

Manufacturing of Biodegradable Plastics

Vinod Ingale¹ and A. Hariram²

Department of Chemical Engineering

Pravara Rural Engineering College, Loni, Rahata, Ahmednagar, Maharashtra, India

Savitribai Phule Pune University, Pune, Maharashtra, India

vinodingale2002@gmail.com¹ and hariramenon@gmail.com²

Abstract: *Plastics have been an integral part of our lives for several decades in the form of convenient and useful commodity items. Plastic products are usually inert, chemically stable, resistant to corrosion, water-proof, durable and light-weight. Furthermore, the fact that conventional plastics are derived from fossil fuels and are also responsible for greenhouse gas emissions during their manufacture is often a sore point. In particular, the plastic bag has in recent times come under attack for its prolific presence in the environment, and its impact on said environment. Degradable plastic bags were created to help solve the problems highlighted and they are often promoted as more ecologically, and environmentally friendly alternatives to conventional, non-biodegradable plastic bags.*

Keywords: Environmental Costs, Environmental Benefits, Biodegradable polyesters.

I. INTRODUCTION

Today, polymers are an integral part of contemporary life because of their desirable properties including stability, resilience and ease in production. Worldwide production of plastic is increasing day-by-day. At present, about 99% of all plastic materials are manufactured by the petrochemical industries. Production and processing of plastics are energy exhaustive processes; leads to increased the emission of greenhouse gases. Plastics on burning release venomous emissions such as carbon monoxide, chlorine, hydrochloric acid, dioxin, furans, amines, benzene, 1,3- butadiene, and acetaldehyde which poses threat to environment. Plastic takes many years to degrade, So we need to prepare biodegradable plastics which takes maximum three months to degrade that preferable and which is also cheaper than normal plastic. Starch is one of the major sources in the development of bioplastic. Many previous studies have been conducted by using starch as a natural biopolymer. Starch consists of a long chain of two glucose units joined together, namely branched polymerized amylopectin and amylose, which gives its granular structure. Due to its large availability, low cost, renewability and biodegradability, starches are commonly used in the production of bioplastics.

Starch can behave like a thermoplastic in the presence of plasticizer, with application of heat and mechanical treatment. As native starch-based films are limited to high water affinity and brittleness, other natural biopolymers are often added as fillers to modify and improve films' properties.

II. LITERATURE REVIEW

2.1 The Problem of Plastics

Over the past decade, man has manufactured more plastic than we did in the century before that. Plastics production worldwide increased from 322 million tonnes in 2015 to 335 million tonnes in 2016 alone (Plastics Europe, 2017). Half of all plastics produced are considered as disposable due to being single-use plastic products and packaging materials. But think about it, how can a one-use item be made of a material that been specifically engineered to be "indestructible", where does it go? After their service life is exhausted and the plastic product becomes waste, most of these plastic wastes are not dropped off in garbage cans for consequent removal to incinerators, recycling centres, or landfills. Rather, they are indiscriminately discarded in proximity to where their useful life ends abruptly. Discarded on the ground, tossed out of a moving vehicle, piled up on a gorged garbage bin, or stolen away by a current of wind, they immediately become an aesthetic problem and pollute the local ecosystem. Increasing accumulation of these plastics in the environment has become a worldwide problem and severe threat to the planet.

2.2 Characterizing Biodegradability of Polymers

Characterizing Biodegradability of Polymers during examination of the biodegradability of a material, results cannot depend solely on chemical analysis of the polymer. The effects of the environment also should be considered.

For simplification, biodegradation environments can be separated into environments where; oxygen is absent (anaerobic), and oxygen is present (aerobic). These are then further subdivided into terrestrial and aquatic environments. Microbial action and hence biodegradability is affected by the:

- Oxygen uptake rate
- Thermal conditions
- Availability of water
- Chemical environment
- Predominance of microorganisms.

Several analytical approaches have been established to measure the extent and nature of biodegradation. These characterisation systems are intended to study the physical, chemical, and mechanical properties of the polymer before and after degradation, which will aid in understanding the degree in addition to the mechanism of degradation. Since the characteristic exposure setting involves incubation of a polymer substrate with enzymes or microbes.

Measurements are hence limited as regards the reactive products, to the microorganisms, or to the substrates. Universal approaches existing for the study of biodegradation processes include:

- Monitoring reaction products
- Monitoring the depletion of substrates
- Monitoring microbial growth
- Monitoring changes in substrate properties

III. OBJECTIVES AND SCOPE OF THE PROJECT

3.1 Main Objective

The primary purpose of biodegradable plastics is to replace traditional plastics that persist in landfills and harm the environment. Therefore, the ability of microorganisms to break down these plastics is an incredible environmental advantage.

3.2 Sub Objective

1. To study the manufacturing process of Biodegradable Plastic production.
2. To study the use of Biodegradable Plastic.
3. Select the best process for production of Biodegradable Plastic from molasses.

3.3 Scope of Project

The development of bioplastics produced by microorganisms will be carried out, where microorganisms equipped with polymer synthesis functions will be screened, their synthesis mechanisms will be clarified, and cultivation methods will be studied.

IV. MANUFACTURING PROCESS

4.1 Method and Material

Biodegradable Plastic By using corn-starch:

To make the biodegradable plastic from corn-starch firstly we need to mix all the ingredients:

1. Vinegar-5ml
2. Cornstarch-7.5gm
3. Glycerol-7.5gm
4. Distilled Water-50ml
5. Food colour (if required)-2-3drops

And the keep mixture on the stove at medium flame. Stir continuously as mixture heats. heat it for 10-15 min. Finally, we get thicker a translucent mixture. Pour the mixture onto foil paper. We can mould it into a shape. Allow the plastic to dry for at least two days. It has fully hardened [1].



Fig. 1 Raw Materials Needed



Fig. 2 Mix All Ingredients and Stir in Low Flame



Fig. 3 Pour the Mixture Onto Foil for Moulding and Dry for 2 Days.



Fig. 4 Final Product

V. RESULT AND DISCUSSION

5.1 Result

Bio plastic which nothing but green plastic was obtained in 2-3 days. Material that was used to such bio plastic was easily available as well as very cheap [1]. Preparation of Bio plastic by using corn-starch is not required higher professional assistance and it could be manufacture in large scale. Material which is used to make such type of bio plastic are easily available. Bio plastic made from corn-starch is very hard and degradable.

5.2 Discussion

It is found that plastic made from corn-starch is 100 percent biodegradable. Biodegradable plastic helps in reducing environmental pollution. Need of Bio plastic is more ever as it helps to minimize pollution rate the plastic causes many health problems so then biodegradable plastic is best alternative to improve our health.

It is found that plastic made from corn-starch have many applications in order to manufacture gift card, baskets, tableware, cutlery, etc. due to harden property.



Fig.5 Indian Govt. Bans the Use of Plastic Materials Effective from July, 2022

5.3 Economics and Production

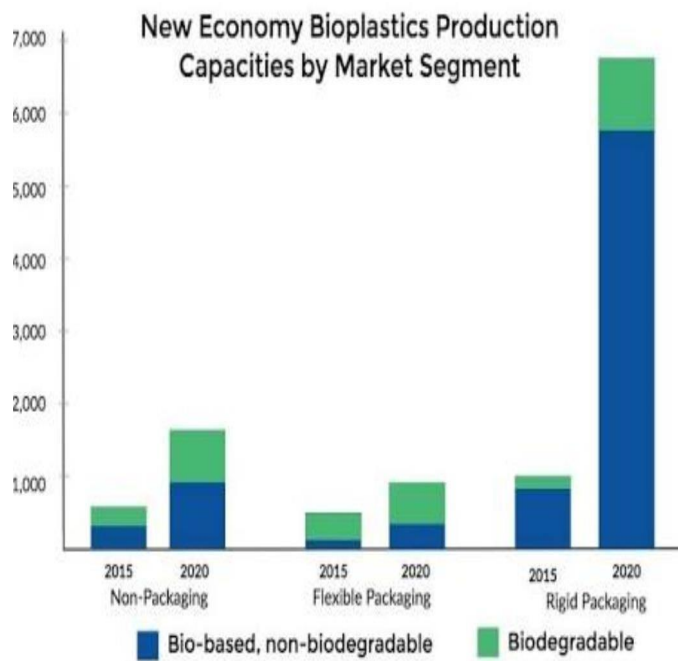


Fig. 6 Production of Non Biodegradable Plastic and Biodegradable Plastic Every Year
Biodegradable plastics can be applied in a range of useful ways.

1. Manufacturing of Gift Cards.
2. Manufacturing of baskets, tableware, Cutlery, etc.
3. They can be foamed into packing materials, extruded, and injection-moulded in modified conventional machines.

VI. CONCLUSION

It can be concluded that this review paper is to create awareness about the waste materials such as vegetables peels and other waste materials that they are used for preparation of biodegradable plastic which eco-friendly to our nature. And that is the most preferable plastic in today's life. Biodegradable plastic covers 1% of all of the plastic present at the moment. So, we need to increase the production of biodegradable plastic.

REFERENCES

- [1]. V. Sharon Keziah, R. Gayathri, V. Vishnu Priya. Biodegradable Plastic Production from Cornstarch. Vol 10, Issue 7, 2018.
- [2]. Ajay Yadav, S. Mangaraj, Ranjeet Singh, Sanjay Kumar Das, Naveen Kumar M. And Simran Arora. Biopolymers as packaging material in food and allied industry. International Journal of Chemical Studies 2018 ;6(2): 2411-2418