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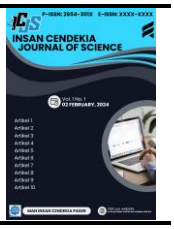

Use Of Potato Starch (Solanum Tuberosum L.) As The Main Ingredient For Manufacturing Biodegradable Plastic To Reduce The Use Of Conventional Plastic

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Abstract

The use of plastic in everyday life is as a packaging material that is most easily obtained by the public. Increasing use over time can cause environmental problems resulting from plastic waste that is commonly used by society. Plastic waste comes from chemicals that have properties that are difficult for microorganisms in the soil to break down. One way to overcome the use of conventional plastics that are difficult to decompose is to produce plastics from materials that can be easily decomposed by microorganisms in the soil, such as the starch contained in potatoes. The aim of this research is to determine how potato starch can be made into biodegradable plastic and to determine the effectiveness of using biodegradable plastic made from potato starch to reduce environmental pollution. This research uses several tests to obtain maximum results such as air resistance tests, biodegradability tests and organoleptic tests. The results showed that in the air resistance test of samples of different sizes the best sample could be found, namely the one with the formula of 5g potato starch, 50ml water, 15g glycerin and no vinegar. In the biodegradability test, the best sample was obtained from a sample containing 10g of potato starch, 100ml of water, 15g of glycerin and 30g of vinegar. Meanwhile, in the organoleptic test, the best sample was obtained when the sample was given 7.5g of potato starch, 100ml of water, 15g of glycerin and 7.5g of vinegar.

INTRODUCTION

Plastic is an item that functions as a packaging material that is often used every day. The plastic commonly used by the public is conventional plastic which is elastic, strong and light, made from synthetic chemicals. The price is affordable, easy to obtain, waterproof and the majority of goods used by the public such as household equipment, food, drink and cosmetic packaging, children's toys and other products other industries. Public No Once free with exists plastic. Use plastic Excessive amounts can have a negative impact on environmental sustainability, because plastic cannot be decomposed naturally or takes more than 500 to 1,000 years to be completely degraded, resulting in the fertilization of plastic waste which causes environmental pollution and damage.

One solution that can be done to overcome this is by develop plastic conventional become plastic biodegradable by replacing conventional plastic base materials with materials that can be easily decomposed, such as materials containing

natural polymers, namely cellulose, protein, chitosan, starch and hemicellulose. Biodegradable plastic uses materials derived from corn, cassava, sago, potatoes and others, namely materials originating from renewable natural sources. In this research, renewable materials are used, namely potatoes which contain a lot of starch compounds which can be used as the main material to replace conventional plastic, namely biodegradable plastic . Biodegradable plastic made from the starch contained in potatoes can prevent environmental damage and pollution, and make people more creative in using potato peel waste.

The aim of this research is to determine how potato starch can be made into biodegradable plastic and to determine the effectiveness of using biodegradable plastic made from potato starch to reduce environmental pollution. This research uses several tests to get maximum results such as water resistance tests, biodegradability tests and organoleptic tests .

RESEARCH METHOD

This research uses quantitative research methods. The type of research used uses experimental methods by means of organoleptic tests on respondents to prove and know that potatoes *(Solanum tuberosum L.)* can be used as a basic material for making biodegradable plastic. Based on the use of starch from potatoes which is used as the main ingredient for making environmentally friendly *biodegradable plastic to reduce the use of conventional plastic* which contains dangerous substances and is difficult to decompose which causes environmental pollution. Making *biodegradable plastic* from potato starch has three stages, namely the stage of making potato starch, the stage of making *biodegradable plastic* using starch from potatoes as the main ingredient and the testing stage of the resulting *biodegradable plastic* .

biodegradable plastic begins by pouring water into a container and then mixing the prepared starch, glycerin and vinegar. At this stage, the researchers initially only used different starch formulas, but when the formula was not successful, the researchers had to change the formula to make biodegradable plastic according to the criteria. In this case, the combination of the four materials must be right so that the resulting plastic is as desired. If one of the four ingredients is incorrect or unbalanced, it will have an impact on the results of *biodegradable plastic*. Researchers have tried various formulas that can be used so that the results of biodegradable plastic are as desired. The formula that can be used is:

- Bioplastics 1: Plastic *biodegradable* Which given 5g starch potatoes, 50ml water, 15g glycerin and no vinegar
- Bioplastics 2: Plastic *biodegradable* Which given 7.5g starch potatoes, 50ml water, 15g glycerin and 7.5g vinegar.
- Bioplastic 3: *Biodegradable plastic* treated with 7.5g potato starch, 100ml water, 15g glycerin and 7.5g vinegar.
- Bioplastic 4: *Biodegradable plastic* treated with 10g potato starch, 100ml water, 15g glycerin and 30g vinegar.

From the formula above, researchers can make *biodegradable plastic* with varying starch contents, not only starch but also water and vinegar. Meanwhile, glycerin is used in the five biodegradable plastics in the same proportion. After making biodegradable plastic successfully according to the criteria desired by researchers, it will enter the testing stage for *biodegradable plastic*.

The testing stage consists of several tests on the results of

biodegradable plastic, namely water resistance tests and organoleptic tests. The water resistance test on *biodegradable plastic* is carried out to see and find out how much absorption capacity the biodegradable plastic has. Organoleptic tests are carried out on *biodegradable plastic* to see the characteristics of the results of samples that have been made with different formulas. The sample results seen start from the resulting color, whether it is clear or blackish, the texture that shows the sample is lumpy and sticky or not, the odor fibers produced from the sample.

RESULTS AND DISCUSSION

Research has been carried out to make environmentally friendly *biodegradable plastic* based on potato starch, water and vinegar in different doses. The testing stage consists of several tests on the results of biodegradable plastic, namely the water resistance test, biodegradability test and organoleptic test.

1. Water Resistance Test

Water Resistance Test Observation Results

No	Bioplastics	Initial mass	Final mass	Water infiltration (%)
1.	Bioplastics 1	0.20 g	0.22 g	10%
2.	Bioplastics 2	0.13 g	0.15 g	15.3%
3.	Bioplastics 3	0.11 g	0.11 g	54%
4.	Bioplastics 4	0.11 g	0.16 g	45%

Information:

- Bioplastics 1: Plastic *biodegradable* Which given 5g starch potatoes, 50ml water, 15g glycerin and no vinegar
- Bioplastics 2: Plastic *biodegradable* Which given 7.5g starch potatoes, 50ml water, 15g glycerin and 7.5g vinegar.
- Bioplastic 3: *Biodegradable plastic* treated with 7.5g potato starch, 100ml water, 15g glycerin and 7.5g vinegar.
- Bioplastic 4: *Biodegradable plastic* treated with 10g potato starch, 100ml water, 15g glycerin and 30g vinegar.
- Water absorption formula = (final mass) – (initial mass) / initial mass multiplied by 100% in gr units.
- Soaking Time is 10 seconds

biodegradable plastic using variations of starch , water and vinegar which shows the results of the four samples respectively, namely 10%, 15.3%, 54% and 45% that have been made that the best bioplastic in the water resistance test was bioplastic 1 which was formulated with 5g potato starch, 50ml water, 15g glycerin and no vinegar. Because the greater the concentration of starch, the greater the water resistance value. This theory can be proven because starch tends to have hydroxyl groups (-OH) which are polar and hydrophilic (like water) and can form hydrogen bonds with water. Because it is *biodegradable plastic* which is formulated with 7.5g potato starch, 100ml water, 15g glycerin and 7.5g vinegar. has a greater water absorption value

2. Organoleptic Test

Observation Results of Biodegradable Plastic Organoleptic Tests

No	Bioplastics	Color	Smell	Texture
1.	Bioplastics 1	Black	No smell	Lumpy and sticky
2.	Bioplastics 2	Black	No smell	Lumpy and sticky

3.	Bioplastics 3	Clear	No smell	Doesn't clump and isn't sticky
4.	Bioplastics 4	Clear	Smelly	Not lumpy and not sticky

Information:

- Bioplastics 1: Plastic *biodegradable* Which given 5g starch potatoes, 50ml water, 15g glycerin and no vinegar
- Bioplastics 2: Plastic *biodegradable* Which given 7.5g starch potatoes, 50ml water, 15g glycerin and 7.5g vinegar.
- Bioplastic 3: *Biodegradable plastic* treated with 7.5g potato starch, 100ml water, 15g glycerin and 7.5g vinegar.
- Bioplastic 4: *Biodegradable plastic* treated with 10g potato starch, 100ml water, 15g glycerin and 30g vinegar.
- criteria : Transparent white
- Texture criteria: not lumpy and not sticky
- Odor criteria : No odor

Judging from the four samples, the best and according to the desired criteria is biodegradable plastic 3 which consists of 7.5g starch, 100ml water, 15g glycerin and 7.5g vinegar. The resulting physical results are clear, odorless, non-clumping and non-sticky. This is because the resulting formula is balanced, starting with a clear color because the starch used is not dirty and there are no lumps, if there are lumps the resulting biodegradable plastic will be blackish in color. In this sample there is no odor produced, this is due to the use of a small amount of vinegar which makes the sample not have a sour smell. The sample is not lumpy and sticky which is caused by using too much glycerin and not being balanced with other ingredients. In this sample the use of glycerin meets the criteria.

DISCUSSION

TPS 3R Tapis Village is a place for collecting waste, most of which is household waste. TPS 3R Tapis Village, which was founded in 2016, started from the idea of a Community Self-Help Group (KSM) called SENYUM (Healthy, Aesthetic, Comfortable, Independent Business). In 2015, KSM SENYUM submitted a proposal to the provincial government to build a 3R TPS around the Tapis Village area. This proposal was finally granted in 2016. After that, a TPS was built located at the Korpri Tapis Housing Complex RT 5, Tanah Grogot District, East Kalimantan. TPS 3R Tapis Village was then ratified on December 26 2018 by the late. Drs. H. Yusriansyah Syarkawi, M.Sc. who at that time served as Regent of Paser.

With the existence of TPS 3R Tapis Village, the management and local residents have high hopes for creating a healthy and clean Tapis Village. The existence of TPS 3R Tapis Village brings its own changes to the appearance of Tapis Village. Before there was TPS 3R in Tapis Village, there were still many residents who threw rubbish carelessly, some even threw it on the side of the road. This of course has a negative impact on the residents of Tapis Village itself, such as creating an unpleasant odor and even being a precursor to the spread of diseases such as ISPA (Acute Respiratory Infection), diarrhea, skin diseases, and so on.

In their operational activities, the TPS 3R of Tapis Village, in this case the administrators and workers of TPS 3R of Tapis Village, have their own obstacles. According to the manager of TPS 3R Tapis Village after an interview, the obstacles faced by those from TPS

3R Tapis Village were varied. The following are operational obstacles from KSM 3R Tapis Village.

a) Operational vehicles

The amount of household waste in Tapis Village has exceeded the carrying capacity of operational vehicles owned by TPS 3R Tapis Village. So more adequate vehicle facilities are needed.

b) Trash can

The number of rubbish bins that have been distributed by administrators in front of residents' houses is still insufficient, so there are still residents who use plastic bags to collect their rubbish.

However, to increase the effectiveness and efficiency of TPS 3R Tapis Village operations, the management will hand over part of the management to third parties.

The operational hours of TPS 3R Tapis Village start at 22.00 WITA. 4 officers who are part of the transport team will pick up the rubbish stored in the bins provided by TPS 3R Tapis Village. Process Transportation is carried out using two operational vehicles, a three-wheeled motorbike and a pick-up truck and is divided into each region. The area reached by these operational vehicles only consists of 7 RTs, namely, RT 2, RT 3, RT 4, RT 5, RT 6, RT 7, RT 8. This is due to the transport capacity of each operational vehicle, whereas for RT 1 and RT 9 whose waste cannot be reached by operational vehicles are forced to dispose of their own waste directly at TPS 3R Tapis Village. After the transportation activity is complete, the next day the waste will be weighed and then sorted by workers at TPS 3R Tapis Village. Waste is sorted based on type, namely organic and inorganic.

All types of organic waste received by TPS 3R Tapis Village are not immediately transported to the Final Disposal Site (TPA). Organic waste will be reprocessed into compost using a compost processing machine. Organic waste that has been processed into compost will be sifted again in the sieving machine tube to obtain the size that suits your needs. Meanwhile, some inorganic waste which cannot be processed will be transported to the final disposal site. In order to reduce the quantity of inorganic waste that accumulates in landfills, some inorganic waste that cannot be processed will be recycled. Trash such as cardboard, bottles, used packaging such as oil packets, noodle packets and detergent packets will be collected individually based on type. This inorganic waste will be reused to be converted into more creative and efficient items such as plastic bags made from oil wrappers, flower vases made from used bottles, and many more. This is the role of TPS 3R Tapis Village in order to reduce the quantity of waste that has accumulated at the Final Disposal Site (TPA)

To improve cleanliness in Tapis Village, the management of TPS 3R Tapis Village hopes that the people in Tapis Village will increase their awareness of disposing of rubbish in the right place and have a sense of responsibility for rubbish, because the presence of rubbish is their responsibility.

CONCLUSION

Biodegradable plastic whose main ingredient is potatoes can be made using a mixture of water, glycerin and vinegar in appropriate quantities, then heated and waited until it thickens. Then the coagulated biodegradable plastic is put in a container and dried in the sun until it becomes the desired plastic according to the criteria.

The effectiveness of environmentally friendly biodegradable plastic can be proven through two tests

carried out, namely the good water resistance test of the four samples, namely bioplastic 1 which is formulated with 5g potato starch, 50ml water, 15g glycerin and no vinegar. Because starch basically contains polar and hydrophilic properties (likes water), therefore less starch is used in bioplastics compared to other samples which can affect water resistance. Meanwhile, the results of the organoleptic test which were the best and in accordance with the desired criteria were biodegradable plastic 3 which consisted of 7.5g starch, 100ml water, 15g glycerin and 7.5g vinegar. The resulting physical results are clear, odorless, non-clumping and non-sticky.

In conducting research, the use of potato starch *(Solanum Tuberosum L.)* as the main ingredient for making biodegradable plastic still has many shortcomings, where the initial formula was not successful due to an unbalanced combination of ingredients. Future researchers should create many formulas that can be tried to facilitate comparison between the tests used. And in making starch, make a comparison of starch which is directly used as a mixture of biodegradable plastic materials and which is different from starch which is dried in the sun first and then used. The author's suggestion to future researchers is to make a more varied formula or add chitosan in making biodegradable plastic and this can produce biodegradable plastic that is more environmentally friendly and can compete with conventional plastic.

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