Utilization of Maizena Flour as a Basic Material for Making Bioplastics

Radithya Adinaka Ruhendi[1], Siska Fauzi[2]

[1,2]SMA Islam Al-Fajar Perguruan Islam Al-Fajar, Yayasan Darul Fajar Jl. Swatantra V No.1 Villa Nusa Indah, Jatiasih-Jatirasa. Bekasi, Jawa Barat, Indonesia.

DOI: 10.24952/Lavoisier.v2i2.8604

Corresponden Email*: adinakaradit@gmail.com

Abstract: Plastic is a widely used packaging material, but has a negative impact on the environment because it is difficultto decompose in nature. Many experts have developed technologies for the production of biodegradable plastics or bioplastics made from natural and environmentally friendly materials. Starch-based biodegradable plastics are easier to produce and access to raw materials is easier to obtain. So in this research an experiment was carried out using cornstarch as a base ingredient for making bioplastics. Examined with quantitative methods through experiments obtained results of comparisons of differences in water concentrations and differences in glycerin concentrations. Then a mechanical test was carried out to see the ability to decompose bioplastics with water. After conducting research on the use of bioplastics from cornstarch as a substitute for plastic, it can be concluded that the best bioplastic produced is at a Glycerin Concentration of 5 mL and a Water Concentration of 100 ml.

1. Introduction

Nowadays, there is a lot of plastic waste. However, plastic is indispensable in everyday life. In general, plastic is only used once. Petroleum-based plastics pollute the environment very seriously because they are not biodegradable. At least plastic bags can decompose in 500-1000 years, which causes plastic to be the largest source of waste in the world, while recycling plastic waste requires higher costs compared to its production costs. Therefore, new thoughts and technologies are needed to make environmentally friendly plastics.

Plastic is a packaging material that has been widely used and developed nationally (Kamsiati, et al, 2017). The use of plastic is often used as packaging because it is lightweight, sturdy, malleable, and affordable. Plastics are currently being pursued by researchers and scientists to become environmentally friendly plastics. Previous research has produced plastic manufacturing technology from natural materials that can be degraded in a short time called biodegradable plastic or bioplastic. Bioplastics will be decomposed by microorganisms into water and carbon dioxide gas after being used

up and disposed of into the environment without leaving toxic substances. This plastic is made from natural polymer materials such as starch, cellulose, and fat.

In this study, the raw material used is starch derived from corn because starch is easily obtained in Indonesia. The advantage of starch-based bioplastics is that they are compostable without requiring shared composting space. Therefore, bioplastic research is carried out so that people can switch from conventional plastics to bioplastics so that they can strive for environmental conservation.

Based on the introduction that has been described, the problem formulation of the research is, can cornstarch be utilized as a basic material for making bioplastics? The research objective to be achieved is to be able to determine the utilization of cornstarch as a basic material for making bioplastics.

2. Methodology

The type of research used is quantitative. Quantitative is a method of scientific theory that has been accepted as truth used as a reference in finding the next truth (Suriasumantri, 2002). The research method used is the experimental method. The variables in this research consist of dependent variables, independent variables, and control variables. The dependent variable is bioplastic, the independent variable is cornstarch, and the control variable is water volume. This research was conducted on January 15 - January 18, 2023. This research took place at Vila Nusa Indah 3.

Tabel 1. Tools and Materials for Making Bioplastics

No	Tools	Materials
1.	Stovetop	Cornstarch
2.	Pan	Glycerin
3.	Glass	Vinegar
4.	Teaspoon and tablespoon	Water

Data Collection Technique

The data collection technique used in this research is to conduct experiments and observations. Then a mechanical test was carried out to see the ability to decompose bioplastics against water. Biodegradation test is conducted to determine the level of plastic decomposition if it is disposed of later into nature.

Operational Definition

a. Bioplastics

Bioplastic from cornstarch is an environmentally friendly plastic made from starch.

b. Cornstarch

Cornstarch is starch flour whose manufacture is extracted from corn which can be used for making bioplastics.

c. Glycerin

Glycerin or glycerol is a trihydric alcohol containing glycerin trivalent radical (C_3H_5).

Table 2. Steps for Making Maizena Starch-based Bioplastics

1. Prepare all tools and materials
2. Weigh water with various concentration variations of 50 mL, 100 mL, 150 mL.
3. Weigh Glycerin with various concentration variations of 5 mL, 10 mL, 15 mL, 20 mL
4. Put each 10 g cornstarch, 5 mL vinegar, 50 mL water into 4 (Four) glasses.
5. Mix with glycerin with various concentrations of 5 mL, 10 mL, 15 mL, 20 mL.
6. Put each 10 grams of cornstarch, 5 mL vinegar, 5 mL glycerin into 3 (Three) different glasses.
7. Mix water with variations in concentration of 50 mL, 100 mL, 150 mL.
8. Stir until smooth each glass that has been filled with the material.
9. Cook over medium heat, stirring until thickened.
10. After thickening like starch glue, prepare the base of the mold.
11. Pour the mixture on the mold and flatten it to the desired thickness.
12. Dry the mold and let it dry.
13. Once dry, remove and serve.

Data Analysis Technique

The data obtained was then analyzed and processed in a descriptive way. Descriptive analysis method is a statistic used to analyze data by describing or describing the data that has been collected as it is without intending to make general conclusions or generalizations (Sugiyono, 2014: 21).

3. **Result and Discussion**

Results of Physical Bioplastic Analysis

After drying for one day, the bioplastics were analyzed physically. This stage is carried out to see the effect of glycerin and water concentrations on various bioplastic manufacturing results. According to Albar (2021), the Indonesian National Standard (SNI) for good bioplastics is bioplastics that have characteristics that are close to conventional plastics. The results of bioplastics in physical terms can be seen in the following tables.

Table 3. Physical Analysis of Bioplastics at Various Glycerin Concentrations

Konsentrasi Gliserin	Bentuk Fisik Bioplastik	Warna Bioplastik
5 mL	Tebal, pecah, bergumpal.	Putih kekuningan
10 mL	Tipis, elastis, lembab.	Bening, buram
15 mL	Tipis, sedikit bergumpal,lembab,	Bening,buram
20 mL	Tebal, bergumpal,lembab.	Bening,buram

From Table 3. above, it can be seen that bioplastics using 5 mL glycerin concentration have

a thick, clumpy and broken surface and a yellowish white color, while 10 mL glycerin has a thin, elastic, moist physical form with an opaque clear color, after the addition of 15 mL glycerin the physical form is thin, slightly clumpy, and moist and opaque clear color, then at a concentration of 20 mL the surface is thick, clumpy, and moist and opaque clear color. So it can be concluded that the optimum condition for bioplastics is with a concentration of 10 mL. This proves that glycerin serves to increase elasticity by reducing the degree between molecules of the polymer.

Table 4. Physical Analysis of Bioplastics at Various Water Concentrations

Konsentrasi Air	Bentuk Fisik Bioplastik	Warna Bioplastik
50 mL	Thick, stiff, broken, clotted.	Yellowish white
100 mL	Thin, slippery, a little stiff	Clean and clear
150 mL	**Thin, slippery, Easy to tear**	Clean and clear

From Table 4. it can be seen that bioplastics using a water concentration of 50 mL have a thick, stiff, broken, and clumpy surface and a yellowish white color, while 100 mL of water has a thin, slippery, and slightly stiff physical form and a clear clear color, at a water volume of 150 mL, the physical form is thin, slippery and also easily torn. So it can be concluded that the optimum condition for bioplastics is with a water concentration of 100 mL.

Biodegradation Test Analysis Results

The purpose of this test is to determine the ability to decompose by soaking bioplastics with water for 24 hours. Good bioplastics are those that have the ability to decompose quickly. The following are the results of the mechanical properties test conducted.

Table 5. Results of Bioplastic Decomposition Ability with Different Concentrations of Glycerin Against Water

Glycerin Concentration	Change in physical form
5 mL	Still
10 mL	Still
15 mL	Torn
20 mL	Bioplastics become brittle

Table 6. Results of Bioplastic Decomposition Ability with Different Concentrations of Water to Water

Water Concentration	Change in physical form
50 mL	Still
100 mL	Become thinner and easy to tear
150 mL	Become supple

So from the results of the bioplastic ability test from corn starch using glycerin which has

the best decomposition ability is bioplastic using 100 mL water. This is because the more use of glycerin will increase solubility, especially those that are hydrophilic will increase solubility in water.

4. Conclusion

From the results of the study it can be concluded that cornstarch can be used as a basic material for making bioplastics with a composition of 100 mL of water, 5 mL of glycerin, 5 mL of vinegar, and 10 g of cornstarch. The bioplastic has a thin, slippery, slightly stiff physical shape, and clear color and quickly decomposes so that it can be used as a substitute for plastic.

References

Albar, A., Rahmaniah, & Ihsan. 2021. *Pembuatan dan KarakterisasiBioplastik Berbahan Dasar Pati UmbiUwi Ungu, Plasticizer Gliserol dan Kitosan. Jurnal Teknosains, Vol. 15,No. 3, Hal. 254.*

Aripin, S., Saing, B., & Kustiyah, E. 2017. *Studi Pembuatan Bahan Alternatif Plastik Biodegradable dari Pati Ubi Jalar dengan Plasticizer Gliserol dengan Metode Melt Intercalation.Jurnal Teknik Mesin, Vol. 6, Hal. 80.*

Aufari, M. A., Robianto, S., & Manurung, R.2013. *Pemurnian Crude Glycerine melalui Proses Bleaching dengan Menggunakan Karbon Aktif. Jurnal Teknik Kimia, Vol. 2, No. 1, Hal. 45.*

Kamsiati, E., dkk. 2017. *Potensi Pengembangan Plastik BiodegradableBerbasis Pati Sagu dan ubi kayu diIndonesia. Jurnal Litbang Pertanian, Vol. 36, No. 2, Hal. 67.*

Melani, A., dkk. 2017. *Bioplastik Pati Umbi Talas melalui Proses Melt Intercalation. Jurnal Teknik Kimia, Vol. 2, No. 2, Hal. 62-64.*

Smail, A., 2010. *Membuat Bioplastik Sederhana. (https://www.kompasiana.com/agungsmail/54ff8115a333111f4b5105f6/membuat-bioplastik-sederhana).Diakses pada tanggal 13 januari 2023*

Sugiyono. (2014). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung:Alfabeta.

Suriasumantri, J. S. (2002). *Ilmu dalam Perspektif Moral, Sosial dan Politik.* Jakarta: Gramedia.