

Article

Study of Water Content Reduction Using Condensation Method In The Framework of Increasing Production Pure Honey

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Abstract: The high water content in honey will trigger yeast activity to grow and develop. At ambient temperature, air humidity increases, so honey will absorb water more easily. High water content will cause the fermentation process to occur. Efforts to reduce the water content in honey are one way to prevent the fermentation process from occurring. Several water content reduction methods commonly used in Indonesia are considered to still need to be updated as innovations. The aim of the research is to increase the efficiency of the honey water content reduction time in the production process, compare the results of the water content reduction process using the dehumidification method with the condensation process method and examine the parameters of temperature, time, water content, humidity and honey quality. Research was conducted qualitatively and quantitatively. Qualitative test results show that the color, aroma and taste of samples using the dehumidification and condensation methods have the characteristics of honey. Meanwhile, quantitative testing shows that using the condensation method has a better level of productivity and quality than using the dehumidification method, this can be seen from the parameters of temperature, water content, humidity, diastase enzyme and hydroxymethylfurfural analysis. Condensation methods produce honey that meets Indonesian national standards 2018. Therefore, this honey water content reduction tool that uses the condensation method is effective in reducing the water content of honey and maintaining its quality.

Keywords: condensation, honey, water content

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1. Introduction

Honey is a natural liquid with various colors, sweet and thick taste produced by bees from the process of secreting sugar in the form of the monosaccharide fructose which comes from flower nectar [1]. Honey is a food product that has high nutritional value and has many health benefits. Based on the results of phytochemical tests, trigona honey (*tetragonula biroi*) contains alkaloids, flavonoids and triterpenoids, as well as vitamin C [2]. Based on this information, honey has the potential to be used as a source of nutrition. Honey is also reported to have antibacterial properties against *Escherichia coli* and *Staphylococcus aureus* which can be used as an alternative treatment and can reduce dependence on modern medicines. Based on the explanation above, honey is a commodity that has great potential to support food security [3].

The nutritional content of honey is very complete, namely it contains complex enzymes and sugars which allow biochemical reactions to occur which

will affect the decline in honey quality [4]. Trigona honey is rich in nutrients obtained from the collection of various types of flower nectar, and is one type of high quality honey [5]

The chemical content and properties of honey allow it to be stored for long periods of time by paying attention to the water content of the honey and the storage temperature. Parameters that determine the quality of honey based on Indonesian National Standards include water content, total sugar content, acidity and pH. These elements of honey quality are interrelated with each other. The challenge for honey producers in Indonesia is the hygroscopic nature of honey so that it easily absorbs water from the surrounding environment, therefore measures are needed that can reduce the water content of honey so that it can be stored longer [6]. The high water content of honey will be a trigger factor for honey damage if stored for a long time. The maximum water content figure for honey based on the Indonesian National Standard [7] is 22%, while the water content requirements for trigona honey according to SNI 8664:2018 are not allowed to exceed the limit of 27.5% with the maximum acidity content contained in honey, namely 200 ml NaOH/kg.

The high water content in honey will trigger yeast activity to grow and develop. At ambient temperature, air humidity increases, so honey will absorb water more easily. High water content will cause the fermentation process to occur. Efforts to reduce the water content of honey are one effort to prevent the fermentation process from occurring. Several water content reduction methods commonly used in Indonesia are considered to still need to be updated as innovations. A decrease in water content at high temperatures will cause changes in the chemical structure of honey, with the glucose content changing to hydroxymethylfurfural (HMF)[8]. In this research, a condensation process was used to reduce the water content of honey. The output obtained from this research is to propose the condensation process as a new alternative in reducing the water content of honey.

The aim of this research is ; 1). Increase the efficiency of reducing honey water content in the production process. 2). Compare the results of the previous water content reduction process (dehumification) with the condensation process. 3). Assess the parameters of temperature, time, water content, humidity, and honey quality (HMF, diastase enzyme) of dehumification and condensation process honey

2. Materials and Methods

This research will be carried out from February to March 2024. The research location will be carried out at the Suhita honey production center located at Jl. Retired 1 No. 40, Langkapura, Bandar Lampung, Lampung Province. The material used in this research was a sample of trigona honey or klanceng honey from the Heterotrigona itama bee species originating from the Suhita Bee Farm honey bee farm. The tools used are Honey Saver as a condensation process tool to reduce the water content of honey, Showcase as a closed/isolated place for testing, plastic container as a place for trigona honey to be tested, spatula as a tool to take honey samples to measure water content, refractometer as a tool for measuring water content, digital scales for weighing trigona honey with an accuracy of 1 gram, electrical power consumption measuring tool for recording electrical energy usage

when the honey water content reduction machine is in process, thermohygro as a tool for recording temperature and humidity.

Qualitative research data including the color, aroma and taste of honey were analyzed using descriptive analysis, while the quantitative data obtained during the research was analyzed using average values and percentages.

3. Results and Discussion

A. Water Content

The way the machine works is based on the principle of capturing water moisture in the honey in an air-circulating room with a temperature below 300 C. The honey in the machine's container tube is assisted by a perforated stenlis disc to make it easier for air to circulate, and increases the surface area of the honey so that the water content is removed. on honey it gets faster. When air circulates and carries water molecules in the honey, the water will be captured and separated into water storage containers in the machine series. The process will repeat continuously until the desired water content. Reducing honey water content using a condensation process aims to obtain honey water content that meets the Indonesian National Standard (SNI), namely not exceeding 27% for stingless bee species in accordance with [9]. The results of reducing honey water content using the honeysaver tool show that it only takes 7 hours to get honey water content that meets SNI (Table 1).

Table 1. Reducing the water content of honey with the honeysaver tool

Time (Hour to -)	water content (%)
1	30
2	28
3	26
4	25
5	24
6	22
7	21

The way it works is carried out by the principle of capturing water moisture in the honey in an airtight room with a certain room size, then the honey is spread out on a tray in a room with periodic air circulation and stirred manually to homogenize the surface of the honey and make it easier for the water in the honey to escape and be captured by the molecules. the water by a dehumidifier machine. The results of reducing water content using a dehumidifier machine require 7 days to obtain honey water content that meets SNI standards (Table 2). The dehumidifier machine requires 715 watts/hour of power to operate with a production capacity of up to 320 kg.

Table 2. Reducing the water content of honey with the Dehumidifier tool

Time (Day to -)	water content (%)
1	30
2	28
3	26
4	25,5
5	23,5
6	22
7	21

The water content of honey is a limiting factor in determining its quality, stability and resistance to fermentation. The higher the water content, the higher the possibility of fermentation occurring during storage [9]. Reducing the water content of honey is intended to maintain the quality of the honey during long storage periods. If the water content in the honey is low, the honey will avoid damage for a relatively long storage period and can minimize the presence of microbes in the honey [10]. The reduction in water content from the two methods above shows that using the condensation method with honeysaver is faster in reducing water content. The speed of decreasing water content greatly influences the effectiveness of honey production.

B. Organoleptic Test

The honey organoleptic results showed that honey processed using the honeysaver tool and dehumidifier tool had a typical honey aroma, a typical honey taste, a brownish yellow color, and a thick texture typical of honey (Table 3).

Table 3. Honey organoleptic test

Sampel	Aroma	Rasa	Warna	tekstur
Honeysaver tool	typical honey	typical honey	brownish yellow	typical honey
Dehumidifier tool	typical honey	typical honey	brownish yellow	typical honey

Organoleptic testing on honey can be used as a qualitative quality test. In the organoleptic test, all test honeys gave results that met the honey quality requirements referring to SNI honey 2018.

C. HMF and Diastase Enzyme Tests

The results of the HMF and Diastase enzyme tests show that honey processed using the honeysaver and dehumidifier meets SNI 8664-2018 standards (Table 3). according to SNI honey 2018, the maximum HMF content is 40 mg/kg while the diastase enzyme is at least 3 DN.

HMF (5-hydroxymethylfurfural) analysis is a method used to measure the quality of honey and is used as a reference in several studies to determine the authenticity of honey [9]. The organic molecule HMF is formed when honey sugar decomposes thermally. HMF levels can be a sign that the quality of honey has decreased as a result of excessive heating or the addition of invert sugar [11]. The higher the HMF content, the lower the quality of the honey. From the two methods used, the HMF results meet SNI 8664-2018, namely a maximum of 40 mg/kg.

HMF levels can be a standard of honey freshness. Honey that has been stored for a long time will increase its HMF value, because HMF is a cyclic aldehyde produced by sugar degradation through the Maillard reaction (non-enzymatic browning reaction) during processing or storing honey for a long time. long [12]. The HMF value is a marker of honey authenticity. According to [11], if honey contains more than 50 mg/kg of HMF, it can be confirmed that the honey is fake or mixed with added sugar.

The results of analysis of the diastase enzyme activity in both methods showed that the diastase enzyme value was above 3 DN. The diastase enzyme is an enzyme produced by bees which functions in the process of ripening honey (complex sugars become simple sugars) which are easily damaged by heating [13]. These results show that the two methods of reducing the water content used

do not damage the quality of the honey used, however there is a significant difference in value, the condensation method has a greater DN value, this could occur due to the difference in the length of the process of reducing the water content. Honey exposed to temperatures of more than 25 °C with varying exposure times will reduce the activity of the diastase enzyme [14]. This is in accordance with the character of enzymes which are easily damaged when heated or also known as protein denaturation. Protein denaturation is a change in secondary, tertiary, and so on structures without changing the primary structure (without cutting peptide bonds) which results in the protein losing its enzymatic function [15]

4. Conclusion

The observation results obtained show that reducing the water content of honey using the condensation method or with a honeysaver tool has a faster time compared to the dehumidifier method, so the condensation method is more efficient in time and production costs. The results of the honey quality test also showed that reducing water content using the honeysaver tool had better quality in terms of HMF and Diastase enzyme parameters.

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