

Production of Bio Degradable Bags Using cassava Starch

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ABSTRACT

Plastic is a material that is used to a great extent. Nowadays Petroleum based plastics are widely used for the commercial purpose. This kind of plastics can take more than a century to degrade. Man made plastics have Polyurethane and Polyethylene polymers. It cannot be easily degraded by micro organisms as it don't recognize as food. When burned plastics release cancer causing carcinogenic chemicals that are harmful to people and the environment. One eco friendly alternative the current commercial plastic is "Bio plastics". Bio plastics are biodegradable plastics that have components derived directly from renewable raw plant materials. Seven type of bioplastics were made using various combinations of renewable raw materials and plasticizers. In this project, Cassava starch is used as a main biopolymer for the production of bio degradable bags.

Keywords: Biodegradable, Renewable, Eco-friendly, Sustainable.

INTRODUCTION

India has a greater love towards plastic, plastic has become a most ubiquitous product nowadays. It makes our life a easy going one. Plastic production is the pillar of India's economy. Large plastic production is found mostly in the developing countries (India, China, Albania, Afghanistan, Argentina, and Bangladesh) than the developed countries (Japan, Germany, Singapore, South Korea). India, China etc., are the largest plastic producing countries. In India there are about 22000 plastic processing units and 150 machinery manufacturers. Different types and methods are used in plastic production.

The reasons why the uses of plastic largely are

- Versatile
- Light weight
- Relative inexpensive
- High moist resistant
- Its molding capacity to different shapes attracts people towards plastic.

Even the awareness towards plastic is known its usage cannot be reduced. It poses great environment hazard by its material and non biodegradability nature.

India's Future Mission in Plastic

- Productivity growth to help India sustain > 8% growth.
- More than 100 million people will enter labour force.
- It is expected that Per capita consumption will be 20kg of plastic by 2020.
- Rural to urban migration will be more than 140 million.
- Infrastructure investments (rail, road & ports) to match global standards.
- Indians will own 5-6 times more car hub

A. Types of plastics

With the help of plastic code we can predict the degree of safety and harmfulness. It itself is a toxic material but with the help of the code, we can use these plastic upto the mere harmful stage. This classification is called as “resin identification”. These are mostly identified at the bottom of the objects like bottles and containers. The recent researches had proved that all plastic is 95% positive for estrogenic activity, meaning they contain chemicals that can potentially disrupt the hormones and cause adverse effects.

B. Safer Plastics

- *Polyethylene Terephthalate (PET)*
- *High Density Polyethylene (HDPE)*
- *Less Density Polyethylene (LDPE)*
- *Polypropylene (PP)*

C. Hazardous Plastic

- Polyvinyl Chloride (PVC)
- Polystyrene (PS)
- Others

Various Amount of Plastics Used

Code	Name of Plastic	Amount generated (Tonnes)
1	PET	2860
2	HDPE	5890
3	LDPE	1640
4	PP	6450
5	PVC	4000
6	PS	2590
7	Others	5480

Bioplastic

Among all the remedies bioplastic is the effective and best alternative for plastic. It is the plastic derived from organic biomass. Bioplastic produce less carbon dioxide while degrading. The bio plastics are encouraged because it will degrade in lesser time when compared to the ordinary plastic.

i) Manufacturing of Bio- Degradable Bags

Cassava starch is used to prepare biodegradable bags which are highly degradable than the conventional plastics. To prepare 10 kg of cassava starch, 48 kg of cassava tubers are required. Along with cassava starch, glycerin, vinegar and water is added to prepare biodegradable bag.

ii) Materials Required

- Cassava starch
- Glycerin
- Vinegar
- Water

iii) Experimental process

- Extraction of starch
- Testing of starch
- Preparation of Bio-film
- Moulding of bio plastic



Fig1. Cassava Starch Powder

iv) Bio film

- For the preparation of bioplastic, we need materials like starch powder, vinegar, glycerin and water.
- At first all the ingredients are mixed up in a container.
- Then it is made to stir continuously in a container under a mild flame.
- Stirring continuously leads the mixture to form into a sticky consistency.



Fig 2. Bio film of Cassava Starch

- When the consistency is obtained, the mixture is allowed to dry.
- Then the biofilm is prepared.

Cassava pellets

- To mould the bio-film into a required material, bio-film is converted into pellets using twin screw extruder machine.
- Then the pellets is heated under certain temperature and converted into desired shape.

- Then the pellets converted to bags.



Fig 3. Cassava Pellets

Preparation of Biodegradable Bags

The manufacturing process can be done by “Blown Film Extrusion process”.

i) Blown Film Extrusion Process

In the blown film extrusion process, small plastic pellets (called resin) are melted down under controlled conditions so that they become molten and pliable. They are then pressed (extruded) through a circular die gap to form a continuous tube of plastic.

ii) Bag Making

- The resin is melted under controlled conditions of temperature and pressure.
- Air is then injected to the molten bio plastic that is blown out and extruded through a die that is circular in shape to form a continuous tube of thin bio plastic.
- Then tube is then cut off, while still in the molten state and stretched and inflated to obtain the required size and thickness.
- The inflated bio plastic is then allowed to cool and then wound into rolls for being converted into bio plastic bags.
- The roll of bio plastic tubing is then fed to a machine that rolls out the tube to specified length that is cut off and heat sealed at one end to give it the shape of a bag.
- The output depends on the size of the bags that are produced.
- In some cases, with small bags, machine cycle speeds may produce up to 70,000 bags per hour. In other instances a large bag may run as slowly as 2,000 bags per hour.
- The quality of bags depends on having good equipment that maintains a consistent flow of material throughout the process.



Fig 4. Biodegradable Bags

iii) Extrusion Process

Extrusion is a process used to create objects of a fixed cross sectional profile. A material is pushed through a die of the desired cross section.

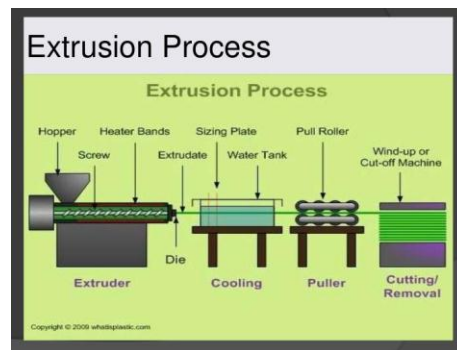


Fig 5. Extrusion Process

iv) Test for Bio plastic

- Effects of strong acid
- Tensile test
- Effects on weak acid
- Flammability test
- Biodegradability test
- Effects of water
- Effects of air

v) Machineries for Production of Biodegradable Bags

The machine which is used for the bioplastic processing industry is Twin screw extruder. It has been applied not only to the extrusion molding of electrode, explosives, building materials, packaging, pulp, ceramics and other fields.

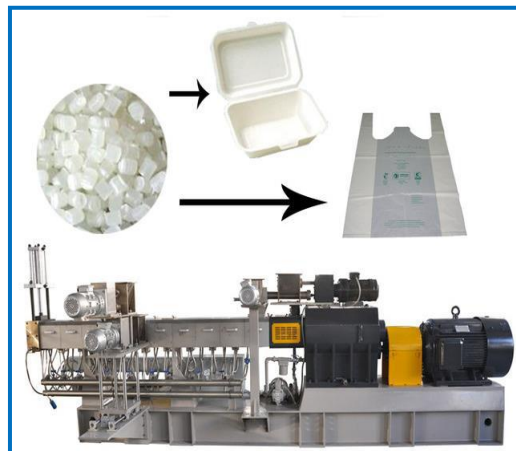


Fig 6. Twin screw extruder

Results & Discussion

S.No	Name of the Test	Result
1	Effects on strong acid	It takes 70 minutes to completely soluble.
2	Tensile test	The tensile strength of bio plastic is found to be 0.013 Mpa.
3	Effects on weak acid	It takes 176 minutes for the sample to be completely soluble.
4	Flammability test	It takes 24 minutes for complete burning of bioplastic and converted into ash.
5	Effects on air	Exposure on air did not have any effect on the samples.
6	Biodegradability test	The ability to degrade takes upto 3-6 months.
7	Effects on water	It takes 498 minutes for bio plastic to be completely soluble in water.

I) Advantages of Bio plastic

- Biodegradable wastes offer reduced carbon dioxide levels.
- Biodegradable plastics are broken down by naturally occurring bacteria.
- Biodegradable plastics does not release any toxic gases when it is burnt.
- Bioplastics are more eco friendly and sustainable materials than conventional plastics.
- Bioplastics easily decompose into the soil as they are biodegradable and compostable.
- Bioplastics consume less energy during the manufacturing cycle.

ii) Limitations of Bio plastic

- Biodegradable plastics become more expensive.
- Biodegradable plastics require the weather to cooperate with their disposal.

Conclusion

In this study, the replacement of plastic material by natural bio plastic material is studied. Based on the results, the obtained bio plastic have good degradable capability, eco-friendly, and it will neither not cause any harmful effects to the environment and human health nor it liberates toxic gases and the studies have concluded that the use of bio plastic can result in 42% of reduction in carbon footprints. Hence the material will be best alternate solution for replacing plastics and more concerned about the environment and eco friendly. Depending upon their properties can be referred to as biodegradable, compostable, hydro-biodegradable photo degradable. Biodegradable is one of the components of composting. Composting in addition, requires disintegration of 90% of the material to size less than 2 mm, and also mandates that the compostable material does not create any eco toxicity in the soil. By composting biodegradable plastic along with the other biodegradable waste, we can generate much needed carbon rich soil (humus) instead of filling up our valuable land with waste. Compost amended soil can have beneficial effects by increasing water & nutrient retention in soil, reducing chemical inputs (toxins, pesticides, etc) and suppressing plant diseases.

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Conflict of Interest

None of the authors have any conflicts of interest to declare.

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