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Utilization of Crab and Cassava Peel Waste As Biodegradable Plastics

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Abstract

Biodegradable plastics are an important thing to consider in order to meet environmentally friendly plastics. This study aims to determine the potential of crab waste and cassava peel waste as raw material for biodegradable plastics. This research was conducted in the Laboratory of Microbiology Industry at the Technical Industry Academy of Makassar in Januari-April 2022. The research method used was an experimental method with simple statistical analysis techniques. This research uses three parameters: the power of elasticity, resistance to temperature and the ability to decompose. The result that chitosan concentration of 1 gram, 5 gram of starch and cassava peel, 15 mL glycerol gave the best results compared to the two other treatments at 4,623% elongation values, degraded faster and has a resistance to temperatures up to 100 ℃ for 2 hours

Keywords—*Biodegradable, cassava, crab, plastics, waste*

INTRODUCTION

Society's need for plastic is increasing along with the increase in population. Plastic is used for various purposes, from kitchen utensils to food packaging. The nature of plastic which has physical properties tends to be lighter than other materials, making plastic the prima donna for various purposes. According to Prasetyo (2019), the plastic consumed by the Indonesian people reaches 1.5 million tons or seven kilograms per capita. Plastic is easily found in various places.

The plastics are then only thrown away after one use. In fact, some of the plastic is simply thrown on the ground. Plastics on the market are generally derived from synthetic polymers that cannot be broken down. The accumulation of plastic waste on the soil surface causes the soil pores to close so that water cannot be absorbed into the soil. By not absorbing water into the ground, in the long term it can cause flooding. Not only on land, in the sea too, plastic waste causes the death of thousands of marine animals. In addition, aesthetically, the accumulation of unused plastic will cause an unpleasant atmosphere. One of the natural materials that can be processed into safe plastic is chitosan which can be obtained from several marine animals, especially from the Crustaceae. Chitosan is a derivative product of chitin and is a compound that can be used as a material for making biodegradable plastics.

Meanwhile, tapioca waste as a by-product of the tapioca industry is very abundant and even tends to be a source of pollution in the community if it is not treated properly. Tapioca is made from cassava which has high productivity in Indonesia. In the tapioca industry, the waste produced includes solid waste as a waste after the cassava essence is filtered. Cassava solid waste is commonly known as cassava peel. Each ton of cassava can produce 250 kg of tapioca flour and 114 kg of cassava peel. Cassava peel is an agricultural waste that often causes environmental problems, because it has the potential as a pollutant in the area around the factory. The utilization of cassava peel has not been optimal, so it needs to be handled and processed again for the cassava peel waste. Utilization of crab shells and cassava peels for the manufacture of biodegradable is a solution to this problem. Through a chemical process, we can utilize crab waste and tapioca waste to produce biodegradable so that problems caused by piles of plastic waste can be resolved.

RESEARCH METHODS

This research was conducted from January to April 2022 at the Quality and Environmental Control Laboratory of the ATI Polytechnic Makassar. The tools used in this research are oven, analytical scale, beaker, measuring cup, hot plate, stir bar, elasticity test equipment (tensile test) and writing instrument. While the materials used in this study were crab shell and head waste, cassava peel, aquades, glycerol, HCL, NaOH.

This research was carried out using an experimental method to determine the optimum concentration of chitosan (K), cassava peel extract (U) and glycerol (G) which can produce biodegradable plastics. The design used is a simple research design with each treatment:

KU_0 treatment : 0 gram (K), 5 gram (U) and 5 mL (G)
KU_1 treatment : 0.5 gram (K), 5 gram (U) and 10 mL (G),
KU_2 treatment : 1gram (K), 5 gram (U) and 15 mL (G).
Each treatment was 2 times.

The data collected in this study were: The elasticity of plastic in various treatments of chitosan composition and cassava peel extract using tensile test.

1. The speed of plastic degradation/decomposition based on the concentration of chitosan and cassava peel extract.
2. Resistance to temperature based on the concentration of chitosan and cassava peel extract.

Analysis of the data used is a simple mathematical analysis to get the value of traction and elongation while the parameters for the speed of decomposition and resistance to temperature are only observed visually.

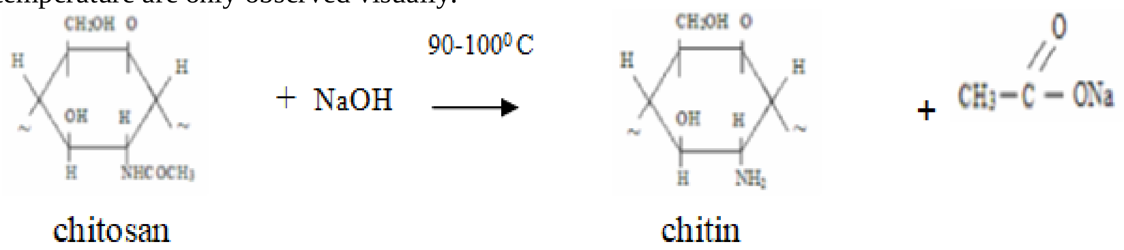

Figure 1 The reaction for the formation *chitosan* from *chitin* (Budiman, 2019)

1. The speed of plastic degradation/decomposition based on the concentration of chitosan and cassava peel extract.
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Analysis of the data used is a simple mathematical analysis to get the value of traction and elongation while the parameters for the speed of degradation/decomposition and resistance to temperature are only observed visually.

RESULTS AND DISCUSSION

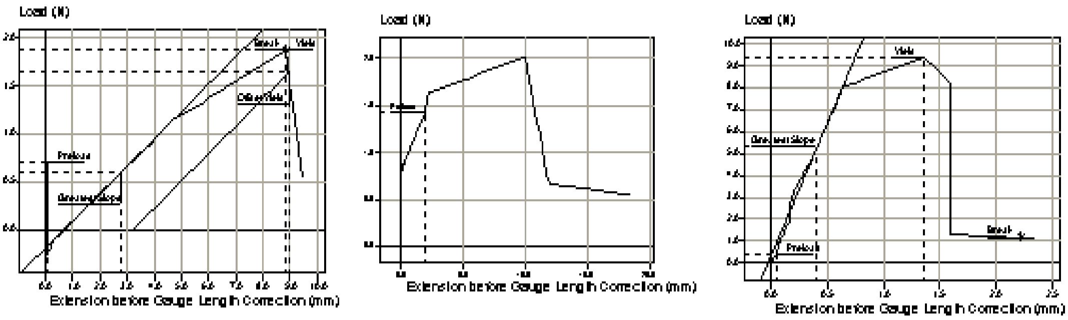
Elasticity

The elasticity of the plastic produced is measured by using a tensile test instrument including maximum strength and elasticity.

Table 1 Average Observation Results of Tensile Test

Treatment	Maximum strength (N/mm^2)	Elongation (%)
KU_0	0,259	0,092
KU_1	0,327	1,516
KU_2	0,589	4,623

In this study, tensile test measurements were carried out on variations in the composition of chitosan and glycerol. From table 1 above, it can be seen that the greater the percentage of chitosan, the greater the strength of the biodegradable. This is because the more hydrogen bonds contained in biodegradable , so the chemical bonds are getting stronger and harder to break decided. plastic biodegradable. From the data above, it can be seen that the optimum composition was found in KU_2 with a strength value of 0.589 N/mm^2 and an elongation of 4.623%.



Characteristics of elasticity *biodegradable* in treatment K_0 | **Characteristics of elasticity biodegradable in treatment K1** | **Characteristics of elasticity biodegradable in treatment K3**

Figure 2 Characteristics of elasticity biodegradable

Speed of Degradation

Biodegradation test on biodegradable plastic using soil as microbial inoculum located on the ATIM Campus by burying biodegradable in a hole with a depth of ± 7 cm for 4 days. Direct biodegradation test on soil media on the grounds that the soil has a number of types of microbes that have diverse metabolic abilities. One of them is the ability to biodegrade pollutant organic compounds.

From the observations on the biodegradation test on biodegradable plastic for four days, very little residue was obtained from each composition. also influenced by factors such as the concentration of pollutants, biomass, temperature, pH, nutrients, and the availability of substrate materials and the occurrence of adaptation (Fahruddin, 2020).

Temperature Resistance

Temperature resistance of biodegradable plastics is carried out to determine the resistance of plastics to certain temperatures. This temperature test was carried out using an oven at 100°C for 2 hours.

Figure 3 Visualization of plastic degradation ability after being immersed in the soil for 4 days

Figure 4 Plastic *biodegradable* after heating at 100 for 2 hours

From observations made on three samples of biodegradable plastic with different compositions, it was found that the sample without chitosan (K_0) changed shape in the first 1 hour of observation, in the second 1 hour it was damaged and became brittle. Samples with a composition of 0.5 gram chitosan (K_1) in the first 1 hour observation did not change shape or texture, at the second 1 hour there were still no changes in shape and texture while biodegradable plastic with a 1 gram (K_2) composition in the first 1 hour observation also did not change shape and texture, while in the second 1 hour with a temperature of 100℃ changed shape and became brittle.

CONCLUSION

The conclusion of this study is that the addition of 1 gam crab shell, 5 gram cassava peel and 15 mL glycerol (K_2) resulted in an elongation value of 4.623%, degraded faster and had resistance to temperatures up to 100℃ for 2 hours compared to other treatments.

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