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Production of Bioplastics from Banana Peels

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***Abstract*- Plastic offers a variety of benefits, in a variety of shapes, such as sheets, panels, film, which can all be flexible as the application requires. However, use of too many plastics results in massive harmful effects. It takes longer time to degrade which is estimated about 500 years to degrade and will become toxic after decomposed. The objective of this study is to produce biodegradable plastic from banana peels as a substitute for the conventional plastic and to prove that the starch in the banana peel could be used in the production of the biodegradable plastic. The strength of the film was determined using the elongation test by comparing the biodegradable film with a control film and a synthetic plastic. In the soil burial degradation test, the intensity of degradation was tested for all three types of film and the biodegradable film degraded at a rapid rate compared to control film while the synthetic plastic did not degrade at all. Based on all the testing that was carried out, the biodegradable film from banana peel is the best and ideal overall compared to the control and synthetic plastic. The tensile strength for sample keeps increasing when the residence times are increased from 5 minutes to 15 minutes and reaches a maximum at 15minutes and then starts decreasing when the time is increased to 20 minutes. This suggests that the optimum hydrolysis time is 15 minutes for this sample set Bioplastic film can sustain the weight near about 2 kg and which have enough tensile strength. The bioplastic prepared from banana peels that can be used as packaging material or as a carrying bag. Glycerol is added as plasticizer that increases its flexibility.**

***Keywords*- Bioplastic, starch, banana peels**.

I. INTRODUCTION

Plastic offers a variety of benefits, in a variety of shapes, such as sheets, panels, film, which can all be flexible as the application requires. However, use of too many plastics results in massive harmful effects. It takes longer time to degrade which is estimated about 500 years to degrade and will become toxic after decomposed. The objective of this study is to produce biodegradable plastic from banana peels as a substitute for the conventional plastic and to prove that the starch in the banana peel could be used in the production of the biodegradable plastic.

The strength of the film was determined using the elongation test by comparing the biodegradable film with a control film and a synthetic plastic. In the soil burial degradation test, the intensity of degradation was tested for all three types of film and the biodegradable film degraded at a rapid rate compared to control film while the synthetic plastic did not degrade at all. Based on all the testing that was carried out, the biodegradable film from banana peel is the best and ideal overall compared to the control and synthetic plastic. The tensile strength for sample keeps increasing when the residence times are increased from 5 minutes to 15 minutes and reaches a maximum at 15minutes and then starts decreasing when the time is increased to 20 minutes.

This suggests that the optimum hydrolysis time is 15 minutes for this sample set Bioplastic film can sustain the weight near about 2kg and which have enough tensile strength. The bioplastic prepared from banana peels that can be used as packaging material or as a carrying bag.Glycerol is added as plasticizer that increases its flexibility.Plastic offers a variety of benefits, in a variety of shapes, such as sheets, panels, film, which can all be flexible as the application requires.

However, use of too many plastics results in massive harmful effects. It takes longer time to degrade which is estimated about 500 years to degrade and will become toxic after decomposed. The objective of this study is to produce biodegradable plastic frombanana peels as a substitute for the conventional plastic and to prove that the

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starch in the banana peel could be used in the production of the biodegradable plastic. The strength of the film was determined using the elongation test by comparing the biodegradable film with a control film and a synthetic plastic. In the soil burial degradation test, the intensity of degradation was tested for all three types of film and the biodegradable film degraded at a rapid rate compared to control film while the synthetic plastic did not degrade at all.

Based on all the testing that was carried out, the biodegradable film from banana peel is the best and ideal overall compared to the control and synthetic plastic. Hence, it can be used in the industry for various application such as moulding and packaging, at the same time rescuing the environment from potential harm by synthetic plastics.

II. PRODUCTION OF BIOPLASTIC

1. Preparation of Banana Skins:
Step 1:
Banana peels are removed using stainless steel knife and converted into small pieces. Then peels are dip in sodium metabisulphite (0.2M) solution for 45 minutes. It is used as antioxidant and preservative. This would increase the biodegradation period of plastic.

Step 2:
Banana peels are boiled in distilled water for about 30 minutes.

Step 3:
The water is decanted from the beaker and the peels are now left to dry on filter paper for about 30 minutes.

Step 4:
After the peels are dried, they are placed in a beaker and using a hand blender, the peels are pure until a uniform paste is formed.

Fig 1. Prepration of Banana.

2. Production of bioplastic:
Step 1:
25gm of banana paste is placed in a beaker.
Step 2:
3ml of (0.5 N) HCl is added to this mixture and stirred using glass rod.

Step 3:
2ml Plasticizer (Glycerol) is added and stirred.

Step 4:
0.5 N NaOH is added according to pH desired, after a desired residence time.

Step 5:
The mixture is spread on a Ceramic tile and this is put in the oven 120C and is baked.

Step 6:
The tile is allowed to cool and the film is scraped off the surface.

Fig 2. Production of Bioplastic.

3. Mechanism:

- 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 in the experiment is simply used to neutralize the pH of the medium.
- Acid hydrolysis changes the physiochemical properties of starch without changing its granule structure. If the amylopectin content is higher in the starch, the recovery of starch decreases.
- Plasticizers or dispersants are additives that increase the plasticity or fluidity of a material. The dominant applications are for plastics, especially polyvinyl chloride (PVC) glycerol, sorbitol.
- The sodium metabisulfite (Na2S2O5) is used as an antioxidant here. It prevents the microbial growth in the peels.

4. Analysis:
As 0.5N solution was not accurate for maintaining neutral Ph level we used 0.1N and 0.3N of HCl and NaOH respectively.

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Amount of paste Taken (ml)	Residence time (mins)	HCl	NaOH	Weight of plastic obtained (gm)
25	5	0.1N	0.3N	4.11
25	10	0.1N	0.3N	3.89
25	15	0.1N	0.3N	4.21
25	20	0.1N	0.3N	4.04

5. Testing methods:

- There should not be any gaps or holes in sheet of plastic obtained.
- After the sample is ready for testing a 16cm by 2cm film is cut and the thickness is determined which is 0.5cm.
- Using universal testing machine, the tensile strength is measured.

6. Uses of bioplastic:

- Bioplastic is widely used in:
- Packaging
- Consumer goods
- Automotive and Transport
- Building and Construction
- Textiles
- Agriculture & Horticulture
- Electrics & Electronics
- Others

III. RESULTS AND CONCLUSION

The tensile strength for sample keeps increasing when the residence times are increased from 5 minutes to 15 minutes and reaches a maximum at 15minutes and then starts decreasing when the time is increased to 20 minutes. This suggests that the optimum hydrolysis time is 15 minutes for this sample set. Bioplastic film can sustain the weight near about 2 kg and which have enough tensile strength. The bioplastic prepared from banana peels that can be used as packaging material or as a carrying bag.Glycerol is added as plasticizer that increases its flexibility. 5.To prevent growth of bacteria and fungi sodium meta bisulphite is used.

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