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Fabrication of Bioplastic by Reinforcing Coconut Coir

Anbukkarasi. M[1], Balamurugan. M[2], Dhanasankar. S[3], Steve Paxon R[4]
[1,2,3,4]*Department of Agricultural Engineering, RVS Educational Trust's Group of Institutions, Dindigul, India.*

Abstract: *Bioplastic films were developed using tapioca starch and coconut coir fibre reinforced with glycerol, gelatin, citric acid, vinegar, and water. Tests conducted showed that the thickness of the bioplastic is about 500 microns, tensile strength of 6.29 MPa, water absorption of 42.54% and successful synthesis confirmed by FTIR analysis. The bioplastic exhibited potential biodegradability and environmental compatibility. Soil burial test indicated partial disintegration after seven days, highlighting the material's eco-friendliness. This research contributes to sustainable bioplastic development, offering a solution to plastic pollution.*

Keywords: *Coconut Coir, Tapioca starch, Reinforcement, Bioplastic.*

INTRODUCTION

Plastic is derived from fossil fuels, while bioplastics are made from renewable sources like starch and cellulose. Bioplastics offer biodegradability and reduced environmental impact compared to traditional plastics. Tapioca starch and coconut coir are used to create bioplastic films. Coconut coir adds strength, durability, and moisture resistance to the material. Bioplastics can help reduce reliance on fossil fuels and combat plastic pollution.

MATERIALS AND METHODS

A mixture along with vinegar and glycerine was added to water, heated, stirred and dried to create a bioplastic film by solution casting method. Tensile strength was tested using the Universal Testing Machine, Soil Burial Test was conducted to assess biodegradability and FTIR characterization was carried out. Tapioca starch, coconut coir, vinegar, glycerine and distilled water were key components. Magnetic stirrer, Bunsen burner, measuring cylinder and tray were utilized in the process.

RESULT AND DISCUSSION

The results obtained from the tests conducted on the fabricated bioplastic showed a thickness of 500 microns and the increase in thickness results from the increase in the starch content because it undergoes gelatinization during the heating process, forming a more rigid and crystalline structure that reinforces the bioplastic matrix because of its solid content that makes the polymer denser (Isotton *et al*. 2015).

The tensile strength of 6.29 Mpa was recorded, this is because of the presence of lignin and hemicellulose from the fibre surface but if the composition exceeds more than 50% then it reduces the tensile strength (Arbanah Muhammad *et al*. 2018) and a water absorption of 42.54% shows the increase in the percentage of absorption is mainly due to the presence coconut coir fibre and cassava starch that increases water absorption due to their hydrophilic nature and ability to attract water. Glycerol enhances the hydrophilicity of the bioplastic, allowing more water to penetrate (Arbanah Muhammad *et al*. 2018). The FTIR analysis confirms the successful synthesis of a bioplastic incorporating starch and coconut coir, where the starch and coconut fibre have contributed to the presence of a hydrogen-bonded hydroxyl group (Arbanah Muhammad *et al*. 2018). A partial degradation of the film within seven days was observed; shows that increasing the amount of starch and glycerol made the bioplastic residual mass decreased and biodegradability increased due to the hydroxyl group in starch the initiates the hydrolysis reaction of the polymer after absorbing water from the media. (Nissa *et al*. 2019).

Table 1: Test Results

S.No	TESTS	RESULT (UNIT)
1.	Tensile strength	6.29 Mpa
2.	FTIR analysis	Spectrum enclosed
3.	Water absorption (Duration 1hr @ 27 ± 2°C)	42.54 %
4.	Average thickness	500 microns
5.	Resistance to Soil Burial for 7 days	After 7 days sample found to have partial degradation

SUMMARY AND CONCLUSION

Bioplastic was made from tapioca starch and coconut coir with glycerol, gelatin, citric acid, vinegar and distilled water. Bioplastic had 500 microns thickness, 6.29 MPa tensile strength and 42.54% water absorption. Fourier Transform Infrared analysis confirmed the successful synthesis using coconut coir and tapioca starch. Biodegradability was absorbed for seven days and it was found to be partially degraded.

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