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Utilization of Bira Tubers (alocasia macrorrhizos) Become Bioplastic with the Addition of Starch Waste of Banana Skins Kepok (musa paradisiaca)

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Abstract

This study aimed to determine the tensile test size of the bira tuber bioplastic with the addition of kepok banana peel starch. The method used is experimental. A tensile test was carried out with ATSM D882. The research results showed that the four samples' best tensile test added the most bira starch at 40% of 1432 N/m^2. The color of the resulting plastic is still clear brown because no bleach is added to the starch.

INTRODUCTION

Indonesia is the country with the 4th most population in the world; therefore, Indonesia also produces the fourth most waste in the world, both organic waste and inorganic waste[1]. Plastic waste is one of the Indonesian people's problems because it has not been processed into many valuable materials [2]. The widely used plastic is difficult to degrade by a microorganism, thus disrupting the environment [3]. According to statistical data, plastic waste is at 5.4 million tons annually, 14 percent of the total waste production [4]. So for plastic to decompose quickly, it is necessary to conduct research to make duplicates of natural plastics that decompose quickly.

This research is essential to reduce organic waste and utilize waste in other valuable items, such as environmentally friendly bioplastic materials [5]. Plastic is a widely used synthetic polymer because of its strong, transparent, lightweight, and flexible properties. Plastic waste, if burned in an open environment, will produce compounds harmful to health; if in a heap, it will be difficult to decompose by microorganisms; therefore, the solution to the problem is to make alternative plastics called bioplastics. Bioplastics are plastics made from natural materials in the form of starch readily biodegradable by microorganisms, so they are more environmentally friendly than synthetic polymer plastics [4].

Starch is a starchy substance from carbohydrates with a polymer of glucose compounds consisting of two main components: amylose and amylopectin. Linear polymers of D-glucose form amylose with a bond (alpha)-1,4-glucose. At the same time, the polymer amylopectin is formed from the adhesive (alpha)-1,4-glucoside and forms branches on the bond (alpha)-1,6-glucoside. Amylose is highly hydrophilic since it contains many hydroxyl groups [6]. Thus, amylose molecules tend to form parallel arrangements through hydrogen bonds. Despite their high concentration, the amount of amylose clusters in water makes it challenging to form gels. Therefore, starch molecules are not readily soluble in water. In contrast to amylopectin, whose structure is branched, starch will quickly expand and form colloids in water [7].

Bira or Alocasia macrorrhizos is an edible tuber-producing plant [8]. Bira is also known by its Javanese origin: sente. This plant has a large soft stem (terna) whose stem tubers are used as a food source for non-cereal carbohydrates. Young leaves that have been boiled can be used as a wrapper for food, such as rice or until. Aboveground parts, such as leaves and flowers, contain calcium oxalate crystals that, when eaten raw or poorly processed, cause the mouth and stomach to itch. Its sap is capable of causing inflammation. This plant grows a lot in humid tropical garden areas such as in the lingsar area of west Lombok. Recently the bira plant was also used as an ornamental plant [9].

Adding banana peel starch reduces waste that disrupts the environment, as it can damage the ozone. Banana kepok is usually used in small industries, such as SMEs, for making chips and other snacks [7]. The results of research that has been carried out by [10] explain that the content of banana peels, as in table 1, from these contents, explains that adhesion with other starches is excellent so that it can be used as an adhesive in the process of making bioplastics.

Table 1. Pectin Characteristics of Banana Peel Kepok

Parameters	Analysis Results	IP
Moisture Content	11,55	Max
Ash Content	3,060	Max
Methoxyl Levels	**3,906%** (low methoxyl)	**2,5 – 7,12 %** (low methoxyl)

The formulation of the problem in this study is how bioplastic characteristics of variations in the addition of bira tubers. Elements include tensile strength and bioplastic physical shape of bira tubers with the addition of banana starch kepok [11].

RESEARCH METHODS

This type of research is experimental research conducted in the Civil Engineering Material Test laboratory of the University of Muhammadiyah Mataram [12]. The research design used is a practical method which is a research method to find the influence of specific treatments [13]. Before the experiment is carried out: determine material materials (bira tubers, banana peels, glycerol, and water), material tests, design mixes, manufacture of test objects, treatment, and testing, including tensile tests. Furthermore, the results are analyzed, and conclusions are made.

The materials used in the study include Bira starch, Banana peel starch, glycerol, and aquades/water. Equipment used includes: sieves, scales, measuring cups, containers, parchment paper, plastic molds, rulers/meters, stoves, blenders, shredding machines, and Universal Testing Machines (UTM) used to test the tensile strength of bioplastics [14]. The selection of starch tests ingredients by sifting and blending banana peel starch. Make Pati Bira by mixing the tubers and then drying. After that, the starch is filtered with a sieve [15].

In this study, a mixture was made with four bira starch: 4 banana peel starch: and two glycerol/vinegar acid, which was converted into a volume ratio. After testing, the material is carried out to determine the amount of planning material needed per mortar in making several tensile test bioplastics [16].

The variables observed variations in bira starch composition from the large volume of banana peel starch are: 10%, 20%, 30%, and 40% in the reference trial mix elemental composition of the bioplastic mixture plan 8:2 starch: glycerol. And variations in bioplastic hardening time in the bioplastic life range of 7, 14, 21, and 28 days under normal conditions. Furthermore, the parameters include; visual texture shape, density (specific gravity, wet weight, dry weight, and saturated weight [1]. Tensile test with a stencil meter.

Table 2. Starch Composition Variables

	Free variables (Banana Kepok)	Bound Variables (Bira Tuber)	Aggregate (Gliserin)
Materials 1	70%	10%	20%
Materials 2	60%	20%	20%
Materials 3	50%	30%	20%
Materials 4	40%	40%	20%

Pre-treatment for making bira starch and banana peel kepok [10]:
1. Chop the banana peel with chopper and then dry it in the sun.
2. Blend the dried banana peel to make it powder and sifted.
3. Blend bira tubers and then take the starch by filtering and then precipitate to take the starch.
4. Drying bira starch deposits to dry.

Plastic Manufacturing:
1. Dissolve 10 grams of bira, starch, and 10 grams of banana starch into 50 ml of glycerol and 10 ml of vinegar and then heat while stirring at 80 degrees.
2. Pour the dough on parchment paper and then oven for 1 hour.
3. Let stand for two days.
4. Test-ready samples.

Data analysis techniques are carried out by synthesis analysis by collecting data from variables and parameters [17]. Characteristic parameters include visual shape texture and tensile strength test of each test object [3]. Furthermore, the data from research variables in descriptive analysis provide an overview in the form of data tabulation and graphs, which are then explained by interpretation [18]. Here's a diagram of the research process:

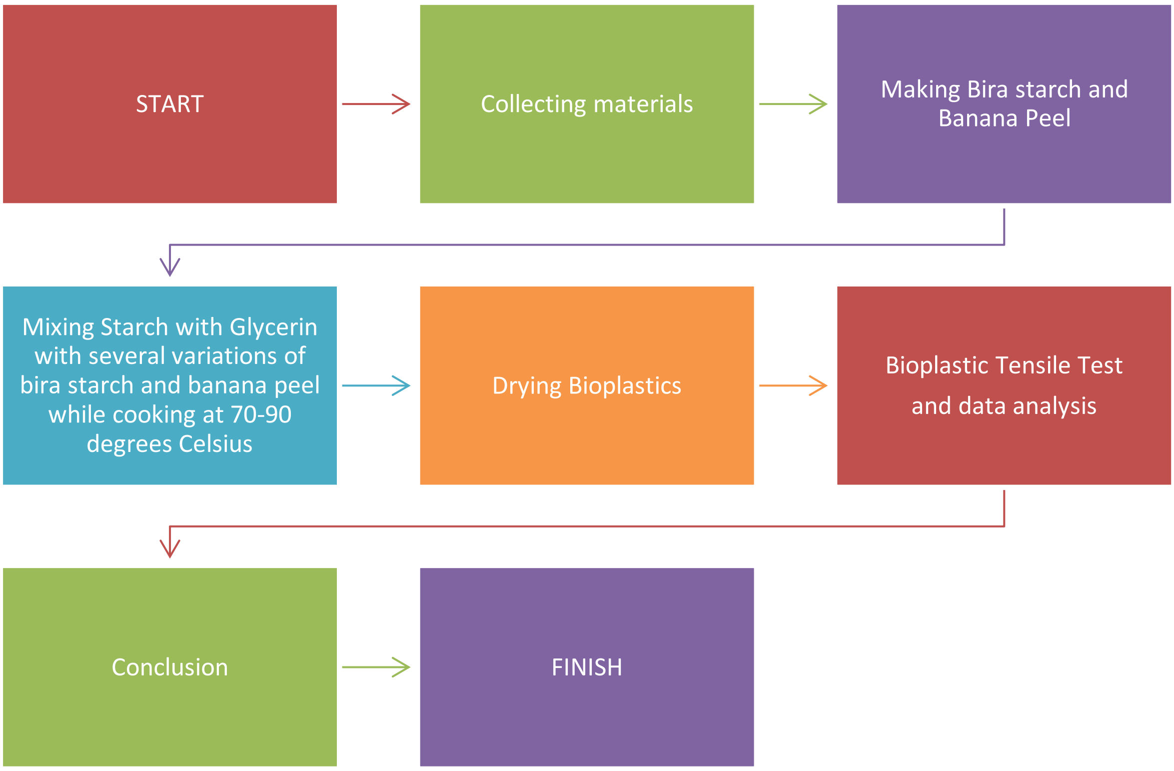

Image 1. Research Flowchart

RESULTS AND DISCUSSION

The results of bioplastic research can be seen in the following figure:

Materials 1 Materials 2 Materials 3 Materials 4

Image 2. Plastic bira tubers and banana peels of cocoons

The sample test result data can be seen in table 3:

Table 3. Tensile test results of plastic samples

Materials	Bira (%)	Tensile Test N/m²
1	10	1111
2	20	1201
3	30	1321
4	40	1432

An overview of the research can be seen in the following figure:

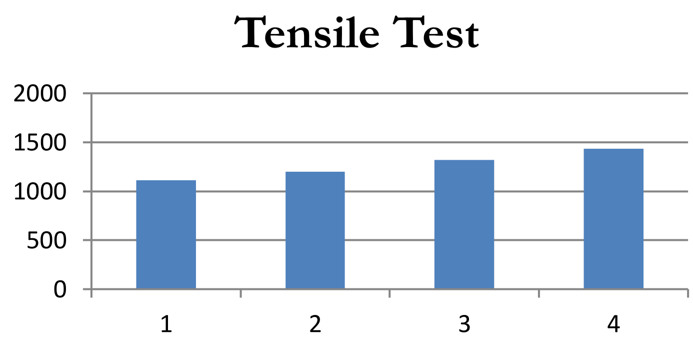

Image 2. Graph of compressive strength variations of bira tuber starch

Material 1 consists of 10% starch of bira tubers, 70% banana peel, and 20% glycerin. It looks clear and light brown. It has a tensile strength of 1111 N/m², and This plastic has a soft texture.

Material 2 consists of 20% bira tuber starch, 60% cocoon banana peel, and 20% glycerin. It is noticed that the color is darker than material 1. It has a tensile strength of 1201 N/m². This plastic has a soft texture that is a little rough.

Material 3 consists of 30% bira tubers, 50% cocoon banana peel, and 20% glycerin. It can be seen that the color is darker than the material 2. It has a tensile strength of 1321 N/m². This plastic has a thicker texture because the ripening results are thicker.

Material 4 consists of 40% bira tubers and 40% banana puke, and 20% glycerin. It looks darker than material 3. This plastic texture is rougher than material three; there are brown spots due to the viscosity when heated.

Based on the processing results, the plastic produced is brown because bira tubers and banana peels are not added bleach to the starch-making process [18]—the more bira starch is added, the browner the plastic looks. The data of tensile test results obtained the most considerable tensile strength or the most elastic in adding bira with 40% starch. Suggests that bira starch is more elastic [19].

The advantages of bioplastics produced in this study are that it can utilize tubers that have never been used as the primary material for bioplastics in the industry; the disadvantages of this plastic are brown but can be minimized by adding bleach, but in this study, no additions have been made to the reference of the following research [10]. The resulting plastic is slightly fragile because bira tubers are obtained from 30% starch compared to the moisture content in the tubers [20].

CONCLUSION

The study results obtained characteristics, including the results of plastic tensile tests that meet SNI because it is more than 800 N / m². However, the resulting color is still natural, namely brown.

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