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The Changes of Moisture Content, pH, and Total Sugar Content of Honey Originated from the Flowers of Bangka Rubber Tree during Storage

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Abstract: ***This study aimed to determine the changes of moisture content, pH, and total sugar content of honey originated from the flowers of Bangka rubber (named as rubber honey) during storage. Honey sample was taken by using purposive sampling originated from Kalung reserved area, Namang village, Central Bangka regency, Indonesia. The collected rubber honey was packaged in a glass bottle and stored for 12 weeks at temperatures of 20°C, 30°C and 40°C. Results showed that moisture content increased from 24.25% to 26.30 %, 26.17 % and 25.53 %; pH value was decreased from 3.92 to 3.73, 3.89 and 3.84, and sugar level was decreased from 74.77 % to 73.70 %, 72.60 %and 71.80 % respectively at the storage temperature of 20, 30 and 40 ° C.***

Keywords: Bangka Rubber honey, moisture content, pH, sugar content

1.Introduction

Honey is one of natural food ingredients that contains good nutritional value, and widely consumed by people due to its benefits. Indonesian National Standard (SNI) 3545: 2013 defines honey as a natural liquid which generally has a sweet taste produced by honey bees (*Apis sp.*) from the nectar of flowers(flora nectar) or other parts of plants. Honey has some functional properties that are beneficial to human health. It can be consumed directly and can also be used as additives in various industries such as food industry, medicine and beauty [1, 2, 3].

Honey is like any other food products which go on the downgrade in quality during storage. The deterioration in the quality of honey can be affected by temperature [4], humidity [5], air [6] and light [7]. The rate of degradation of honey depends on the types of honey [8][9], manufacturing process, and storage conditions [9][10]. It may also be indicated by the physical and chemical changes as a result of honey chemical reactions during the storage.

Important parameters that can affect the quality and shelf life of honey are moisture content [11], pH [12], and sugar content [13]. A low water content of honey generally has a longer shelf life as compared to high water content, while the pH can affect the texture and stability of honey during the storage [12][14]. A high sugar level of honey may cause the growth resistance to the bacteria. This study aimed to determine the changes of moisture content, pH, and sugar content of Bangka rubber honey rubber during storage.

2.Materials and Method

The samples of honey used in this study were honey from nectar of rubber trees flowers in Kalung reserved area, Namang village, Central Bangka regency, Indonesia. They were taken by using purposive sampling. In this study, those rubber honeys were packaged in glass bottles with a lid sized 500 mL. They have been sterilized using an autoclave. Then, they were stored in bottles for 12 weeks at a temperature of 20°C, 30°C and 40°C. The quality parameters which were analyzed every week were: color, pH, moisture content, and total sugar content, whereas moisture content and pH were monthly analyzed [15][16][17].

3.Results and Discussion

3.1 Moisture Content

The moisture content of honey prior storage was 24.25%. Unfortunately, it did not meet the honey quality requirements of Indonesian National Standard as stated in SNI 3545: 2013. (Maximal 22%). The water content analysis of rubber honey during 12 weeks of storage is presented in Figure 1.

Figure 1 shows that the moisture content of rubber honey was increasing during storage at the storage temperatures of 20, 30 and 40°C. The moisture content of honey after 12 weeks of storage were 26.30%, 26.17% and 25.53% at the storage temperatures of 20, 30 and 40 °C, respectively.

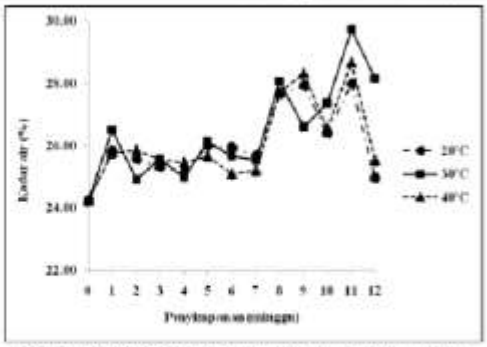

Figure 1: Moisture content changes during storage

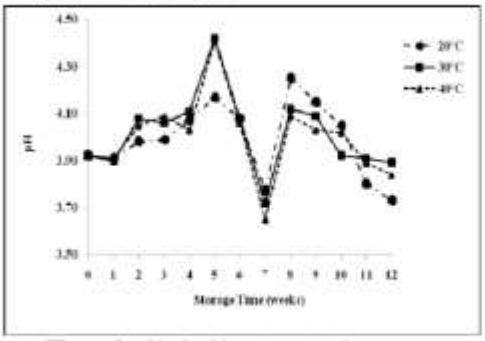

Figure 2: pH of rubber honey during storage

The moisture content of more than 20% in honey is a favorable condition for fermentation to occur in honey [18]. The most favorable temperature for the occurrence of fermentation in honey was 27°C [6]; however, this research was found to be at 30°C.

Furthermore, the fermentation in honey could be due to yeasts which are naturally present in honey. Yeasts are microorganisms that survive and proliferate on products that have high sugar content such as honey and will grow optimally in the temperature range of 25 to 30 °C [6]. During the fermentation process, the yeast cells breakdown sugars in honey into glucose and fructose, then into alcohol. The alcohol reacts with oxygen (O_2) to form acetic acid; therefore it will increase the acidity of honey, as well as aroma and flavor. The end products of fermentation in honey will be carbon dioxide (CO_2) and water [19]. Honey that has undergone the fermentation will lose its typical flavor [18]. Therefore, this can cause the rubber honey moisture content increases with the length of storage at a temperature of 30 °C.

3.2 pH

Fresh honey has a pH value ranged from 3.4 to 6.1 [14]. The pH value of honey is affected by acids and minerals. Acid will give an effect to the stability of honey on microorganisms, flavor and aroma [12]. The acidity of honey is determined by the dissociation of hydrogen ions in aqueous solution. It can also be influenced by the content of minerals such as Calcium, Sodium and Potassium, so high mineral content of honey will have a high pH as well.

The result of rubber honey pH analysis during 12 weeks of storage can be seen in Figure 2. The initial pH value of rubber honey before the storage was 3.92. During the storage, pH value of rubber honey fluctuated at the storage temperatures of 20, 30 and 40° C. At the end of storage (12 weeks), the pH value decreased to 3.89, 3.83 and 3.80, respectively at storage temperatures of 20, 30 and 40°C. Figure 2 shows that pH value of rubber honey increased until the fifth week of storage at the temperatures of 20°C, 30°C and 40°C. It was assumed that the increased pH was due to the degradation of glucose and fructose at the beginning of fermentation.

The pH values were sharply decreased at the seventh week of storage period. It was due to the conversion of glucose and fructose into CO_2 and alcohol during the fermentation. Alcohol is further hydrolyzed to produce O_2 and acetic acid; therefore the acidity of honey increased [20]. As shown in Figure 2, the decrease pattern was also found from 8 weeks of storage period until 12 weeks at all storage temperatures.

3.3 Total Sugars Content

The main components of honey are sugar and water. The dominant types of carbohydrate are glucose and fructose which contains approximately 70-80%, 10-20% water and other components such as organic acids, minerals, vitamins, proteins, enzymes, volatile component, and flavonoids [21][22]. The sugar composition of honey depends on the nectar source plants [23] and geographical conditions [24][27].

The initial total sugar content of rubber honey was 74.77%. The high sugar content of honey might have some effect on the honey quality. High sugar content in honey will result in more viscous of the texture; and therefore honey is more hygroscopic. Honey with high sugar content will affect the color, taste and shelf life of honey, as well as inhibition of the bacterial growth [13]. Honey with high sugar is lighter in color compared to high phenolic content which is darker in color [26][27]. Crystallization is used to find in honey with high content of sugar which is caused by the formation of sugar into glucose monohydrate crystals and the crystals subsequently broke away from the water and fructose. The crystals can be sediment at the bottom of the packaging or coagulation hovering in the packaging or on the top of the liquid honey that cause honey becomes turbid [6].

The results of the analysis of total sugar rubber honey during 12 weeks of storage can be seen in Figure 3. At the end of storage (12 weeks), the total sugar content of rubber honey decreased. The highest drops occurred at the storage temperature of 40°C followed by 30 °C and 20 °C respectively which were 71.8%, 72.6% and 72.7%, respectively. The decline in total sugar content during storage due to degradation of sugar into alcohol and CO_2 [6].

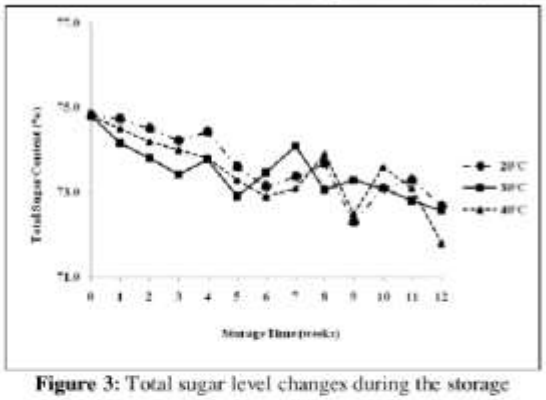

Figure 3: Total sugar level changes during the storage

The decline in total sugar content during storage was affected by temperature. Total sugar in honey which is stored at 5, 20 and 35°C for one year would decrease during storage, especially at higher storage temperature [28]. In addition, sucrose content will change 79% as compared to the initial conditions when it is stored at a temperature of 20°C ± 2°C for six months [29].

4.Conclusion

During the 12-week storage, moisture content of rubber honey was increased from 24.25% to 26.30 %, 26.17 % and 25.53 %, pH value was decreased from 3.92 to 3.73, 3.89 and 3.84, and total sugar levels was decreased from 74.77 % to 73.7 %, 72.6 %, and 71.8 %, respectively at the storage temperatures of 20, 30 and 40°C.

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