

# Plastic disposal and comparative study on degradable and non-degradable

<sup>1</sup>Balaji J, <sup>2</sup>Dr.Nataraja M M, <sup>3</sup>Vinod K L, <sup>4</sup>Shashikanth N

<sup>1</sup>Research scholar, <sup>2,3</sup>Assistant Professor, <sup>4</sup>Associate Professor  
Mechanical Engineering Department,  
Dr. Ambedkar Institute of technology, Bengaluru, India

**Abstract:** Exposure to chemicals during manufacturing, use and waste disposal in the life cycle of plastic materials can be a direct health problem to human beings. We are trying to solve this major problem by putting in efforts to manufacture a degradable plastic which can be derived from natural ingredients. By using natural ingredients like potato, we are aiming to produce degradable plastic. This type of plastic would degrade completely within few months. And also it would be non-toxic and environment friendly.

**Keywords:** degradable, polymers, environment, polylactic acid

## I. INTRODUCTION

A plastic waste is present everywhere and is reported from arctic to Antarctic, from the surface to the sediment [1]. Global production of plastic is now up to 300 million tons [1]. Most chemicals for producing plastic polymers are derived from non-renewable crude oil [2]. Six basic types of plastic dominate today's market: polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), polyurethane (PUR) and polyethylene terephthalate (PET). Packaging is world's largest plastic sector. In the United States, Europe, Australia and Japan, plastics are classified as solid waste [3]. A wide range of species have been reported to be negatively impacted by plastic debris: marine birds [4, 5], sea turtles [6], cetacens [7], fur seals [8], sharks [9] and filter feeders [10] are just some of those documented. Plastic degradation in nature is very slow. This means that almost all plastic ever produced still exists in our environment in some form. This type of pollution also involves a more stable but clear problematic aspect- the chemicals hiding in the so often handy material.

## Theory:

Plastics are formed by polymers consisting of smaller units known as monomers, which are combined with bonds to form long chains. Plastic is a word that originally meant "pliable and easily shaped". That means plastic can be re-modelled into required shapes and it is flexible in nature. There are two types of plastics mainly,

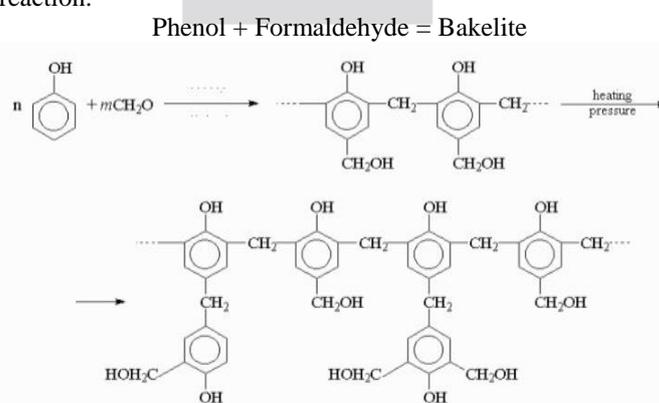
1. Natural polymer plastics
2. Synthetic polymer plastics

Natural polymer plastics can be extracted from nature and these occur in nature. Examples include silk, wool, cellulose and proteins, etc.

Synthetic polymer plastics are man-made polymers. Examples include polypropylene, polystyrene, etc.

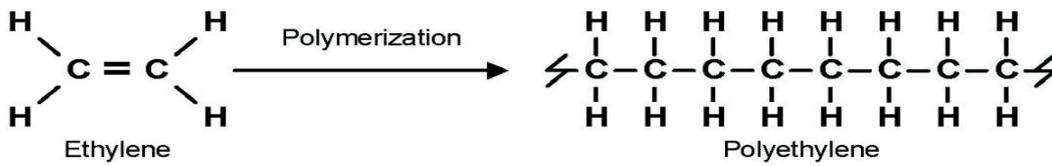
Plastic was invented accidentally by "Leo Hendrik Baekeland" in 1907. The polymer Bakelite which comes from monomers phenol and formaldehyde is the first synthetic polymer introduced to the world. Leo Hendrik Baekeland is the father of plastics. Before this invention, a scientist "Alexander Parks" invented the first man made plastic called "Parkesine" in 1862. Since it is the combination of nitro-cellulose in solvent like alcohol/wood naphtha which polymerises like vegetable oil, it can be degradable.

First synthetic polymer chemical reaction:

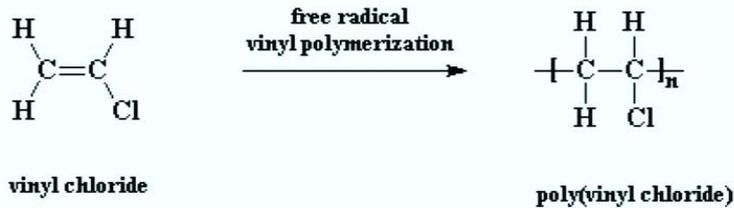


The chemical structures of some polymers are given below:

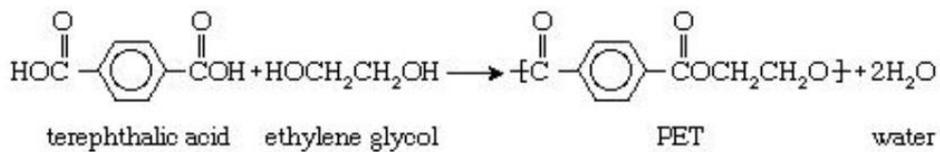
Polyethylene:



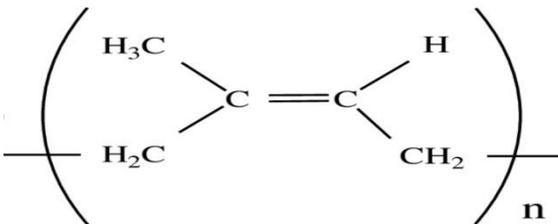
Poly vinyl chloride (PVC):



Poly ethylene terephthalate (PET):

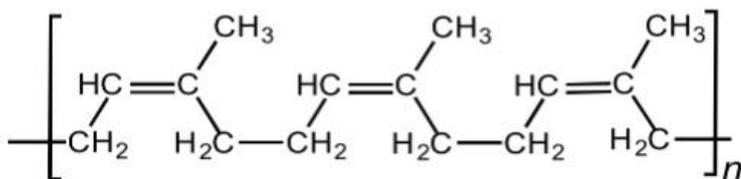


Natural rubber:



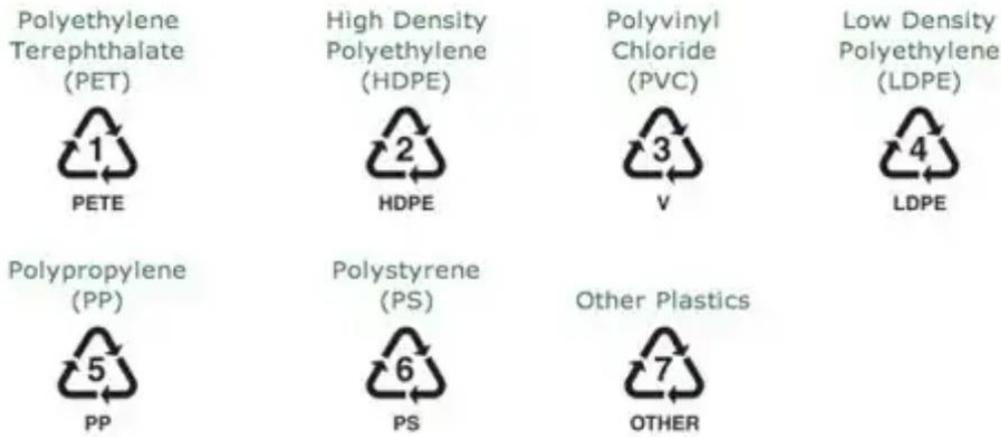
It is extracted from a tree called Hevea Brasiliensis.

Synthetic rubber:



It is flame resistant and acts as an insulator.

Specific codes are given to every type plastic which are unique and which denotes the type of plastic.



These codes were given by SPI (society of plastic industry) in 1988.

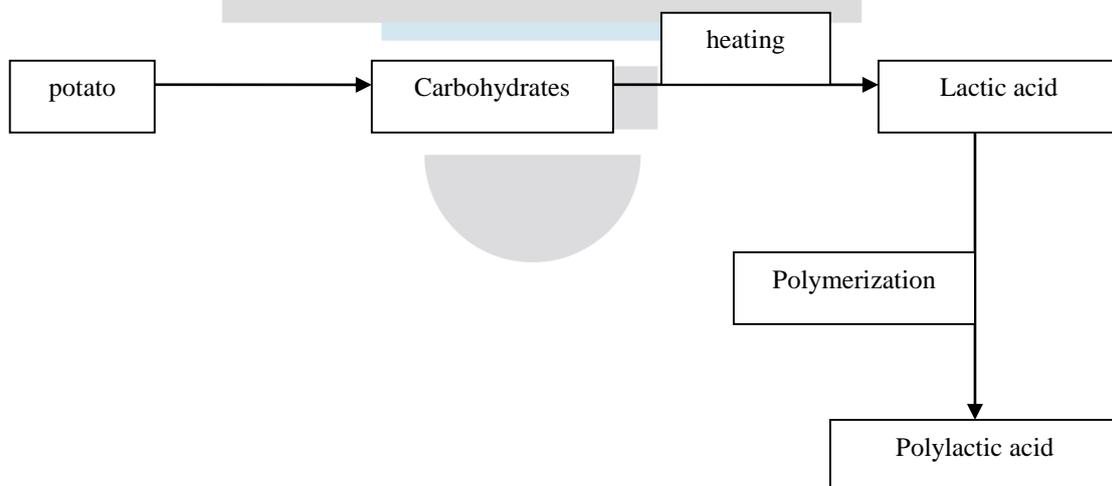
**Experimental Analysis:**

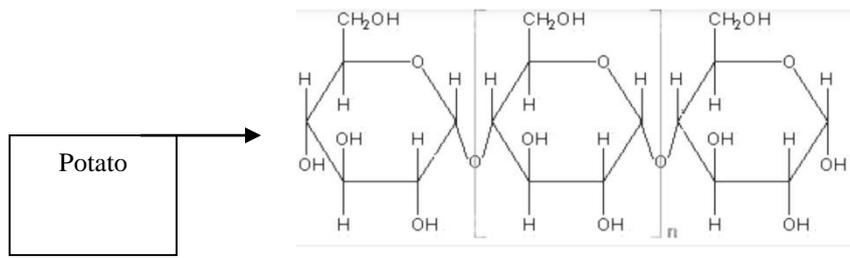
To produce /manufacture degradable plastic.

Required ingredients: potato, water, beakers, HCl (0.1M), NaOH (0.1M), glycerol.

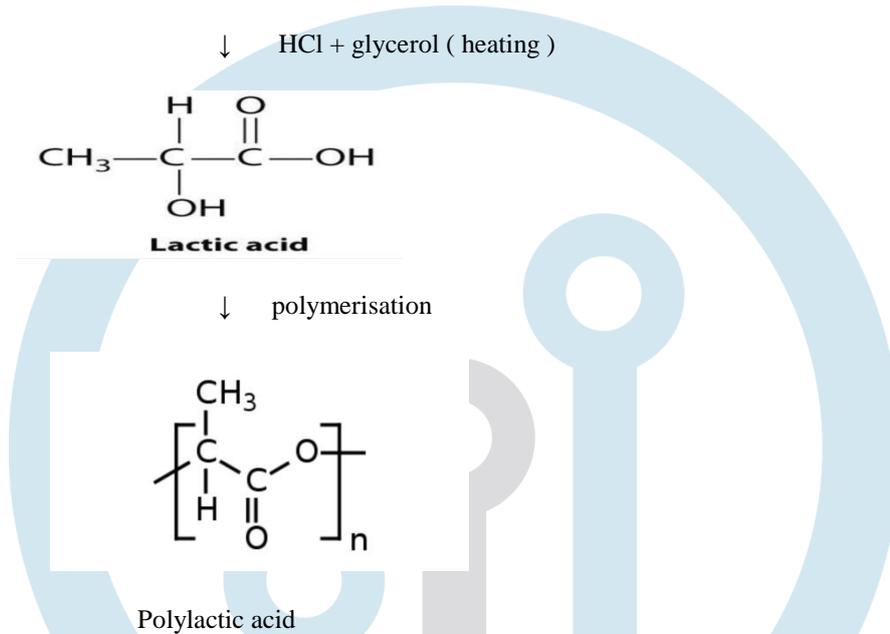
- Take 3-4 potatoes and wash them with water. Peel out the outer layer of the potatoes.
- Grate the potatoes using grater. The carbohydrates are held and stored in cells of potatoes. To extract, we need to break these cells by crushing them.
- After this take the crushed potatoes into a grinder with 100 ml of water.
- Pour the liquid through a tea strainer, repeat the process with more water. Leave it for 5 minutes.
- After 5 minutes, the starch settles out at the bottom of the beaker. The liquid can be decanted(poured) off.
- Now starch is left in the beaker. Add 100 ml of water to rinse the starch again. The water can be decanted off. This leaves clean wet starch in the beaker.
- If we dry the starch in an oven. We obtain a white powder.
- To 2.5 gms of starch, add 25 ml of water and 3 ml of HCl (0.1M) and stir it. Then add 2 ml of glycerol.
- After this, the mixture is heated with a burner for 15 minutes. With the help of universal indicator test, the nature of the mixture is determined. If the indicator turns red it shows the mixture is acidic. Then add 0.1M NaOH and stir the mixture.
- This NaOH will neutralise the mixture and therefore the universal indicator shows green colour.
- Now, pour the mixture into petri dish and spread it out.
- At last bake this mixture in an oven. We get a plastic in some amount of pieces.

**Flowchart:**





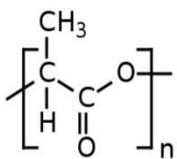
**Starch (carbohydrate)(amylose)**



**Result and Discussion:**

From this experiment, a plastic which is degradable is produced. i.e, polylactic acid plastic.

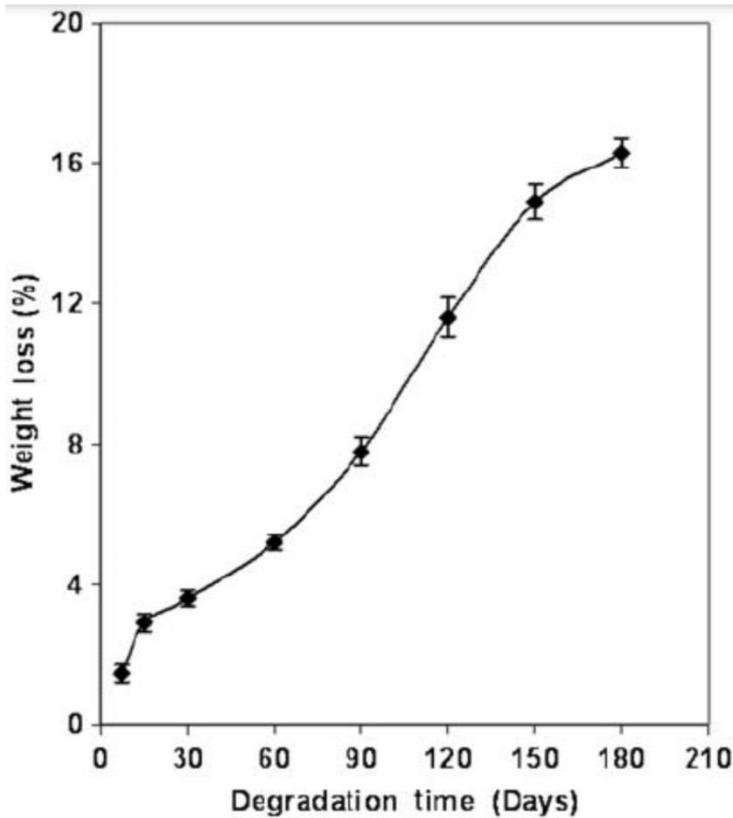
**Polylactic acid:**



**Degradation cycle:**

Product → (decomposition) → CO<sub>2</sub> → (photosynthesis) → plants → (conversion of plastic materials) → plastic synthesis → (molding) → product

Graph expected:



### **Conclusion:**

We conducted an experiment on producing a degradable type of plastic which is obtained from natural ingredients like potato.

Since this plastic is made from natural ingredients it does not harm the environment in any way. This plastic is biodegradable within few months. And this plastic helps in reducing the non-degradable waste.

By using degradable plastics, we can reduce the generation of non-degradable waste and we can effectively save our natural environment.

### **References:**

- [1]. Cressey, D. 2016. The plastic ocean. *Nature* 536. 263-265.
- [2]. Lithner et al. 2011. *Sci. Total. Environ.* 409, 3309-3324.
- [3]. Rochman et al. 2013. *Nature*. 494:169-171.
- [4]. Azzarello, M.Y.; E.S marine birds and plastic pollution, 295-303.
- [5]. Blight, L.K.; Burger, A.E. Occurrence of plastic particles in sea birds from the eastern north pacific 1997, 34, 323-325.
- [6]. Barreiros, J.P.; Barcelos, plastic ingestion by a leatherback turtle, 2001, 42, 1196-1197
- [7]. Baird, R.W.; Hooker, S.K. Ingestion of plastic and unusual prey by a juvenile harbour porpoise. 2000, 40, 719-720.
- [8]. Pemberton, D.; Brothers, N.P.; Kirkwood, R. Entanglement of Australian fur seals in man-made debris in Tasmanian waters. 1992, 19, 151-159.
- [9]. Sazima, I.; Gadig, O.B.F.; Namora, R.C.; Motta, F.S. Plastic debris collars on juvenile sharks in southwest atlantic. 2002, 44, 1147-1149.
- [10]. Moore, C.J.; Leecaster, M.K.; Weisberg, S.B. A comparison on plant and plankton in the north pacific central gyre. 2001, 42, 1297-1300.