analyzed by using pH Meter and Refractometer HI96801 Digital Brix

#### 3.1 Effect of Sugar in Fermented Solution

Table 1 shows the percentage of sugar detected by refractometer influenced by the total days of fermentation process. The percentage of sugar in all fermented solutions were decreases and then increases when the number of days taken for fermentation process increases. At the end of 60 days, the sugar content obtained from the lemon fermented solution has the highest percentage which is 5.1 % Brix followed by pineapple (4.3 % Brix) and lime (3.7% Brix). At days 30 the reading is high due to bacteria that appeared on the fermentation solution thus affected on the readings.

**Table 1: Percentage of sugar in fermented solution**

Total Days Type of Fruits	Sugar content (% Brix)		
	30	45	60
Lemon	6.8	3.3	5.1
Pineapple	4.1	3.4	4.3
Lime	3.2	3.1	3.7



**Figure 3: Effect on sugar percentage that caused by the total number of days taken for fermentation process.**

Based on Figure 3, the graph represents the data from Table 1. It shows the effect on percentage of sugar due to the total days of fermentation process. There are three colorful lines represent all types of raw materials which is three types of fruits peel. The blue line represents the pineapple, the green line represents the lemon and the orange line represents lime. As seen, there is a clear difference of sugar content within 30, 45 and 60 days. The trend of the graph is decreasing and then increasing with the total days of fermentation. The final percentage of sugar for lemon is 5.1% Brix, followed by pineapple 4.3% Brix and lime 3.7% Brix. It shows that the sugar has activated the enzymes from the fruit.

### 3.2 Effect on pH

**Table 2** shows the data on second test which is the total value of pH readings affected by the total days of fermentation process. The reading of pH meter increases when the amount of days taken for fermentation process increases. In the end of 60 days, lemon fermented solution has the lowest pH value among the others which is 3.84 pH. It shows that the acidity of fermented solutions is increasing along time. The most effective cleaning agent is the one that has an acidic value range from 2.0 pH to 3.17 pH. Therefore, lemon fermented solution is the one that meets the properties stated earlier. The pH reading for it solution is 2.35 pH which was taken during the first month of fermentation process. Thus, it concludes that the lemon fermented liquid from the first month of fermentation is the most effective cleaning agent with good cleaning properties.

**Table 2: Total pH in fermented solution**

Type of Fruits	pH Value (pH)		
	30	45	60
Lemon	2.35	3.28	3.84
Pineapple	3.09	3.21	4.02
Lime	2.87	3.72	4.28

### 4. Conclusion

As a conclusion lemon is the best cleaning agent compared to lime and pineapples based on pH meter and sugar level. Based on the pH level, lemon has a least value of pH number compared to lime and pineapples from all days. Besides that based on sugar level, lemon has a highest reading compared to lime and pineapple based on all days. Sugar helps in activating the enzyme from fruits.

### Acknowledgement

The authors would like to thanks Centre for Diploma Study, University Tun Hussein Onn Malaysia (UTHM) for its support.

### References

- [1] F. P. Documents, “( 12 ) United States Patent ( 10 ) Patent No .: (\* ) Notice .;” vol. 2, no. 12, 2017.
- [2] A. B. Othman, “Investigation on the potencial of orange peel waste in the production of useful homemade solution,” p. 24, 2013.
- [3] F. E. Tang and C. W. Tong, “A Study of the Garbage Enzyme ’ s Effects in Domestic Wastewater,” pp. 1143–1148, 2011.
- [4] P. Thirumurugan, “Production and Analysis of Enzyme Bio-Cleaners from Fruit and Vegetable Wastes by Using Yeast and Bacteria Tamil Nadu State Council for Higher Education ( TANSCH E ),” 2016.
- [5] A. A. Bakare, R. B. Bassey, C. A. Onyeka, and F. I. Duru, “Lime Juice ( Citrus aurantifolia ): Effect on fetal parameters of pregnant Sprague-Dawley rats,” Int. Jounal Med. Med. Sci., vol. 2, no. 5, pp. 114–116, 2012.

- [6] C. Arun and P. Sivashanmugam, "Investigation of biocatalytic potential of garbage enzyme and its influence on stabilization of industrial waste activated sludge," *Process Saf. Environ. Prot.*, vol. 94, no. October, pp. 471–478, 2014.