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Dried nata de coco for extend the shelf life of fruits

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Abstract. We reported preliminary study about dried nata de coco for extend the shelf life of fruits. We made nata de coco by mixing coconut water and adding *Acetobacter xylinum*. Nata de coco was dried and compacted with hot press. The design of nata de coco as an absorbent of water made similar to the design of silica gel. Moisture absorption test was carried out by storing dried nata de coco samples along with fruits (apple, mango, pear) in one container. Fourier Transform InfraRed Spectrometer (FTIR Alpha Platinum ATR A220) was used to check the water content in the dried nata de coco sample. The result showed that dried nata de coco successfully to absorb water vapor.

Keywords: Nata de coco, water absorption, fruits

1. Introduction

Food is one of the primary needs of human. In this instant era, food preservatives are inseparable from food products. The use of food preservatives is intended to extend the shelf life of foods and to prevent microbial contamination that damages them. In the case of fruit storage, we can not store fruit for a long time because they will become runny and rotten. One way to keep the fruit is to maintain the humidity of the storage area. The material commonly used as a moisture absorbent on the storage of hygroscopic materials is silica gel [1]. Meanwhile, problem that arise if silica gel is accidentally consumed is a neuromuscular [2], nausea, vomiting [3], carcinogenic [4].

There are not many non-chemical food dryers on the market. Handayani et al. (2015) reported the results of research on the use of rice husk waste to make silica gel, but there was a weakness, namely that is the addition of chemical compounds such as NaOH, HCl and CH₃COOH, which made this material less safe [5]. Another organic materials commonly used as a moisture absorbers is bacterial cellulose [6]. Umartyotin et al (2016) reported that a mixture of bacterial cellulose and eggshells can absorb moisture in packaging products [7]. Bacterial cellulose has a high absorption capacity so that it can be used in chemical and physical modification processes [8]. Therefore, the study about the absorption properties of bacterial cellulose is an interesting subject to study. Nata de coco is one of the products of bacterial cellulose [9,10]. Researchers also investigated the application nata de coco as dye-absorbent in artificial wastewater [11], heavy metal absorbent for water treatment [12], ultrafiltration membranes [13], and materials for air mask [14]. Hence, in this study, the development of moisture absorbent material using nata de coco was carried out. Focus on this study for extend the shelf life of



fruits. Perhaps, this is a simple research topic but could be an interesting research topic that has not been considered by many people as do many other researchers [15-17]

2. Experimental methods

2.1. Nata de coco preparation

Nata de coco was made by mixing coconut water and adding *Acetobacter xylinum*, a bacteria that produces cellulose. Coconut water and *Acetobacter xylinum* were purchased from local market in Bandung, Indonesia. The coconut water was stored for more than 4 days to increase the acidity. Coconut water was mixed with 4.5 g of sugar and 4.5 g of urea. 4.5 ml of acetic acid was added to adjust pH into 3-4 and then boiled. After the mixture became cold, 9 ml of *Acetobacter xylinum* was also added [14]. It was then subsequently transferred into clean jars and covered with newspaper. After being stored for 7 days, Nata de coco was ready to be harvested.

2.2. Sample preparation

Nata de coco was washed and soaked in water, the sugar content was assumed to disappear (nata de coco becomes tasteless). Next, the nata de coco was pressed with load until 5 ton at 120°C for 5-10 minutes. The dried nata de coco was cut into pieces of the same size.

2.3. Experiment

Moisture absorption test was carried out by storing dried nata de coco samples along with fruits (apple, mango, pear) in one container. Data collection was carried by directly weighing the mass of dried nata de coco before and after it was used to absorb. Fourier Transform InfraRed Spectrometer (FTIR Alpha Platinum ATR A220) was used to check the water content in the dried nata de coco sample.

3. Results and discussion

To prepare the dry material, nata de coco was pressed using a hot press while being heated to a temperature which allows the release of water in nata de coco easily but does not damage the physical properties of nata de coco so that dried nata de coco can be obtained (with a very low or near zero water content). The square specimen with dimensions 1 cm of length \times 1 cm of width were cut from the sample (Figure 1(b)). Figure 1(a) is nata de coco before pressed.

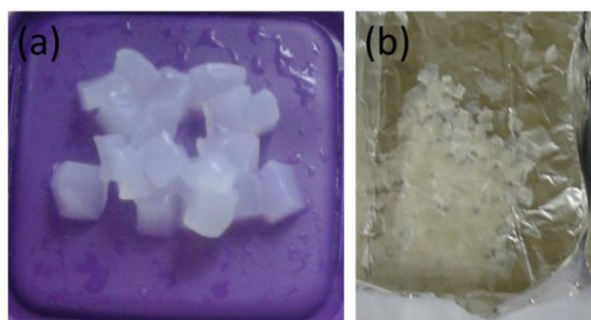


Figure 1. Image of nata de coco (a) before pressed (b) after pressed and was cut.



Figure 2. Dried nata de coco and apple were placed in the same closed container.

The smaller size may be preferred because it has a very large surface area, so it can absorb more water vapour. Surface area is defined as the total area of the material in contact with the air divided by the mass of the material and the unit is expressed in square meters per kilogram or equivalent units if expressed in a unit system different. Then, dried nata de coco were tested using FTIR to see the initial condition before the moisture absorption test was done.

The design of nata de coco as an absorbent of water made similar to the design of silica gel which is commonly used as a food dryer, where the material is wrapped in strong reticulation paper consisting of a waterproof layer, fiber layer, and polythene layer so it is safe to use [18].

Furthermore, dried nata de coco and fruits were placed in the same closed container. Figure 2 showed apple and dried nata de coco were placed in the same container. Storage was carried out for several days. Measurements were conducted by directly weighing the mass of all nata de coco. Figure 3 shows the weight of water absorbed by samples on different days. It seems that the rate of absorption initially increases rapidly with time and reaches a saturation value for a very long time. The increase in mass indicates the amount of water vapor absorbed. It means that dried nata de coco was able to absorb the moisture.

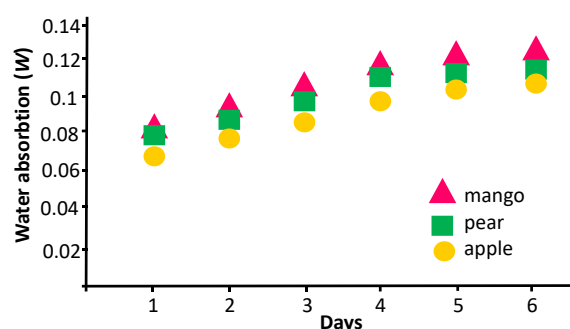


Figure 3. Image of nata de coco (a) before pressed (b) after pressed and was cut.

The highest water absorption was obtained from mango. Meanwhile, dried nata de coco absorbs less water vapor in apples. It also in line with the FTIR measurement graph which shows that the absorption area from mango is the largest (in the region of 3400-3500 cm^{-1}) than another fruits, as shown in Figure 4. The amount of absorption area is calculated using an ImageJ TM software, a Java-based image processing program developed at the National Institutes of Health [xxx.] to predict the area of absorption curve. The result is shown in Table 1.

Table 1. The amount of absorption area.

Manggo	Pear	Apple
4725	4359	4143

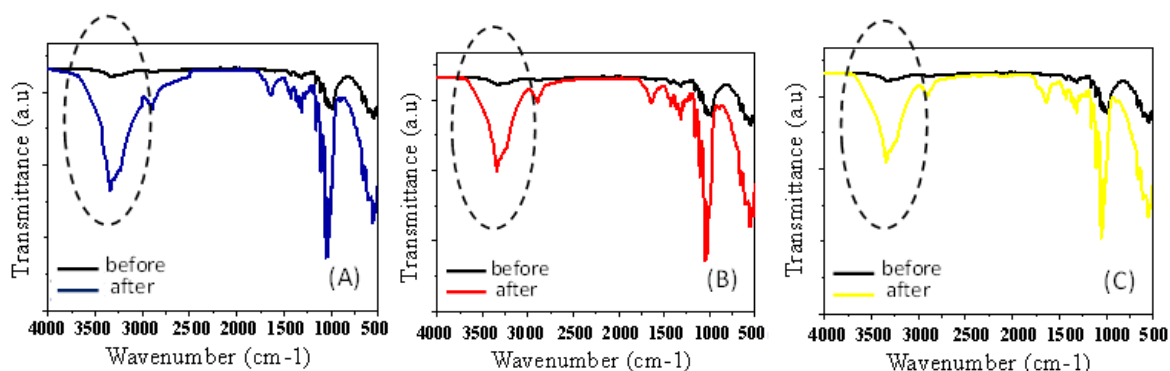


Figure 4. Graph of water absorption by the dried nata de coco for several days on fruit.

Figure 5 shows that the pear that stored in a sealed container without dried nata in days-6 showed juicier than pear that stored together with dried nata. This shows that dried nata de coco can absorb moisture around the storage container of pear so that pear not rotten. To prevent fruits do not rotten quickly, one is to maintain moisture levels. From the description above, we can conclude that dried nata de coco can extend the shelf life of fruits. However, further study must be performed in the future to clarify how long dried nata de coco can be used as a moisture absorber considering that nata de coco is an organic material that can rot.

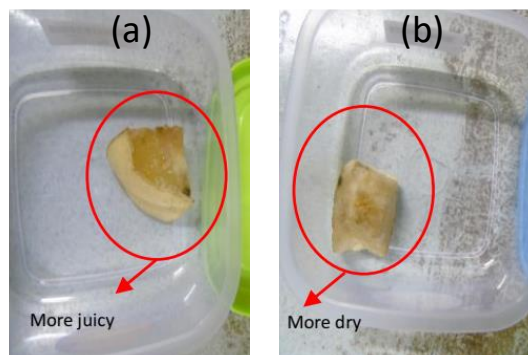


Figure 5. Figure of pear after stored for several days: (a) without dried nata (b) with dried nata.

4. Conclusion

We have succeeded in carry out a simple experiment to extend the shelf life of fruit using dried nata de coco. Based on the results of data analysis and discussion, the rate absorption dried nata de coco initially increases rapidly with time and reaches a saturation value for a very long time. The increase in mass indicates the amount of water vapor absorbed. Its mean that dried nata de coco was able to absorb the moisture. These results are consistent with results of characterization by FTIR.

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