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Preparation and Characterization of Edible Straw Made from Dragon Fruit Peel to Solve The Problem of Plastic Waste

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Abstract

Plastic waste is a global environmental problem that is being faced by the world, especially Indonesia. In addition, Indonesia is ranked 4th in producing plastic straw waste. This problem needs to be taken seriously because the waste generated through plastic straws is difficult to recycle. One effort that can be done is to replace plastic straws with edible straws. Red dragon fruit peel contains nutrients such as carbohydrates, fat, protein, and dietary fiber but is often only thrown away and considered as waste. This study aims to utilize dragon fruit peel as a basic material for making edible straws and to analyze the characteristics of edible straws. The study used quantitative experimental methods by testing temperature resistance and water absorption. The results showed that edible straw has good temperature resistance at a temperature of 10°C-20°C, where at that temperature there is an increase in mass of about 2-3 grams. As for water absorption, a good temperature range is 20°C-80°C where absorption occurs between 0.38%-7.46%.

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INTRODUCTION

Plastic waste is a classic problem experienced by Indonesia lately. It was recorded that 10.528 million tons of the total national waste production in 2017 was plastic waste (KLH, 2018). Various kinds of plastic waste are produced, one of the biggest contributors is plastic straws. In Indonesia, the use of plastic straws reaches 93,244,847 sticks per day (Hermawan et al., 2021). According to Pelan et al. (2018), plastic waste is a global environmental problem that is being faced by the world, especially Indonesia. In addition, Indonesia is ranked 4th in producing plastic straw waste (Murniati, 2019). This problem needs to be taken seriously because the waste generated through plastic straws is difficult to recycle (Wang et al., 2018). Especially during the Covid-19 pandemic, one of the worst impacts on the environment is the increased use of single-use plastic from medical equipment (Hariyanto, 2021), such as gloves, masks and other plastic packaging. This will exacerbate environmental problems related to plastic waste in Indonesia.

In 2017, the no straw movement was rampant, this was done to address the large amount of plastic straw waste that pollutes waters and beaches in Indonesia. Unfortunately, over time the #Nostrawmovement movement has begun to fade and even begin to dim. So that this triggers an increase in the use of plastic straws in Indonesian society. It should be noted that nowadays there are many substitutes for plastic straws, including bamboo straws, stainless straws, paper straws and edible straws (Mosquera, 2019). However, three of the 4 straws each have their drawbacks. Stainless straws will eventually produce waste that is even more difficult to recycle, bamboo straws in use are a little dangerous because it is feared that bamboo fibers can hurt the mouth, paper straws are not environmentally friendly because they are wrapped in plastic too. While edible straws are the right choice because they are food grade and zero waste.

Dragon fruit is a fruit that is easily found in Indonesia. There are four types of dragon fruit that have been cultivated, including the white flesh dragon fruit (Hylocereus undatus), the red flesh dragon fruit (Hylocereus polyrhizus), the super red flesh dragon fruit (Hylocereus costaricensis), and the white flesh yellow skin dragon fruit (Selenicereus megalanthus) (Oktiarni, 2012). The shape of the dragon fruit is quite unique where the whole skin is filled with tassels which are analogous to dragon scales. Part of the dragon fruit 30-35% is the peel of the fruit but is often just thrown away and considered as waste (Fatiha el al., 2012). Red dragon fruit skin contains nutrients such as carbohydrates, fats, proteins and dietary fiber. The content of dietary fiber contained in the skin of the red dragon fruit is about 46.7% (Apriyani, 2018). Thus the dragon fruit peel can be utilized so as to minimize the presence of organic waste. One of the uses that can be applied to dragon fruit skin is the manufacture of edible straw.

So far, there has been no edible straw product made from dragon fruit skin, so the creation of this product is expected to overcome plastic straw waste in Indonesia which is increasingly piling up (Hidayat et al., 2019), exacerbated by the Covid-19 condition which requires cafes or places to eat to avoid using glass. and disposable straws (Syakila, 2021) to reduce the spread of the Covid-19 virus. This product can also overcome dragon fruit peel waste which is often wasted without being used, even though dragon fruit peel has good content for public health, namely antioxidants (Luo el al., 2014) and vitamin C. (Maflahah 2020). Besides functioning as a straw, this product is also safe for consumption by the public (edible). Thus, this study was conducted to utilize dragon fruit peel as a basic material for making edible straws and to analyze the characteristics of edible straws by conducting temperature resistance tests and water absorption tests. The two tests were carried out by giving 6 variations of temperature on the edible straw, then calculating the mass using a digital scale and calculating the diameter using a caliper before and after being given variations to determine the temperature resistance test and water absorption.

METHOD

The materials used were materials for making edible straws and materials for analysis. The ingredients used to make edible straws include dragon fruit peel extract, wheat flour, eggs, margarine, sugar, gelatin, carboxymethyl

cellulose (CMC), baking soda, and vanilla. While the material for analysis is water (H^2O).

The tools used include an alcohol thermometer, digital scales, caliper, 6 glass cups, gas stove, blender, 25 pcs stainless straws, aluminum foil, oven, mixer, and 2 thin wall containers, 30x15 cm tray, knife, swallow, blender, 100 ml and 250 ml beakers, volume pipette, spatula, spoon and test form.

This research used quantitative research methods in the form of temperature resistance test experiments and water absorption tests on edible straws. The temperature variations used were 6 variations of temperature with a temperature range of 10°C-20°C with an observation time of 10 minutes. The resulting data was a comparison of temperature resistance and water absorption in each edible straw. The resulting data can determine the characteristics of the edible straw made from dragon fruit peel.

Prior to conducting experimental research, the temperature resistance test and water absorption test were carried out on edible straw. It is necessary to carry out the stages of making edible straws by heating at a temperature of 70°C for 30 minutes to obtain fully cooked edible straws. In addition, heating at a temperature of 70°C is carried out as a natural preservative for the durability of edible straws in the packaging. In full, the process of making edible straws made from dragon fruit peel is shown in Figure 1.

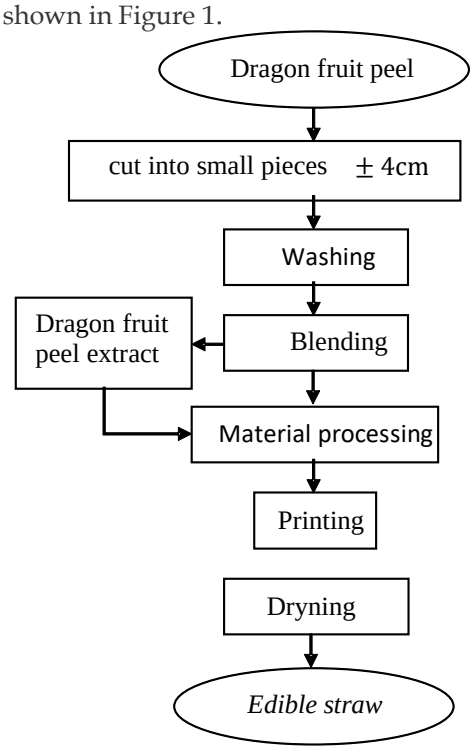

Figure 1. Flowchart of making edible straw made from dragon fruit peel

RESULT AND DISCUSSION

The production of edible straws, of course, uses 100% food grade materials so that they do not cause side effects when eaten. Edible straw made from dragon fruit peel with the addition of gelatin and CMC has a hard texture. Based on the research, edible straws that have been tested for temperature resistance and water absorption tests have changed in texture to become mushy. The edible straw that has been analyzed is shown in Figure 2.

Figure 2. Edible straw product

Temperature Resistance Test

The analysis carried out on the temperature resistance test used quantitative edible straw mass with a research time of 10 minutes. The temperature used in the temperature resistance test is 6 variations. Edible straws were weighed before and after the temperature resistance test was carried out to determine the ratio of the resulting mass. The comparison of the mass of edible straw in the temperature resistance test is presented in Table 1

Table 1. Comparison of edible straw mass on temperature resistance test

Temperature (°C)	Initial Mass (gram)	Final Mass (gram)
10	8	10
20	11	14
40	7	19
60	10	20
80	10	22
90	10	29

In the temperature resistance test, it was found that the edible straw changed its texture to become softer due to the temperature of the water used. A very significant change in mass occurred at a temperature variation of 90°C, with an initial mass of 10 grams and a final mass of 29 grams. Thus, the temperature resistance test gives an additional mass of 19 grams. While the least mass change occurred at a temperature variation of 10°C with an initial mass of 8 grams and a final mass of 10 grams, so that the addition of mass occurred only 2 grams. Based on the water absorption test data, the best temperature resistance range for edible straw is 10°C-20°C. In this temperature range, the edible straw has a texture that is not so soft and the change in mass addition that occurs is only about 2-3 grams. This is in accordance with A'yun's research (2020) which states that the best results obtained for the water resistance test occur at an initial temperature of around 25°C with a percentage of 65.18%.

Water Absorption Test

Similar to the temperature resistance test, the water absorption test was carried out using 6 variations of temperature with a research time of 10 minutes. The water absorption test was carried out to determine the characteristics of water absorption in edible straws made from dragon fruit peel. The highest water absorption is 29.89%, while the lowest water absorption is 0.38% which is shown in Figure 3. The different water absorption can be caused by the shape factors in the form of length and mass on the edible straw. based on the water absorption test, the best temperature range is 20°C -80°C where absorption occurs between 0.38%- 7.46%. This is in accordance with the Japanese Industry Standard for water resistance in bioplastics 70% (A'yun, 2020).

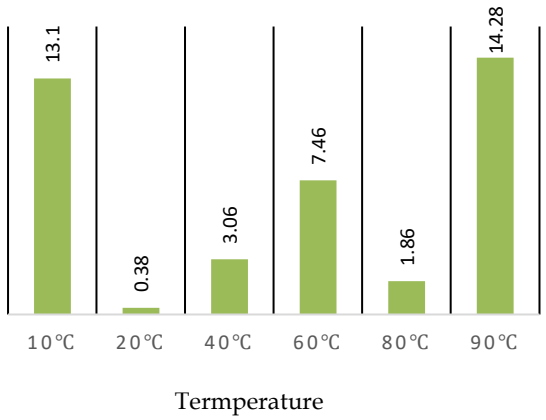

Figure 3. Percentage of water absorption of edible straw

CONCLUSION

Edible straw made from dragon fruit peel has good temperature resistance at a temperature of 10°C-20°C, where at that temperature there is an increase in mass of about 2-3 grams. As for water absorption, a good temperature range is 20°C-80°C where absorption occurs between 0.38%-7.46%. This is in accordance with the Japanese Industry Standard for water resistance in bioplastics 70%. Edible straw as a straw that can be eaten is very environmentally friendly because it does not leave waste or zero waste. In addition, edible straw has the advantage that it is made from natural ingredients with antioxidants and vitamin C from dragon fruit skin.

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