



BIOPLASTIC PRODUCTION FROM BIOWASTES (Citrus Peels and Coconut Husk)

Sudharsan K¹, Keshika S²

¹ Dept of Chemical Engineering, Annamalai University

² Dept of Bio Technology, Rajalakshmi Engineering College



INTRODUCTION

- Biowaste is biodegradable organic waste from biological sources. Bioplastics are plastics made from biomass and/or can biodegrade naturally.
- Food waste like fruits and vegetables contains natural polymers (starch, pectin, cellulose, lignin) suitable for making bioplastics.
- Brown coir fibers, rich in lignin and low in cellulose, are stronger but less flexible than flax or cotton.

METHOD (CITRUS PEEL BIOPLASTIC):

Citrus peel powder was added to a Citrus peel powder was mixed with water/ethanol (9:1) at a 1:15 ratio and stirred at 90°C for 2 hours. After centrifugation, the pectin-rich supernatant (A) was collected. The residue was treated with 1 M NaOH (150 mL), stirred again at 90°C for 2 hours, and filtered to extract cellulose. The cellulose was washed, then combined with Supernatant-A and 15% glycerol. This mix was incubated at 60°C for 1 hour, stirred into a uniform slurry, poured into Petri dishes, and dried at room temperature for 48 hours to form bioplastic films.



FIG: BIOFILM (COCONUT HUSK EXTRACT)



FIG: BIOFILM (ORANGE EXTRACT)

METHOD (COCONUT HUSK BIOPLASTIC):

10g of dry coconut husk was treated with 2.5M NaOH (300 mL) at 100°C for delignification. A condenser was used to return vapors. The solvent was separated, and 5 mL of conc. H₂SO₄ was added to precipitate lignin by heating at 60°C for 1 hour, then cooled overnight. Lignin was filtered, washed to neutral pH, dried at 50°C for 3 hours, and ground. The lignin was mixed with 50 mL water, heated, and combined with 3g gelatin and 0.2g citric acid, concentrated to 20 mL, and cast into bioplastic.



S.no	Pectin	Lignin	Citric	Temp
1	1	1	0	30
2	1	2	0.1	33
3	1	3	0.2	37
4	1	4	0.3	40
5	2	1	0.1	37
6	2	2	0	40
7	2	3	0.3	30
8	2	4	0.2	33
9	3	1	0.2	40
10	3	2	0.3	37
11	3	3	0	33
12	3	4	0.1	30
13	4	1	0.3	33
14	4	2	0.2	30
15	4	3	0.1	40
16	4	4	0	37

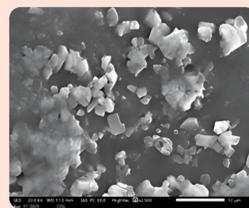


FIG:SEM IMAGE OF BIOFILM

RESULT:



FIG: BIOFILM FROM COMBINING ORANGE AND COCONUT EXTRACT

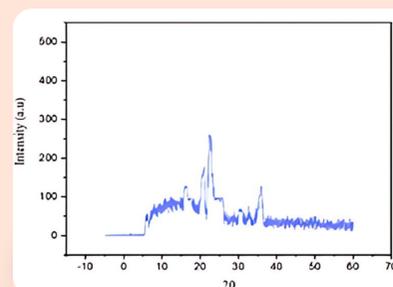
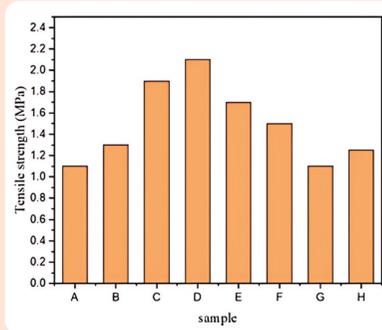
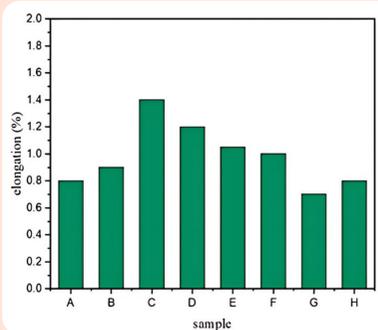


FIG: XRD GRAPH FOR BIOFILM



FIG:FILM BIODEGRADABILITY TEST

CONCLUSION:

- The experimental investigation revealed that the biofilm formulated with 2g of pectin, 4g of lignin, and 0.2g of citric acid at a temperature of 30 °C & 33 °C exhibited enhanced mechanical and physicochemical properties.
- In contrast, the formulation consisting of 2g of pectin and 3g of lignin, while still effective, showed comparatively lower values in key performance metrics.
- These findings suggest that increasing the lignin content along with optimal cross-linking through citric acid significantly contributes to the overall functionality of the biofilm.