

NIT ROURKELA

Department of Food Process Engineering

COTTON SEED PROTEIN- BASED PACKAGING: A SMART AND ECO-FRIENDLY SOLUTION

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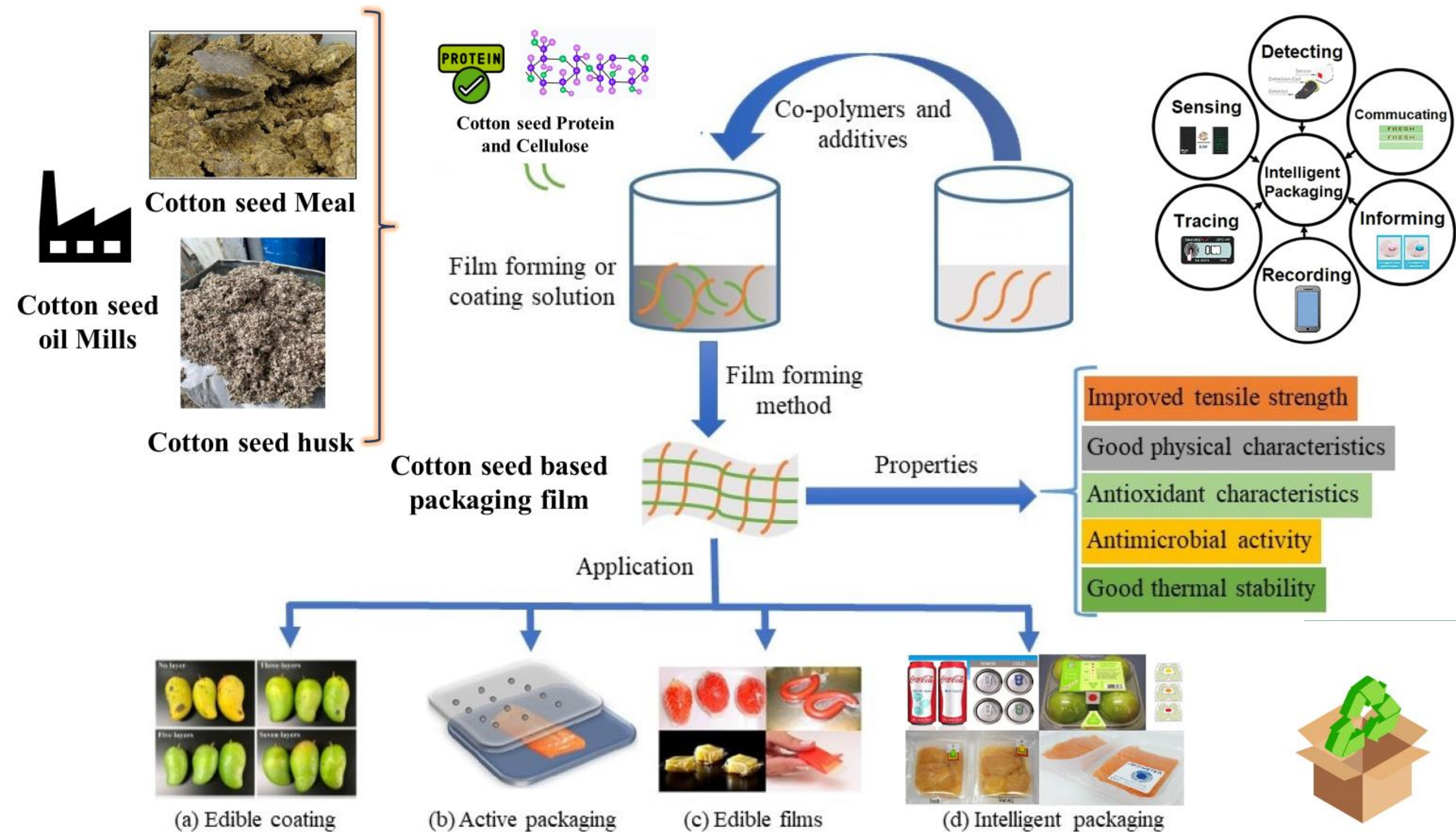


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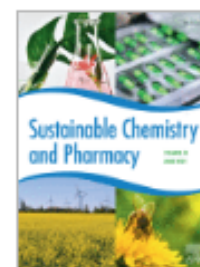


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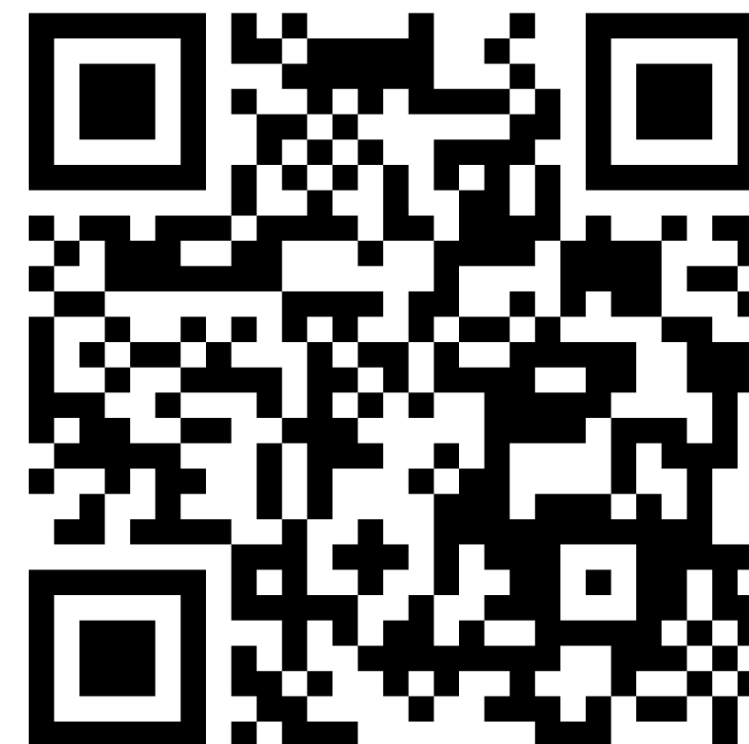
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IMPORTANCE



Biodegradable Materials:

Develop packaging from cotton seed protein and cellulose waste.



Carbon Footprint Reduction:

Optimize production and disposal to minimize environmental impact.



Consumer Demand:

Align with eco-friendly trends and global sustainability goals.

SUPPLY CHAIN AND MATERIAL SOURCING

01



Sources of Cotton Seed
Meal and Cellulose Waste

02



Partnership with
Cotton Mills

03

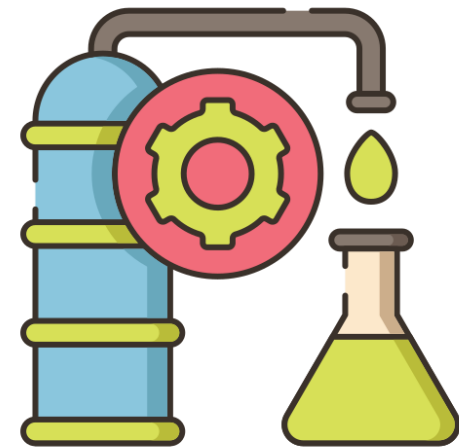


Development of Packaging films

BIOPOLYMER PROCESSING STRATEGIES

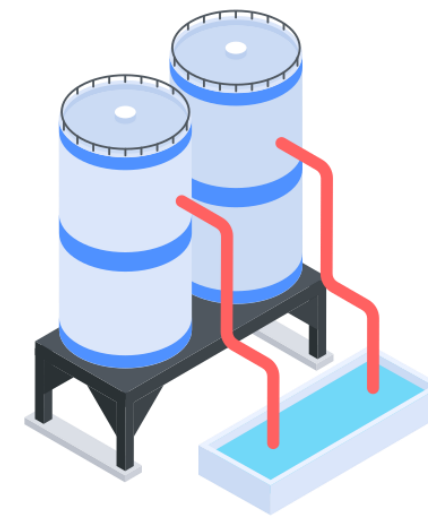
Protein Extraction Technique

- 1) Cotton Seed Meal (Defatting with Hexane)
- 2) Defatted Cotton Seed Meal (Alkaline Extraction with Sodium Hydroxide Solution)
- 3) Protein-Rich Solution (Isoelectric Precipitation at pH 4.5)
- 4) Precipitated Protein (Centrifugation and Washing)
- 5) Washed Protein (Freeze-Drying)
- 6) High-Purity Protein Powder (Ready for Film Formulation)

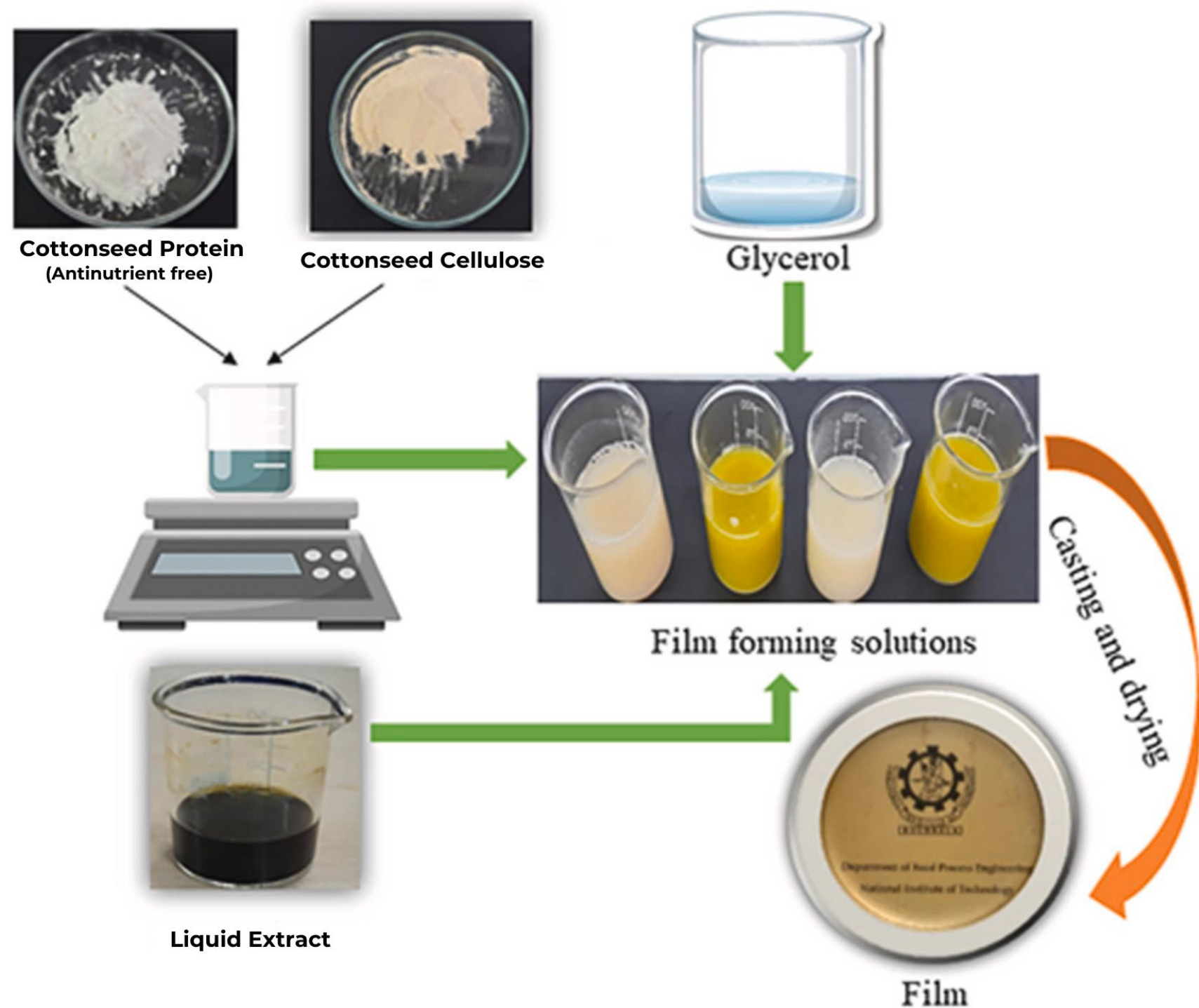


Cellulose Purification Method

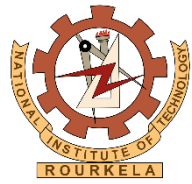
- 1) Cotton Seed Hulls (Treatment with Sulfuric Acid)
- 2) Hydrolyzed Hemicellulose and Lignin (Alkaline Treatment with Sodium Hydroxide)
- 3) Cellulose Mixture (Extensive Washing)
- 4) Purified Cellulose Fibers (Drying and Grinding)
- 5) Fine Cellulose Powder (Ready for Incorporation into Packaging Film)



FORMULATION PROCESS

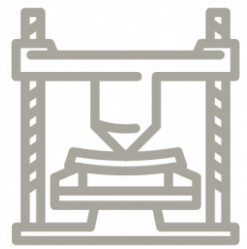


**APPLICATION FOR FRUITS
AND VEGETABLES**



COMPREHENSIVE EVALUATION AND APPLICATION

Prototype Development



Mechanical Property Tests



Biodegradability Assessments



Thermal Property Tests



Toxicity Assessments



Barrier Property Tests



Real-World Testing

ECONOMIC IMPACT



- Job Creation • Cost Savings
- Community Benefits • Market Competitiveness

ENVIRONMENTAL IMPACT



- Reduction in Plastic Waste • Lower Carbon Footprint
- Less Environmental Pollution • Circular Economy Promotion

SOCIAL IMPACT



- Improved Food Safety and Quality • Transparency and Trust
- Empowering Local Communities



CONCLUSION

The innovative packaging film made from cotton seed protein, cellulose, and functional agents represents a significant advancement in sustainable and intelligent packaging solutions.



Multifunctional properties providing protection, shelf-life extension, and real-time monitoring



Strong environmental benefits through biodegradability and reduced plastic waste.



Positive economic and social impact through job creation, cost savings, and improved food safety.

This innovation exemplifies the potential for combining sustainability and technology to create solutions that benefit the environment, economy, and society.



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Thank You

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