

SYNTHESIS OF BIODEGRADABLE PLASTIC FROM SPOILT POTATOES

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Abstract: Plastics are typically organic polymers often containing other inorganic compounds. Conventional plastics are most commonly derived from precious petrochemicals. But over the time it leads to the depletion of fossils fuels and traditional plastic is proving to be a major environmental problem. In an effort to overcome these issues, an apparent solution being explored was 'Biodegradable Plastic. In this study biodegradable plastic are produced by using the starch of spoilt potatoes with the help of plasticizer. And this study reveals that Biodegradable plastic made from the starch of spoilt potatoes are good in strength and they are eco-friendly as it is completely degraded within a short period of time. So, Biodegradable plastic from spoilt potatoes gives a promising solution to the environmental problems and it can be used for various purposes in our day to day life.

Keywords: Biodegradable plastic, starch, potato, plasticizer.

1. INTRODUCTION

Our whole world is wrapped in Plastic. Plastic have become an important part of our lives. Plastics are typically organic polymers often containing other inorganic compounds. Conventional plastics are most commonly derived from precious petrochemicals, but some are partially natural. Raw materials to make plastic can be Fossil fuels.

Problems associated with Plastics:

But over the time, the amount of petroleum used to make plastic does contribute to depletion of fossil fuels. However traditional plastic is proving to be a major environmental problem because once it is discarded in landfills and oceans, it takes centuries to degrade as plastic are non-degradable. Another issue is that Conventional plastic are manufactured from non-renewable resources (such as crude oil, natural gas, coal etc.). [8] Plastics are so vital to our lives and so versatile in their usage that their use cannot be completely stopped. Hence alternative solution to this problem is being looked into. The alternate salvation had come called 'Biodegradable Plastic'. The term Biodegradable plastic is a plastic which can be broken down biologically into organic substances by the activities of living organisms like fungi, bacteria or other microorganisms which can completely metabolize them to carbon-dioxide and water. [2]

Starch Based Biodegradable plastic:

Starch is a natural polymer. It is a white granular carbohydrate produced by plants during photosynthesis and it serves as the plant's energy store. Cereals plants, rhizome and tuberous plants normally contain starch in large proportions. Starch is a renewable resource of plant that is biodegradable. [1] Starch can be processed directly into biodegradable plastic on adding plasticizer (like sorbitol, glycerol etc). Plasticizer is used to impart flexibility and mould ability to the plastics and thus produce a range of different characteristics. Owing to its complete biodegradability, low cost and renewability, starch is considered as a promising plant source for synthesis of Biodegradable plastic.

One of the well known starch rich source is Potato (*Solanum tuberosum* L.) belongs to the family Solanaceae. It is an herbaceous plant grows to 0.4-1.4m tall and may erect to fully prostrate. Stems nearly hairless to densely hairy and may be green or purple, leaves are pinnate. Potato is a perennial cultivated worldwide in over one hundred countries throughout Africa, Asia, Australia, Europe and North America.

As those potatoes which either been stored for a long time or in warm temperatures, such potatoes were treated as spoilt or they were not edible and they just become a waste, so starch of such spoilt potatoes can be used for synthesis of biodegradable plastic. Hence, hence the present study is designed with the objective to study the synthesis of biodegradable plastic using the starch of spoilt potatoes and its degradability.

2. MATERIALS AND METHODS

1) SAMPLE COLLECTION AND PREPARATION

Spoilt potatoes were collected from the local market of Gandhinagar, Gujarat. The potatoes were peeled and washed thoroughly in water to remove dirt's and other foreign particles.

2) STARCH EXTRACTION

After the manual peeling and washing of spoilt potatoes, they were cut into small pieces and the sample were ground in a laboratory blender with distilled water. The ground slurry was then sieved and filtered using a coarse sieve and filter cloth respectively. Thereafter, the filtrate was allowed to settle for 2 hours, the resulting starch was washed three times with distilled water and allowed to settle for 21 hrs. After 21hrs, supernatant was decanted, the starch (wet) was dewatered manually and then oven dried at a temperature of 55°C for 4hours. Finally the dried starch was collected in a container for further use.

3) STARCH YIELDS

Starch yield was measured in percentage by comparing the weight of obtained starch (dry basis) with the weight of dry matter sample (Spoil potato). The Starch Yield (SY) was determined by the equation:

$$SY (\%) = \frac{W_1}{W_2} \times 100$$

Where W_1 (in gm) is weight of dried starch and W_2 (in gm) is the weight of original sample (Spoilt potato) [8].

4) PREPARATION OF BIODEGRADABLE FILM

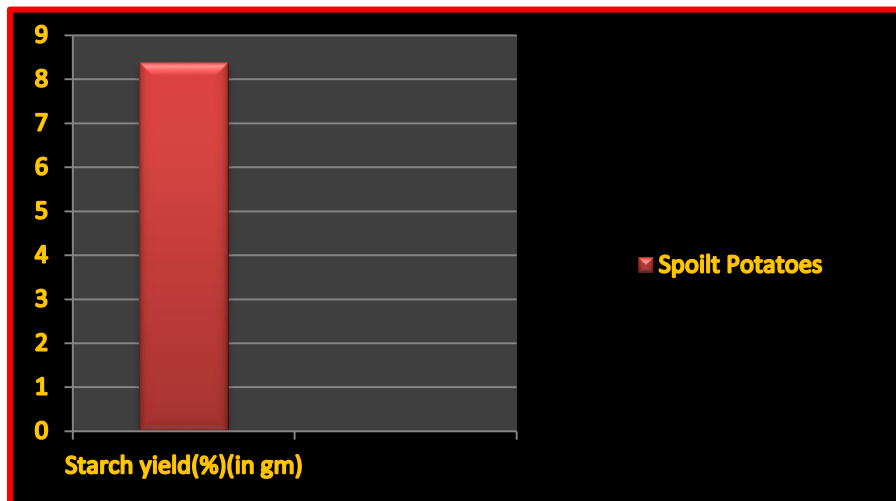
Once the starch was extracted from spoilt potatoes, 5.5g of potato starch was mixed in 30.6ml distilled water with dilute HCL on addition of 2.5ml of plasticizer. This mixture was heated on hot plate for 5mins. After cooling, balance the pH with NaOH. Spread this mixture into a glass plate and kept it in the oven for 21hrs at 55°C.

3. RESULT AND DISCUSSION

As studies says potatoes contains a starch in a sufficient amount but potatoes have its own economical importance. Potatoes which were stored for more than 3months in warm temperatures were considered as spoilt potatoes which were not edible and treated as a waste. So in this study starch was extracted from the spoilt potatoes and it gives white powdered starch.



Fig 1: Showing white powdered starch extracted from spoilt potatoes



Graph 1: Showing starch yield in gram (%)

Graph1 shows that when starch was extracted from Spoilt potatoes then the total starch yield was 8.37 %.(in gms)

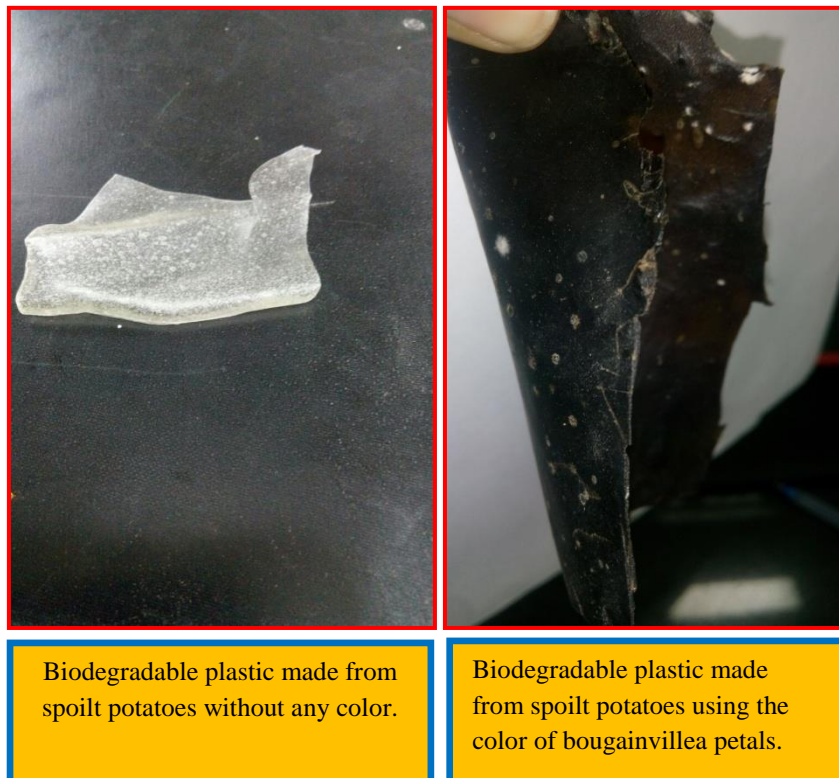


Fig 2: Showing Biodegradable Film from spoilt potatoes

4. DISCUSSION

Our experiment shows that starch could be extracted from the spoilt potatoes and it gives a sufficient amount of starch. According to Fleming, biodegradable plastic from corn starch was feasible and good in strength but if biodegradable plastic was made from starch of spoilt potatoes it was more feasible and higher in strength. [4] A colored biodegradable plastic was made from the starch of spoilt potatoes as same as resulted in the experiment done by E.S Stevens. [6]

5. CONCLUSIONS

This study has shown that the chemical process is a promising method for extraction of starch from spoilt potatoes. It is relatively simple and low cost process and it produces good quality of starch. Spoilt potatoes which were stored for more than 3months in warm temperatures which is considered as a waste in market has been utilized to make Biodegradable

plastic which can be used for packaging, catering products, consumer electronics, automotives, agriculture/horticulture and toys, textiles and a number of other segments. [3] By combining the disciplines of Engineering, Agriculture, Food packaging, and Chemistry, new biodegradable packaging solutions from renewable plant resources will help to address this environmental concern of rampant worldwide growth in plastic wastes.

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