

# FABRICATION AND PRODUCTION OF BIOBAG – AN ALTERNATIVE FOR PLASTIC BAG

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**Abstract** - Biodegradable bags are those which can be biologically decomposed by microbial action which involves the decay or breakdown of materials. This occurs when microorganisms use an organic substance as a source of carbon and energy. Though plastic bags offer a variety of benefits and are available in a variety of shapes, they take several hundred years to decompose. Whereas, biobags decompose over a shorter period and it largely depends upon the temperature and moisture content. The objective of this study is to prepare biobags using banana peels as the raw material. The peels are synthesized with chemicals to form a paste by both manual and mechanical methods. For producing the biobag mechanically, a sheet making machine is fabricated. The sheet obtained from this machine is in turn converted into a bag. The product is checked for its biodegradability, solubility, tensile strength, thickness, and weight.

**Key Words:** Banana peel, bag, plastics, biodegradation, sheet, decompose.

## 1. INTRODUCTION

Plastics are materials that are classified as a group of synthetic man-made materials mostly obtained from non-renewable resources such as petrochemicals. As per the Environmental Protection Act 2004 governing 'Plastic Carry Bags' the plastic carry bag is defined as 'the vest-type carrier bag made of plastic designed for the general purpose of carrying goods purchased by consumers' (Ministry of Environment and Sustainable Development, 2004). Over the past 4-5 decades the plastic industry has witnessed a humongous growth due to the versatility and flexibility of their products. However, they do not degrade when dumped in landfills, on incineration can emit gases that are potentially harmful and are manufactured from petrochemicals which is a non-renewable resource. Plastic bags pose a serious threat to aquatic life and prevent seepage of rainwater into the ground when dumped in water bodies and on open fields respectively. On the other hand biodegradable bags do not contain any toxic chemicals and degrade without any external stimulation. This product is gaining attention as people are aware of the ill effects of petrochemical derived plastics. Many states in India have already banned use of polyethylene bags and single use plastic. A similar ban is imposed in Tamil Nadu from January 1, 2019. While people are still searching for a user friendly alternative, these biobags come handy in the nick of time.

These biobags made out of fruit by-products can not only replace polyethylene bags but can also minimize waste generation.

## 1.1 Polyethylene bags vs. Biobags

Plastics are broadly classified into thermosetting plastics and thermo plastics and each of these two types are further classified into a number of divisions based on their physical and chemical properties. Among them polyethylene is the most common plastic and constitute about 34% of the entire plastic production. Polyethylene bags are widely preferred for domestic and commercial purpose due to its low weight, low cost and high durability and reusability. However polyethylene bags take 10-1000 years to degrade in landfills. Other methods of disposal also cause threat to both biotic and abiotic resources. As a result of legal restrictions and self awareness among people they are moving towards other alternatives.

Biodegradable bags are gaining momentum as one of the replacements of polyethylene bags, the primary reason being degradation of the bags along with the waste material in a safe manner once dumped in a landfill. Our study deals with utilization of banana peels to make biobags as banana peels contain about 31.7% fibre content which adds strength to the bag. It's been estimated that 400,000 barrels of oil are used each day to make plastic packaging in the world. Hence the sheet produced using the banana peel paste can also be used as an excellent alternative to packaging material.

## 2. PREPARATION OF BIOBAG

### 2.1 Manual process using oven

1. Banana peels are converted into small pieces using a stainless steel knife.
2. It is soaked in Sodium metabisulphite (0.2M) solution for 45 minutes. It acts as an antioxidant and preservative and increases the biodegradation period of the bio-bag.
3. The banana peels are immersed in an 800ml beaker filled with distilled water and is boiled for 30 minutes. After which the peels are decanted off the water and placed on a filter paper to dry for 30 minutes. This is done to remove impurities and to make the peels soft for easy preparation of paste.

The peels are then ground in a mixer to make a smooth paste.

- To 25 ml of banana peel paste 3ml of Hydrochloric acid (Hcl), 2ml of Propan-1, 2, 3-triol (Glycerol) and 3ml of Sodium hydroxide (NaOH) and mixed evenly with a glass stirrer rod.
- The paste is spread evenly over a ceramic tile and heated in an oven at 130°C for 45 minutes.

| No. of trials | Formation of film                 | Thickness of film |
|---------------|-----------------------------------|-------------------|
| Trial 1       | No film is formed                 | NIL               |
| Trial 2       | Film is formed with minute cracks | 0.4 mm            |
| Trial 3       | Neat film without cracks          | 1.5 mm            |



Fig -1(i): Trial 2

Fig -1(ii): Trial 3

## 2.2 Mechanical process using sheet making machine

- The banana peels are soaked, boiled and dried is obtained as per the previous process and is poured inside the mixer set up in the sheet making equipment.
- The peels are ground to make a fine paste which is conveyed to a tray attached to a heater coil.
- A pneumatic press operated with the help of a compressor is lowered over the tray.
- The combined effect of compression and heat helps in the formation of a sheet.



Fig -2: Sheet making machine

## 3. TESTS

### 3.1 Biodegradability test

The film is buried in soil and its rate of degradation is checked once in a week. The soil is exposed to sufficient sunlight and sprinkled with water.



Fig -3: Banana film before and during biodegradation respectively

### 3.2 Solubility test

The film is tested for solubility against ethanol, acetic acid, orthophosphoric acid, acetone, chloroform and water.

|                      |                   |
|----------------------|-------------------|
| Ethanol              | Insoluble         |
| Acetic acid          | Insoluble         |
| Orthophosphoric acid | Partially soluble |
| Acetone              | Partially soluble |
| Chloroform           | Insoluble         |
| Water                | Insoluble         |

### 3.3 Tensile strength

The tensile strength of the film is tested using an ASTM and found to be negligible.

### 3.4 Gauge thickness

The thickness of the film is measured using a screw gauge. The final film is found to be 1.5mm thick.

### 3.5 Weight

The weight of the banana film is negligible.

## 4. CONCLUSION

Based on the recent surveys conducted in Tamil Nadu (TN), 8% to 15% of garbage by weight is plastic and TN leads the south Indian states in plastic consumption and production. However there is still no clear idea on the exact quantity of plastic waste generated. On the other hand banana yield in Tamil Nadu is much higher than the national, with 100

metric tonnes produced per hectare against the national average of 37 metric tonnes. This gives us an indirect indication of huge amounts of banana peels generated and discarded as waste. Taking into account both the scenarios production of biodegradable film to make various products from the generated banana peels is an ideal decision.

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