Preparation of Bio-Bag using Banana Peel as an Alternative of Plastic Bag

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Abstract— The current work aims at preparation of bio-bag sheet using banana peels. The banana peels are amalgamated with glycerol as plasticizer and sodium metabisulphite as antimicrobial .This research work is completed in two steps, first step is levigation of banana peels with unique concentration of different chemicals. The second step is preparation of sheet by heating in oven at 130 ^{0}c temperature. Its properties like tensile strength, creep, thickness was studied in this research work.

Keywords: Banana Peels, Plastic, glycerol, starch

I. INTRODUCTION

In view of dwindling reserves of fossil resources，industry is showing growing interest in bio-plastics.few percent of the world's oil production is used in processing industries because oil-based plastics require substantial amounts of energy to manufacture.

As oil runs out，and the use of fossil fuels becomes increasingly expensive, the need for replacement sources of raw material for the manufacture of vital plastics becomes increasingly urgent. In addition, the use of plastic bags increases the green house gases like co ,co$_2$ which may lead to increase in global warming [1, 2].

In general, type of packaging that frequently used our community is plastic. Plastic Using by community is made from petroleum and natural gas that derivative from petrochemical products and non-renewable natural resources. Raw material of plastic is made and compiled via polymerization using monomer raw material, which is composed dial-connect into one in the form of polymer. Many kinds of foods and beverage packaging's from plastic e.g. polyethylene, polypropylene, polystyrene, polyamide, polyester, polyurethane, polycarbonate, polyvinylchloride are used. Plastics has advantages, the price is cheap, can be produce in a large amounts, light, transparent, flexible, and selective in permeability to H_2O, CO_2 and O_2 but, plastic also has a weakness, can't stand of heat, easily torn, can be a pollution in our environment and can contaminate the packaged food [3, 4].

Plastics causing environmental pollution because of having non-biodegradable characteristic, beside plastics can contaminate the packaged food because presence of certain substances are potentially carcinogenic than can move into the packaged food. Monomer-monomer on plastics can enter into the packages food next can enter into the body of consuming. Accumulation of chemical substance in our body are insoluble in water so can't waste with urine and feses. Accumulation of chemical substance can make disruption our healthy and causing cancer [4, 5].

Biodegradable packaging and biodegradable bags take much less time to break down after being discarded, if they haven't been recycled, of course. What this means is that it gets absorbed in the earth, and there will no longer be tons of plastic dominating our landfills. Biodegradable plastics are made from biomass, which is a completely renewable resource. It is an organic compound, which breaks down. There is plenty of it around the globe. Biomass includes trees, plants, grass, and all organic materials that decompose. This may even include animal fats, meats, and other tissues. Biodegradable plastics are much better for the environment, because there is no harm done to the earth when recovering fossil fuels. Also, in this process there are very few greenhouse gas and harmful carbon emissions. Regular plastics need oil for their manufacturing, which pollutes the environment. Biodegradable plastics need less than half the energy to produce than their non-biodegradable counterparts. This means that it is possible to make twice the amount of biodegradable packaging and biodegradable bags using the same amount of energy. Biodegradable plastics are created from materials that are fully biodegradable. This means that they can break down much faster and recycling them takes less energy. Biodegradable plastics can be reused more efficiently, which gives them a clear advantage. Traditional plastics are full of harmful by-products and chemicals, which are released during their breakdown process. Biodegradable plastics are completely safe and do not have any chemicals or toxins. This plastic harmlessly breaks down and gets absorbed into the earth. Such advantages of bio-plastics are of extreme importance, as the toxic plastic load on the earth is growing and at this rate will cause a whole range of problems for future generations. Since last few years many of the companies have started their packaging of products in bio plastic materials due to strict laws framed by government. Even it takes less time to degrade and it is not harmful for animals.

II. MATERIALS AND METHODS

Banana peel, Glycerol, Starch, HCl (Hydrochloric acid), NaOH (sodium Hydroxide), $Na_2S_2O_5$ (Sodium meta bisulphite) collected from Finar Chemicals (Ahmedabad, Gujarat), Distilled water.

III. EXPERIMENTAL PROCEDURE

1) Banana peels were removed using stainless steel knife and it was converted into small pieces. Then it was soaked in sodium met bisulphite (0.2M) solution for 45 minutes. It is used as antioxidant and preservative. This would increase the biodegradation period of bio-bag.

Fig.1: Soaking of Banana peels in $Na_2S_20_5$ Soln.

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2) An 800ml beaker was filled with distilled water and placed over a Bunsen burner. The banana peels were placed in the beaker and were boiled for 30 minutes. After the boiling process, the beaker was removed from the Bunsen burner and the peels were decanted off the water and placed on and covered with a dry gauze pad, left to dry for 30 minutes. This was done for removing any impurities and making the peels soft for easy preparation of paste.

Fig.2: Heating and Cooling Banana Peels

3) 25ml of banana paste was placed in each 50ml beaker. 3ml of HCl was added and the mixture was mixed using a glass stirring rod. 2ml of propan-1, 2, 3-triol was added to each beaker. The mixture was stirred again. 3ml NaOH was added and the mixture was stirred once more.

Fig.3: Preparation of paste

4) The mixture was poured into a Petri dish and put in the oven at 130°C. It was baked for half an hour. It is necessary to bake for considerable amount of time and proper composition of paste. Otherwise it may result into burnt sheet with low strength

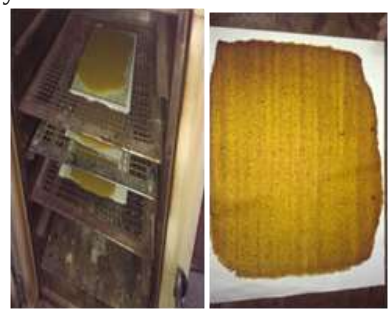

Fig.4: Preparation of sheet

E. The sheet was removed from Petri disk after cooling at room temperature. This sheet was given the shape of bags and mobile case using natural glues. This was having enough strength to carry 2.5 kg of weight.

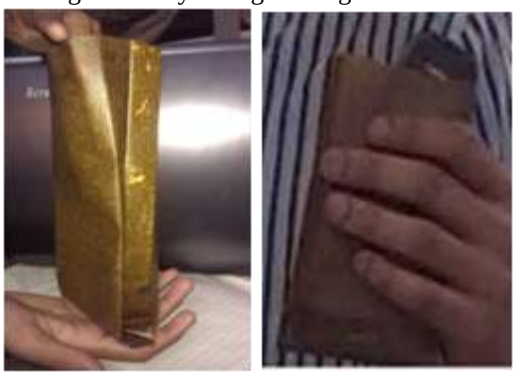

Fig.5: Bio-bag and Mobile Case

A. Thickness measurement

The dial thickness gauge [4] is typically used to measure the thickness, in miles (0.001"), of sheet metal, plastic, paper, and cardboard. Metric measurements (0.01 mm) are likely to be used for fabric thickness and numerous medical, botanical and biological applications. The thickness of our bio-bag is 0.1mm.

Fig.6: Digital thickness Gauge

B. Creep:

Creep is the tendency of solid material to move slowly or deform permanently under the influence of mechanical stress. Thus the creep is due to stress, which is defined as load per unit area .it was noted that under the load of 4 kg creep was developed in the bio-bag. The change in strain was noted after 12 hours. Thus we can conclude from this that maximum carrying load of this bio-bag is below 4 kg.

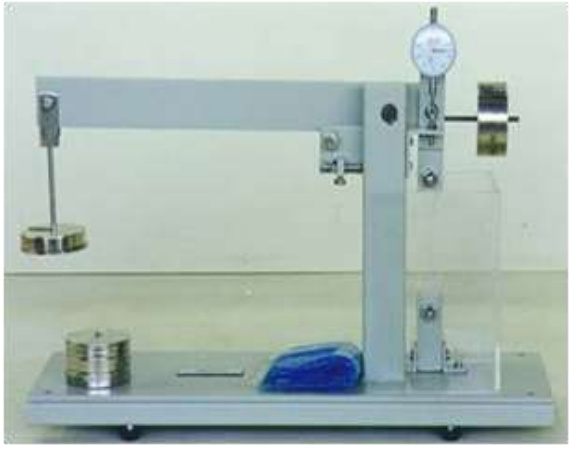

Fig.7: Creep testing machine

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C. Tensile strength:

The tensile strength was measured by using standard machine ASTM. It is measured for the sheet in the absence and presence of starch .it is noted that in the absence of starch the tensile strength is negligible and in the presence of starch its tensile strength increases. This is because the starch acts as fillers and it is strongly bonded with cellulose. The maximum tensile strength of bio-bag in the presence of starch is 5.94 MPa (megapascal).

D. Biodegradation period:

It is noted that the degradation period for bio-bag is due to sodium metabisulphite which acts antimicrobial. The addition of glycerol as plasticizer is to increase its flexibility. The biodegradation period was found to be 8-10 months. After 10 month there was degradation of bio-bag due to fungal growth.

Fig.8: Degraded Bio-bag after 12 month

IV. Result & Discussion

A. Effect of hcl and naoh:

A Bio-bag of 0.3 mm has been successfully prepared from above experimental procedure. It is emphasized that presence of HCl and NaOH in proper concentration is consider to be a controlling factor for its strength.

Table 1: Effect of HCl and NaOH Concentrations

Parameters	Trial 1		Trial 2		Trial 3		Trial 4	
	Molarity of HCl and NaOH Soln. used							
	0.1	0.1	0.5	0.5	0.5	0.1	0.1	0.5
Amount of banana peel paste used (ml)	25		25		25		25	
Sheet Formation	NO		YES		YES		YES	
Strength test	Failed		Failed		Partially Passed		Passed	
Thickness(Cm)	0.3		0.3		0.1		0.3	
Decay/Days	1		3		>30		>30	

Starch consists of two different types of polymer chains, called *amylose* and *amylopectin*, made up of adjoined glucose molecules. The hydrochloric acid is used in the hydrolysis of amylopectin, which is needed in order to aid the process of film formation due to the H-bonding amongst the chains of glucose in starch, since amylopectin restricts the film formation. The sodium hydroxide used in the experiment is simply used in order to neutralize the pH of the medium.

B. Effect of Concentration of Glycerol:

Fig.9 stipulates the effect of concentration of glycerol on tensile strength .It is interesting to notice that the tensile strength of samples prepared decreases with increase in concentration of glycerol respectively.

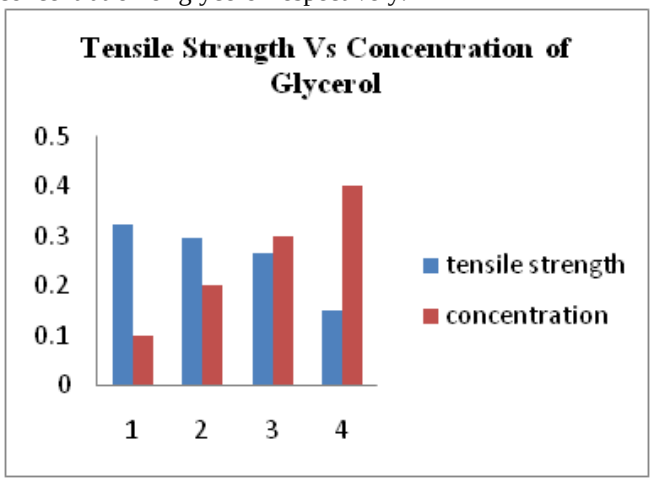

Fig.9: Effect of Concentration of Glycerol

C. Effect of Concentration of Starch:

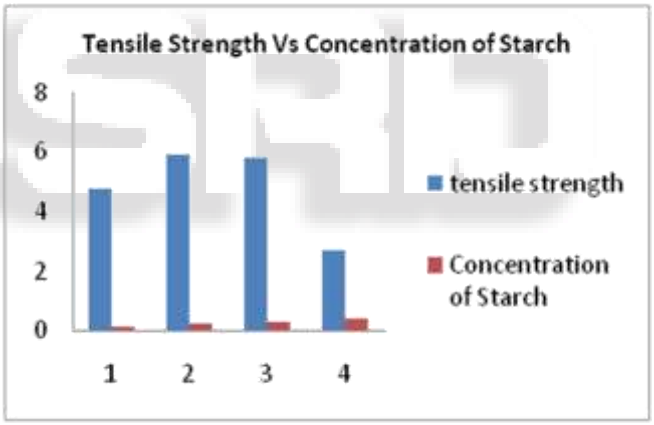

Fig.10: Effect of Concentration of Starch

Fig.10 shows the effect of concentration of starch on tensile strength. It is interesting to notice that all the samples prepared with starch showed increase in its tensile strength with increase in its concentration up to 2M of starch and then decreases.

V. Conclusion

Bio-bag is the thin layer that can be used as packaging material or as a carrying bag. Glycerol is added as plasticizer that increases its flexibility. To prevent growth of bacteria and fungi sodium meta bisulphite is used. Addition of starch has increased its strength that can withstand a load of 2.5 kg easily.

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