

# Comparative study of Fibre Reinforced Bioplastic from Corn and extracted Potato peel starch

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**Abstract**— In many fields use of plastic has been spread. Due to problem of biodegradation period and low solubility in the environment in existing plastics. Biodegradable plastic with certain properties is generally preferred. Since the new invention and findings are required to be done in large extent to solve the difficulties in use of plastic without affecting the environment by improving its properties. The alternative environmentally friendly bioplastics prepared from other resources due to their its specific properties in place of harmful environmental impacts of plastic materials used in packaging are required to use. For better in their mechanical and chemical properties properties most of the bioplastics are starch-based. In this study, experiments were conducted with various materials like corn starch and starch derived from potato peel to produce bioplastics. And to determine the effect of these materials on the final product by its comparative study of its various properties.

**Index Terms**— Bioplastics, Corn Starch, Potato peel, Gelatine, chemical mechanical properties.

## I. INTRODUCTION

Now a days, for environmental sustainability concern research in alternate material for plastic formation is required for its better biodegradability. To minimize the ecological hazards the biodegradable plastics offers innovation in solutions to form the conventional petroleum-based plastics. Which enhances the world of biodegradable plastic films from natural food waste like potato peel and corn starch. Significant attention to the potato peel, corn-based bioplastics due to its potential reducing waste and easy solubility. Whereas the extracted corn from potato peel and corn starch has the distinct property to derive the biodegradable plastic films. In this study comparative analysis seeks to result into the properties, degradation rates, mechanical strengths, and overall environmental

impact of both potato and corn biodegradable plastic films.

In the experimentation, the combination of corn starch and gelatine was tested for its outcomes on the mechanical and chemical properties of the final sample. Also effect on the mechanical and chemical strengths of the final product was examined. The outcome of the product examined by its strength, solubility, biodegradability, texture, tensile strength, elongation, density, moisture content, clarity and surrounding effect on the product. Also, both the films derived from corn starch and extracted starch from potato peel (waste) for their chemical composition OH group was tested the FTIR analysis was done. The produced bioplastic films show better texture and tensile strength. By estimating the bioplastic film characteristics, it can be used for household food packaging due to its chemical and mechanical properties at a cost-effective rate. Additional banana fibre can be used strengthening better mechanical properties, biodegradability, and overall functionality compared to the pure constituent components. This product can be used and manufactured domestically and industrially, and it showed long life durability and proper degradation. Further innovation is required to be done for the enhanced and potential industrial applications of this initiation in bioplastic.

## II. MATERIAL AND METHODS

For conducting intensive comparative study of biodegradable plastic films derived from corn and extracted starch from potato peel, the materials are as fallow

| Raw material | Properties   |
|--------------|--------------|
| Starch       | Main polymer |
| Fibres       | Strength     |
| Glycerol     | Flexibility  |

|                 |                              |
|-----------------|------------------------------|
| Citric acid     | Crosslinking and plasticizer |
| Gelatine        | Binding agent                |
| Distilled water | Homogeneous mixture solvent  |

Starch extraction from potato peels: Starch Extraction process: The potato peels were collected from different sources and then processed to extract starch from them. The entire process will take two to three days. The procedure for extraction of starch is as follows-

- Sorting and Washing- remove all the damaged parts from the waste, wash the peels 2-3 time to remove any residual dust
- Disinfection and Size reduction- maximum extraction, peels have to be reduced in size to create a homogeneous mass.
- Filtration- Prepare a homogeneous mixture and allow this to flocculate then filter this solution to remove fibrous waste twice.
- Sedimentation- The filtrate then is allowed to sediment to remove any impurities.
- Drying- Once the starch is free from impurities, it is dried and reduced to a uniform size in a miller or mixer
- Further sieved to get the homogeneous powder.



Fig: Extracted starch from potato peels waste

Bio plastic preparation method: Bioplastic is an alternative for traditional plastic and can help reduce many problems. As its strength is quite low, fibres are added to the composition matrix, this increases its strength. Followed the procedure to bioplastic formation such a composite on a laboratory scale.

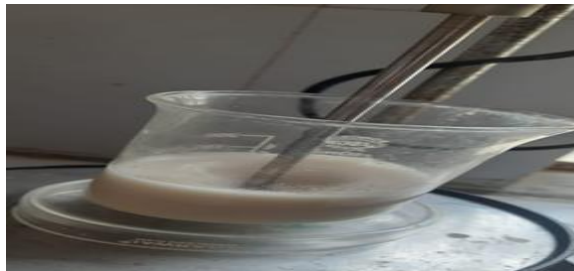
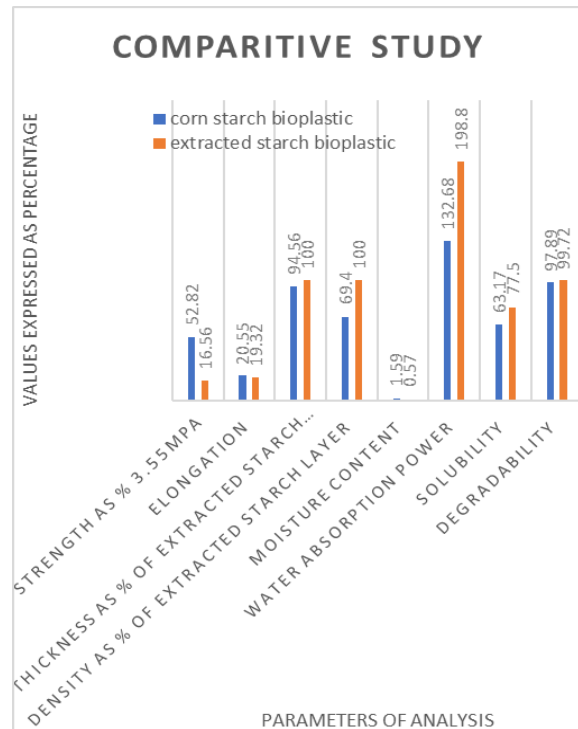


Fig: Use of electric stirrer of starch solution

#### IV. RESULT AND DISCUSSION

By comparing results obtained from two different bioplastics made from different sources. For first sample we took corn starch as the main ingredient and for second sample we took potato peel extracted starch as the main ingredient. All other things were in same proportion. Every test was conducted in identical environment. Results for tests conducted on bioplastic made from corn starch and starch extracted from potato peel are as follow: -

| Testing Parameters | Bio plastic prepared from corn starch | Bio plastic prepared from extracted starch potato peel |
|--------------------|---------------------------------------|--|
| Strength           | 1.875 load in N                       | 0.588 load in N  |
| Elongation         | 20.55 mm @ max load                   | 19.31 mm @ max load                                    |
|                    | 31.07 mm @ break point                | 35.71 mm @ break point                                 |
| Average Thickness  | 0.2624mm                              | 0.2774 mm  |
| Density            | 1.794 gm/cm <sup>3</sup>              | 2.585 gm/cm <sup>3</sup>                               |
| Moisture content   | 1.59%                                 | 0.57%  |
| Absorption         | 132.68%                               | 198.8%   |
| Solubility         | 63.17%                                | 77.50%   |
| Biodegradability   | 97.89%                                | 99.78%   |



## V. CONCLUSION

In the comparative study between biodegradable plastic films from corn starch and starch extracted from potato peel got the several findings. Both materials show importance as alternative to the traditional plastics which environmentally friendly. This study has covered the bioplastics, degradability, standards, advantages and disadvantages. As the trials proceeded, it was concluded that most of the properties of corn starch-based bioplastic and potato peel extracted starch-based bioplastic were almost same. The potato peel starch bioplastic did lack strength, but it could be easily accounted for by adding many sources like PLA or any protein. In terms of biodegradability, both films exhibited promising results, breaking down into non-toxic components over time. The potato starch film showcased slightly faster degradation, potentially making it preferable for applications with minimal use duration. Moreover, in this study if fibre was added in bioplastic to increase the strength. It is a good alternative in packaging industry. Adding antimicrobial agents will ensure safety of food product. Laboratory glycerol was used during the trials but it is suggested that glycerol obtained as by-product from biofuels can be used on commercial basis. In conclusion, both corn and potato extracted starch-based biodegradable plastic films offer valuable alternatives, each with its own set of advantages. Further research and development are necessary to optimize production processes, address scalability challenges, and explore diverse applications, ultimately contributing to a more sustainable future.

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