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BIOPLASTIC PRODUCTION FROM BIOWASTES (Citrus Peels and Coconut Husk)

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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 (COCONUT HUSK BIOPLASTIC):

10 g of dry coconut husk was treated with 2.5 M NaOH (300 mL) at 100°C for delignification. A condenser was used to return vapors. The solvent was separated, and 5 mL of conc. H_2SO_4 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 3 g gelatin and 0.2 g citric acid, concentrated to 20 mL, and cast into bioplastic.

FIG: BIOFILM (COCONUT HUSK EXTRACT)

FIG: BIOFILM (ORANGE EXTRACT)

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.

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

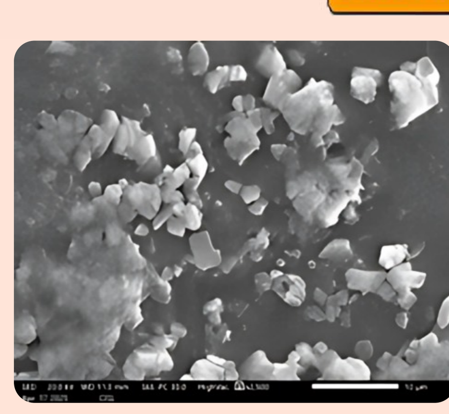
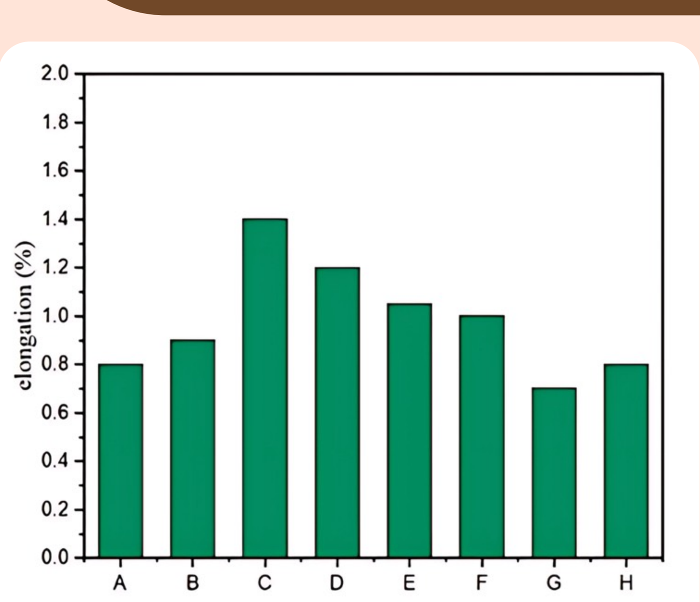
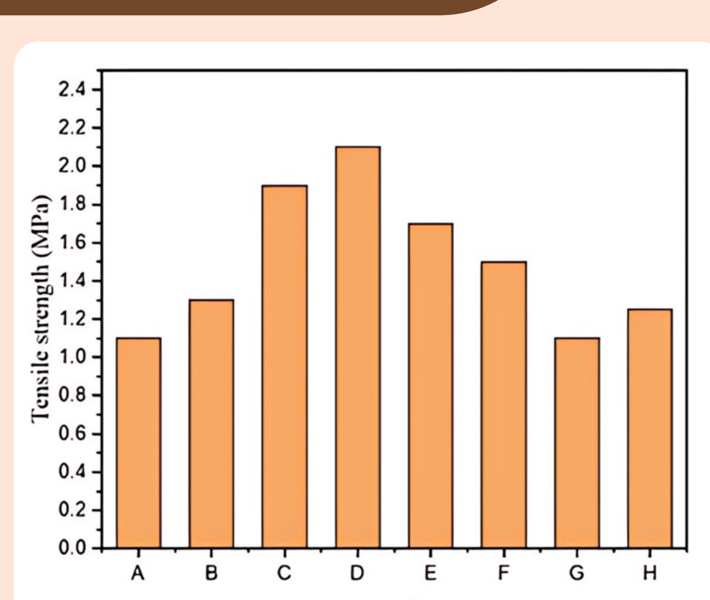


FIG:SEM IMAGE OF BIOFILM

RESULT:





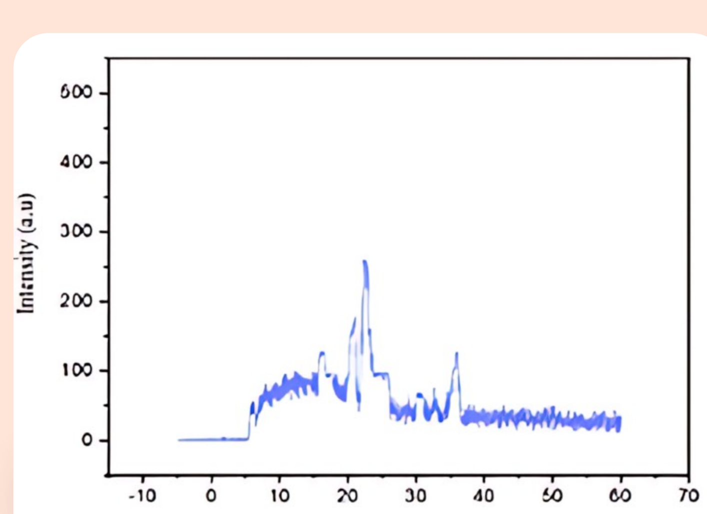


FIG: XRD GRAPH FOR BIOFILM

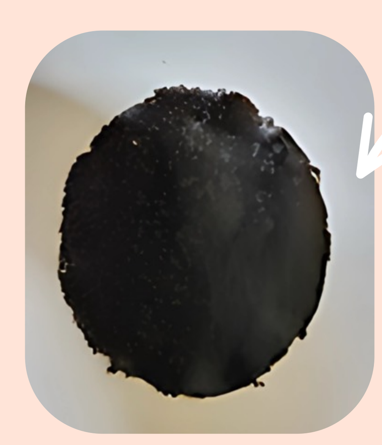


FIG: BIOFILM FROM COMBINING ORANGE AND COCONUT EXTRACT

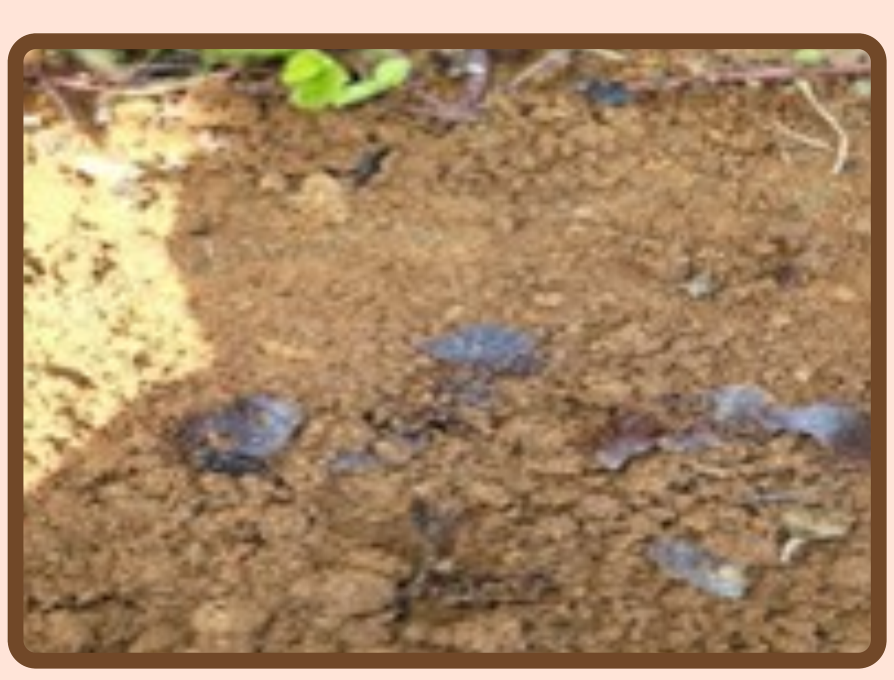


FIG:FILM BIODEGRADABILITY TEST

CONCLUSION:

- The experimental investigation revealed that the biofilm formulated with 2 g of pectin, 4 g of lignin, and 0.2 g of citric acid at a temperature of 30 °C & 33 °C exhibited enhanced mechanical and physicochemical properties.
- In contrast, the formulation consisting of 2 g of pectin and 3 g 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.