

# Plastic Film from *Dioscorea Hispida* Dennst (KOROT) Tuber

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## INTRODUCTION

Living "green" has become a popular trend in the last twenty years. Litter is a problem with a very negative social and environmental impact. Some people believe that using biodegradable plastic is an environmentally-friendly solution for things such as plastic bottles, bags and food wraps.

In the 20<sup>th</sup> century, millions of barrels of petroleum products and natural gas materials were used to make plastic product that later end up in landfills, where they take years to breakdown. Due to economic and ecological drawbacks, researchers pushed to develop and investigate biodegradable plastics as an environmentally-friendly alternative.

Plant-based research in manufacturing biodegradable plastic promise a variety of application like in agriculture, food packaging, biomedical devices and table wares. Different plastics wraps are made of different polymers, chains of molecules that have come together in a chemical reaction. These different polymers have different levels of permeability. Even though the plastic looks solid, it still allows water molecules to pass through and evaporate.

The researcher is interested in making a biodegradable plastic film with the use of a *Dioscorea hispida* Dennst (Korot) tuber s extract as major raw material and test its

## ABSTRACT

This study was conducted to produce a biodegradable plastic film from the *Dioscorea Hispida* Dennst (korot) tuber extract. Specifically, it aimed to determine the physical properties of prepared plastic film from korot extract in terms of effect of strong acid and base, flammability, pH, transparency, tensile strength and texture. It also aimed to determine the mechanical properties of prepared plastic film from "korot" extract and determine the permeability in water of the plastic film.

The test for effect on strong acid and base in the two formulations showed that the plastic films were both soluble in strong acid and base. The film was flammable with luminous flame, with pH of 6.3. The produced film was smooth and transparent. The tensile strength test for formulation B was more stretchable and stronger than formulation A, and the weight resistance of formulation B was 1.2 kg while 0.8 kg for formulation A which is comparable to commercial plastic film. The two formulations differ in texture for which the formulation A was smooth and thinner than formulation B which was slightly rough. The produced plastic film was permeable in water. The prepared film was incomparable to commercial plastic wrap, for the prepared film water lost was 4.0 mL to 6.0 mL higher than 1.4 mL for commercial plastic film. The researcher found out that "korot" tuber can be used as main raw material in preparing commercial plastic and the formulation A is better than formulation B.

physical properties in terms of permeability in water, tensile strength, and flammability.

## METHODOLOGY

This study was conducted at the University of Eastern Philippines, College of Science Laboratory. The major raw material used in this study is *Dioscorea hispida* Dennst (korot) grown from the municipality of Lavezares, Northern Samar. The study is of experimental research design under laboratory condition.

In preparing the materials, the *Dioscorea hispida* Dennst (korot) root crop was thoroughly washed with water and peeled. The root crop was ground and its juice was extracted using cheesecloth. The juice was allowed to settle for two (2) hours. The residue was then collected and used immediately as a raw material in making plastic film. Formulation A is 18 g and the Formulation B is 36 g.

	Formulation A	Formulation B
Polyvinyl alcohol	18 g	36 g
Water	18 g	36 g
Starch	18 g	36 g
Glycerol	0.4 g	0.8 g
Oil	0.4 g	0.8 g

A mixture of 18 g of water and 18 g of starch together with polyvinyl alcohol was heated to 70°C until a paste was

formed and the polyvinyl has totally melted. The other materials were added and thoroughly mixed. The mixture passed through a rolling pin then compressed for 10 minutes. Same procedure was performed using the second formulation.

The sample produced was cut into 1 inch by 2 inches for testing. Several tests were conducted to determine their texture and transparency. A piece of cut film was tested sensory evaluation.

Strips of samples produced including the commercial plastic were immersed in diluted Hydrochloric acid (2M HCl). The result was recorded. The same procedure was performed using a strong alkali, (2M NaOH).

A small piece of "korot" plastic was placed in watch glass tested for flammability, by igniting with flame.

pH was tested on the korot extract using a digital pH meter. About 5 mL of korot extract was contained in a beaker. Then, a digital pH meter was dipped into the extract.

The two of plastic film formulation and the commercial plastic were subjected to tensile test by hooking in a weight of balance.

To test for permeability, a piece of film produced plastic film of korot was used to cover a beaker with water and was isolated from the external environment. The decrease of the volume of water was monitored within a week period.

#### Test for Best Formulation of Korot Plastic Film

Two formulation mixtures were the prepared of a different amount of starch. The produced films were both tested.

### RESULTS AND DISCUSSION

This chapter showed the results for the physical properties, formulation of plastic film and comparison of commercial wrap to *Dioscorea hispida* dennst tubers extract, locally known as korot. The physical properties showed that korot film were both soluble in strong acid of 2 M HCl and strong base of 2 M NaOH, flammability was confirmed as flammable, permeable in water with a pH of 6.3, transparent, has 1.2 kg tensile strength of formulation A and 0.8 kg in formulation B comparing to the commercial plastic which is 0.2 kg tensile strength, and in terms of texture it is smooth and thin. The researcher compared the two formulations of the produced plastic to the commercial plastic. The researcher found out that formulation A and B cannot be the best formulation of plastic and it cannot be suitable to use, hence the two formulations are permeable in water.

Formulation A and B cannot be a substitute to a plastic film since formulation A and B are permeable in water and have a weak strength with a pH of 6.3 compared to commercial plastic.

#### Physical Properties

The physical properties were determined in terms of effect of strong acid and base, flammability, pH, transparency and determination of tensile strength.

#### Mechanical Properties

The mechanical properties were determined in terms of permeability in water.

### Effect of Strong Acid and Base

Table1. Test for the Effect of Strong Acid and Base.

Sample	Strong Acid 2 M HCl	Strong Base 2 M NaOH
Formulation A	Soluble	Soluble
Formulation B	Soluble	Soluble
Commercial plastic	Insoluble	Insoluble

Table 1 shows the effect of strong acid and base to the korot wrap compared to the commercial plastic. The formulation A and B are soluble in the two solvents comparing to the commercial plastic which is not soluble in two solvents. The researcher observed that the two formulations dissolved in the two solvents for just 30 minutes.

### Test for flammability

Table2. Test for the flammability of the sample comparing to commercial plastic.

Samples	Results
Formulation A	Flammable
Formulation B	Flammable
Commercial plastic	Flammable

Table 2 shows the results of flammability of the samples. This test was conducted to determine the flammability of the sample (korot) compared to the commercial sample. The test showed that three samples are all flammable. The color of the flame for korot plastic is yellowish (luminous) for both formulations compared to the commercial plastic with same color yellowish (luminous).

### Test for pH

Table3. Test for the pH of korot extract.

Samples	Trials	Remarks
Formulation A	T <sub>1</sub> 6.3	Weak acid
	T <sub>2</sub> 6.3	Weak acid
	T <sub>3</sub> 6.3	Weak acid
Formulation B	T <sub>1</sub> 6.3	Weak acid
	T <sub>2</sub> 6.3	Weak acid
	T <sub>3</sub> 6.3	Weak acid

Table 3 shows the reading of the pH using a digital pH meter; the result showed a pH of 6.3 that the korot extract is a weak acid for both formulations.

### Test for Transparency

Table4. Physical Properties of the Prepared Korot Plastic Film for transparency.

Mixture	Trials	Size (inches)	Description
Formulation A	1	5.5x4	Transparent
	2	5.5x4	Transparent
	3	5.5x4	Transparent
Formulation B	1	7.5x6	Transparent
	2	7.5x6	Transparent
	3	7.5x6	Transparent
Commercial plastic (control)	1		Transparent
	2		Transparent
	3		Transparent

Table 4 shows the physical properties of the produced plastic for transparency. The two formulations showed that both films were physical transparent. The amount of starch differs the consistency of the mixture that affects the differences on the transparency of the film.

**Test for Tensile Strength**

Table5. Test for the tensile strength of korot film comparing to commercial plastic

Samples	Reading of Commercial Scale (in kg)
Formulation A	0.8 kg
Formulation B	1.2 kg
Commercial plastic	0.2 kg

Table 5 shows the tensile strength of korot film. This test was conducted to compare the produced plastic film to commercial plastic in terms of stretched tightness. The two formulations were loaded in commercial scale separately, the results were observed when formulations were stretched until it was broken. The test for commercial plastic was the same to the procedure in formulation A and B; the reading of commercial scale in formulation A was 0.8 kg and 1.2 kg in formulation B compared to commercial plastic which is 0.2 kg. The two formulations have different reading compared to the commercial plastic, This means that formulation B is more strengthen than formulation A. The test for tensile strength showed that two formulations have more strength compared to commercial plastic.

**Test for Texture**

Table6. Physical Properties of the Prepared Korot Plastic Film for Texture

Mixture	Trials	Size (inches)	Description
Formulation A	1	5.5x4	Smooth and thin
	2	5.5x4	Smooth and thin
	3	5.5x4	Smooth and thin
Formulation B	1	7.5x6	Smooth and thin
	2	7.5x6	Smooth and thin
	3	7.5x6	Smooth and thin
Commercial plastic (control)	1		Smooth and thin
	2		Smooth and thin
	3		Smooth and thin

The texture property of produced plastic film in table 6 shows that formulation A was comparable to commercial plastic wrap in terms of smoothness and thickness. The amount of the starch differs the consistency of the mixture that possibly affect the smoothness and thickness of the film.

**Test for Permeability in Water**

Table7. Test for permeability of korot in water.

The table below shows the result of the total volume water lost starting Day 1 to Day 7.

Sample	Initial volume of water	Days of Observation							Total volume of water lost after 7 days
		Volume of water lost, ml							
		Day 1	2	3	4	5	6	7	
Formulation A	50 ml	0.5	0.5	1	0.5	0.5	1	1	5 ml
Formulation B	50 ml	0.2	0.8	1	0.2	0.7	1.1	2.8	6 ml
Commercial plastic	50 ml	0.1	0.1	0.7	0.1	0.1	0.1	0.2	1.4 ml
Temperature	27°c	27°c	27°c	27°c	27°c	27°c	27°c	27°c	

Table 7 shows the comparison permeability in water of korot film and commercial plastic. The results showed that formulations A and B were permeable in water which resulted to the evaporation of water for formulation A with a total volume of water lost of 5 mL while the formulation B total water lost was 6 mL compared to commercial plastic which loses water about 1.4 mL only in a one (1) week period of observation.

Table8. Summary of the Results for Physical Properties

Physical properties	Formulation A	Formulation B	Commercial plastic
Effect of strong acid and base	Soluble	Soluble	Insoluble
Flammability	Flammable	Flammable	Flammable
pH meter	6.3	6.3	6.3
Transparency	Transparent	Transparent	Transparent
Tensile strength	0.8 kg	1.2 kg	0.2 kg
Texture	Smooth, thin	Smooth, thin	Smooth, thin
Permeability	Permeable	permeable	Slightly permeable

Table 8 shows the results of physical properties of the samples. This test was conducted to compare the produced plastic film to commercial plastic in terms of effect of strong acid and base, flammability, pH meter, transparency, tensile strength and texture. In terms of tensile strength data showed the difference in tensile strength.

**Comparison of Permeability in Water of Prepared Plastic Film with Commercial Plastic Wrap**

From the test of permeability in water, the two formulations showed that the prepared plastic of where permeable indicated by its higher loss of water compared to commercial plastic film, Therefore prepared plastic film is not comparable to commercial plastic film.

**Determination of the best formulation for plastic film making**

The researcher found out that formulations A and B cannot be used as substitute to a plastic film making due to its

permeability in water, and has weak strength comparing to commercial plastic.

**Conclusion**

Based on the experimental results obtained in this study, korot starch can be used as a material in preparation of biodegradable plastic; it is confirmed through the determination of physical properties, permeability and tensile strength. Plastic film from korot is therefore potential substitute for commercial non-biodegradable plastic.