Functionalized Agro-Based Fiber Alternative for Enhanced Performance in Thermoformed Molded Fiber Packaging

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1865 THE UNIVERSITY OF MAINE
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Unlocking the Potential of Agro-Based Fiber Alternative



Reduced dependence on virgin wood fiber



More diversified and local supply chains



Circular-economy benefits



Potentially lower environmental footprint



Potential product differentiation

Proprietary business information of ADM.

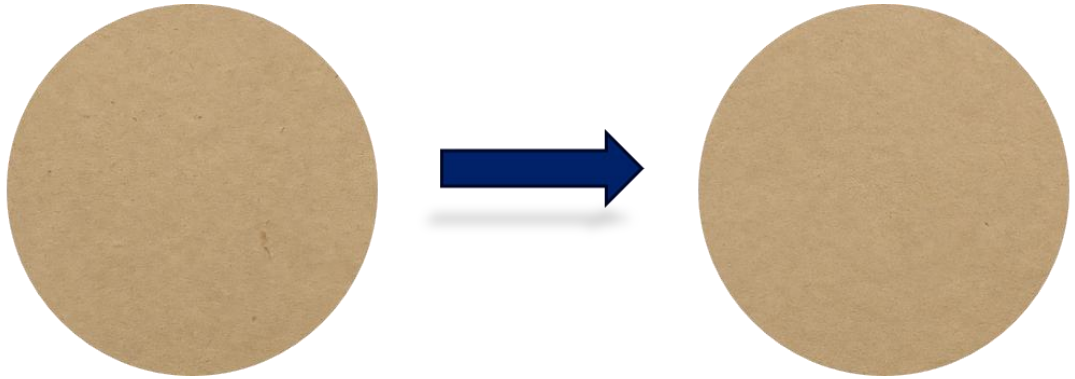
Translating Fiber Properties into Handsheet Performance

Proprietary business information of ADM.

Strength Testing

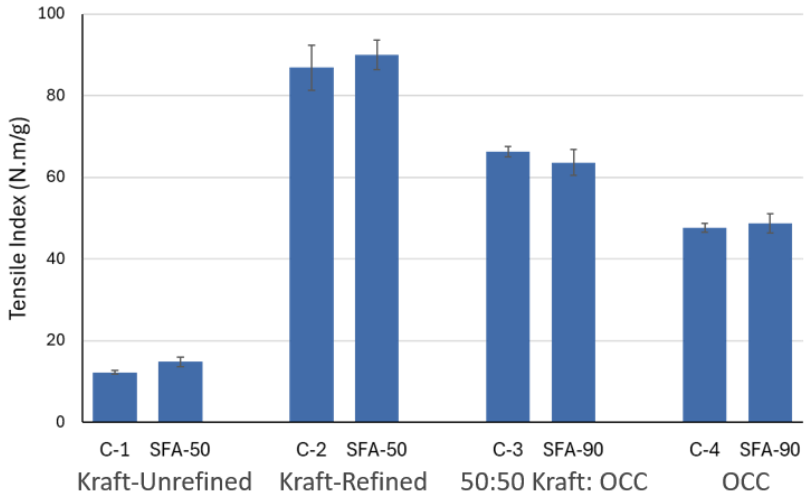
Soy Fiber Alternative

Control
100% Kraft

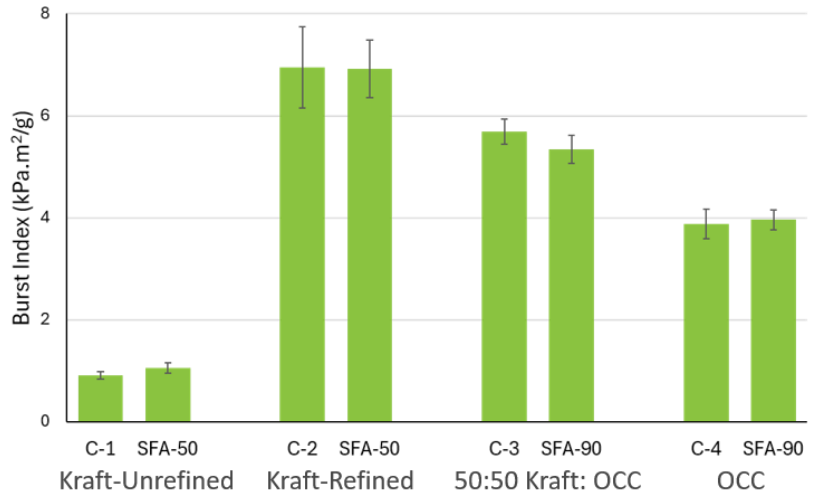


10% Soy
Fiber Alternative

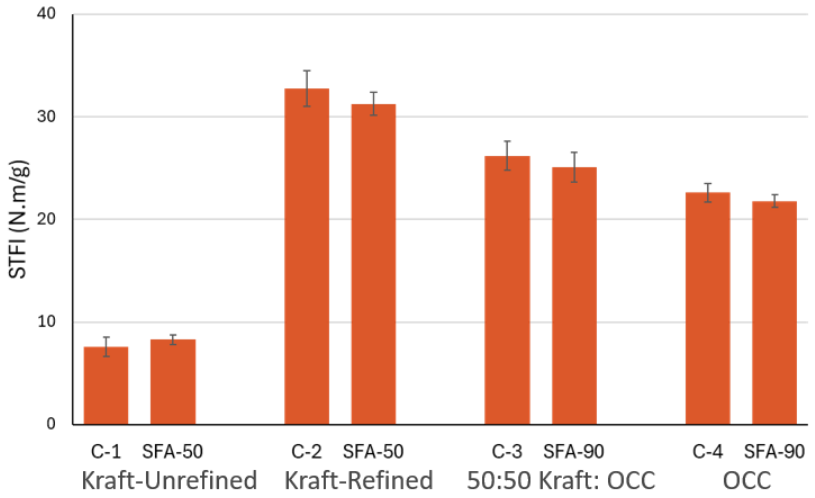
Tensile Strength



Burst Strength



STFI



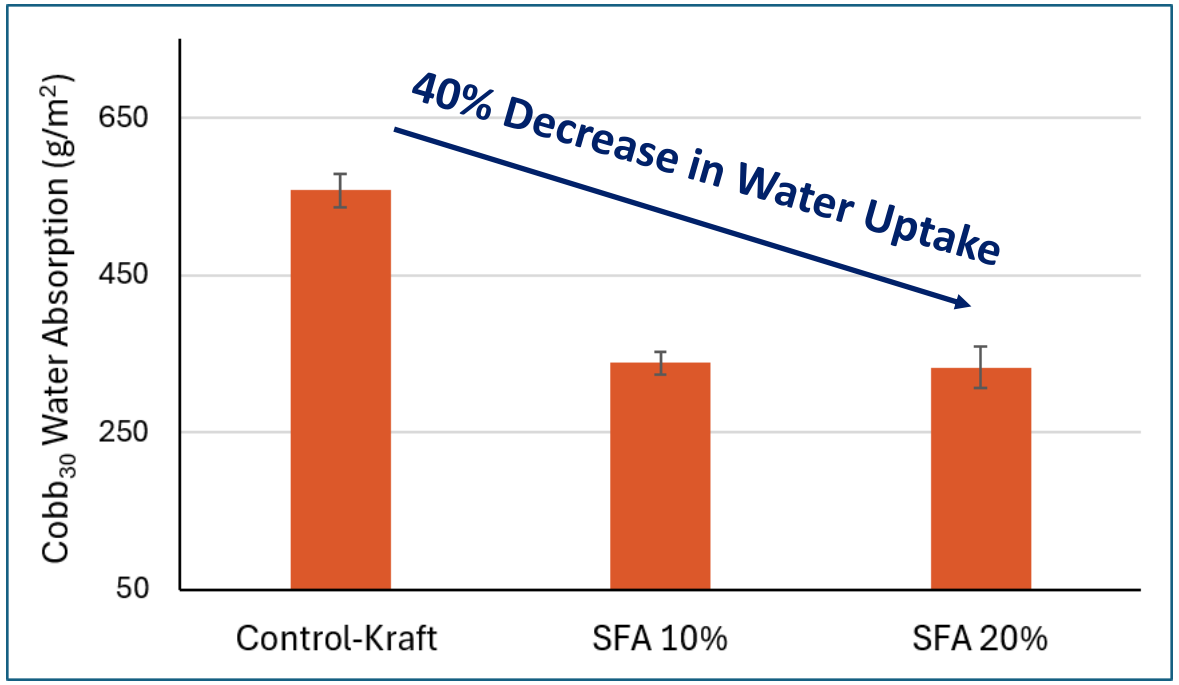
Water Barrier Properties

Soy Fiber Alternative

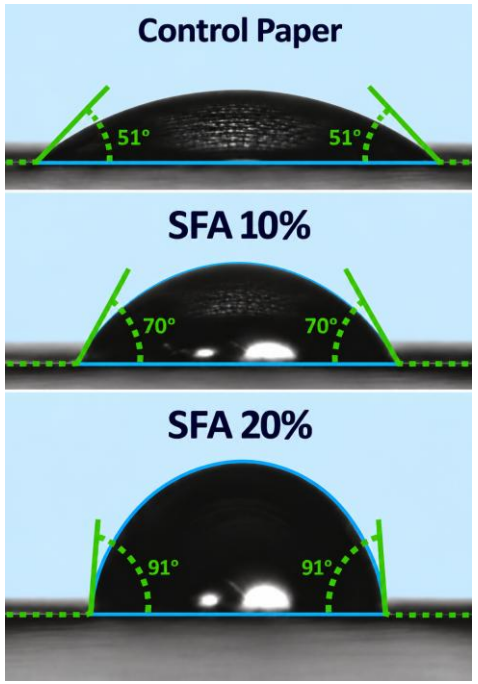
Cobb Test T441



Water Absorption



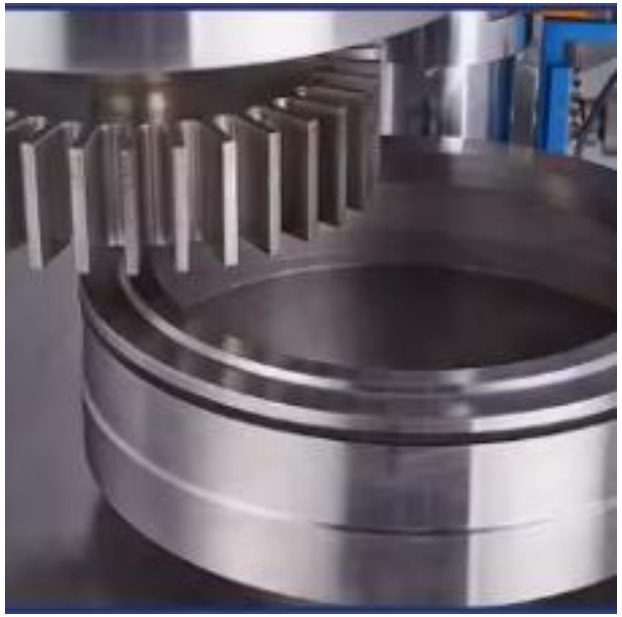
Surface Wettability



Proprietary business information of ADM.

Refining Conditions

Soy Fiber Alternative Refining Requirements



Targeted Freeness

400 mL CSF

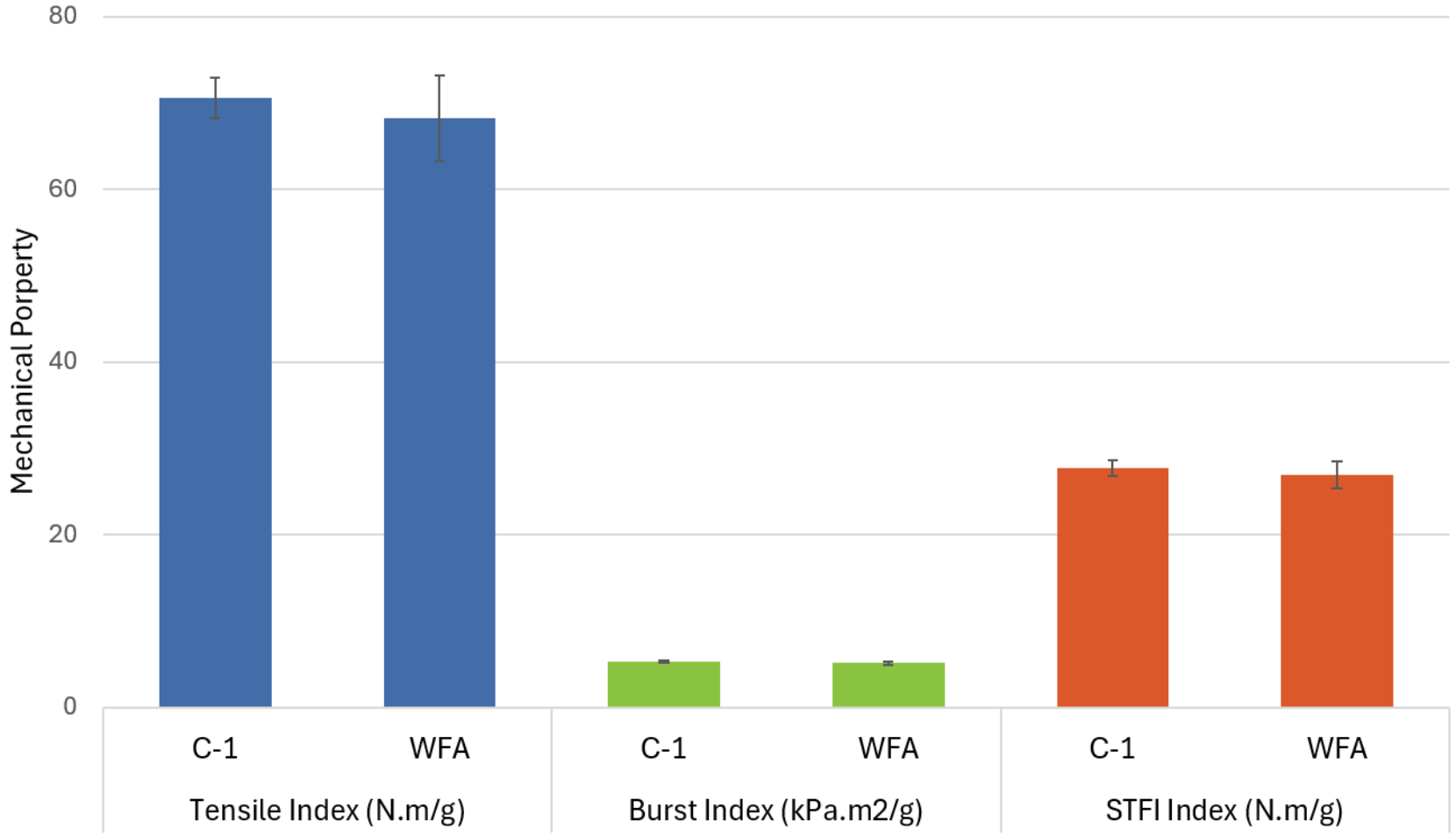
Sample	Refining (Revs.)
Control-Kraft	6,750
SFA 10%	4,750
SFA 20%	4,250

Reduced refining requirements while maintaining mechanical performance →

Potential Energy Savings

Strength Testing

Wheat Fiber Alternative





Control – 100% Kraft



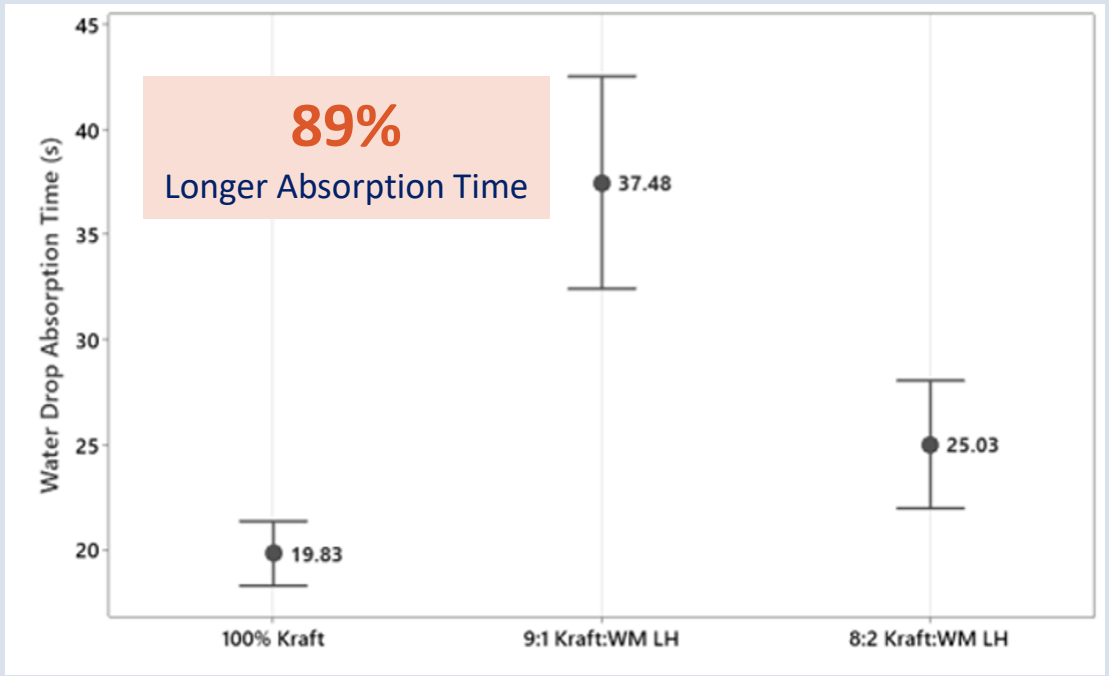
10% Wheat Fiber Alternative

→ Fiber substitution maintains comparable mechanical performance across furnish compositions

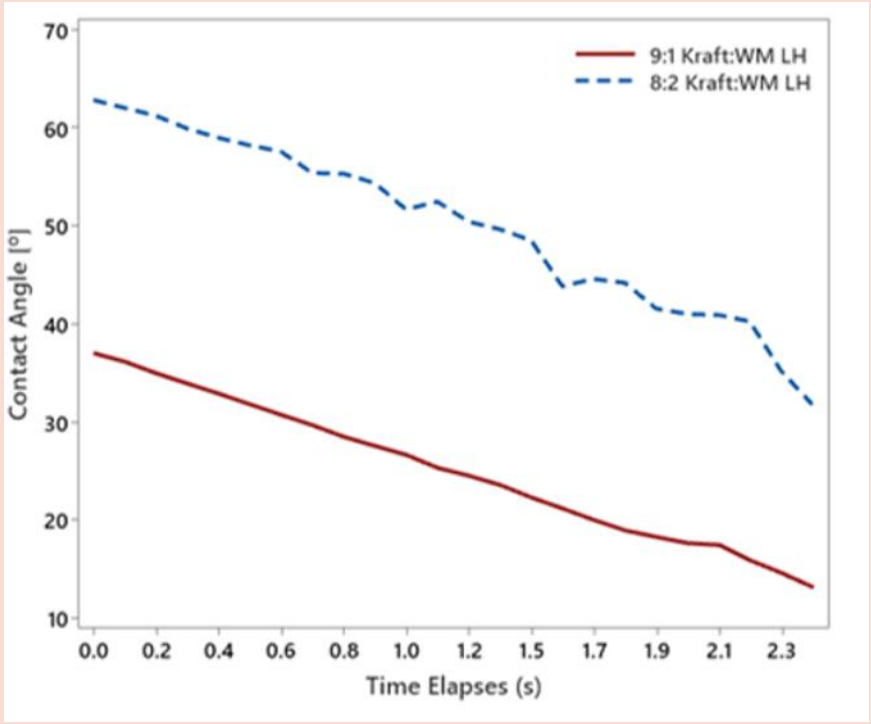
Water Barrier Properties

Wheat Fiber Alternative

Water Absorbency– T432



Contact Angle

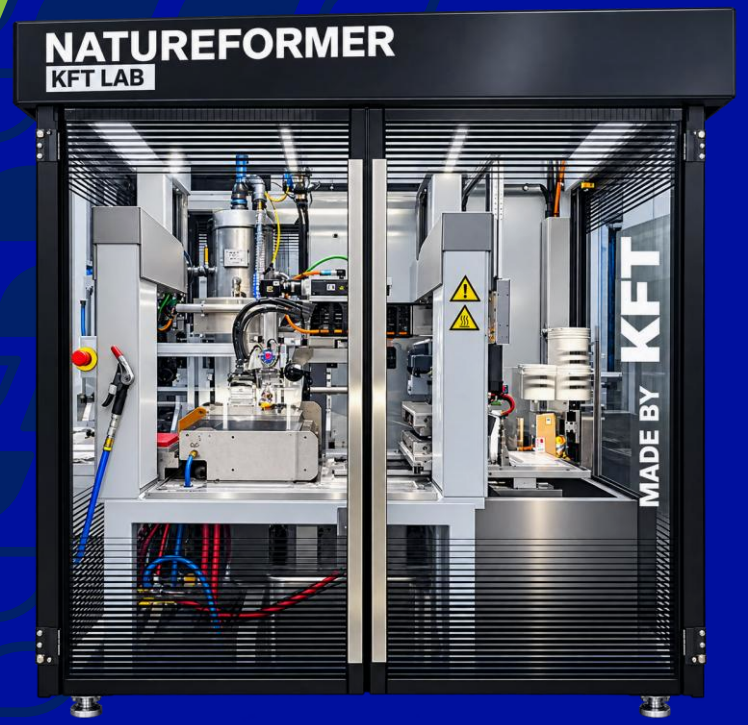


Contact angle not measurable for 100% Kraft due to immediate water absorption.

Agro-based fiber replacement improved resistance to water wetting and penetration

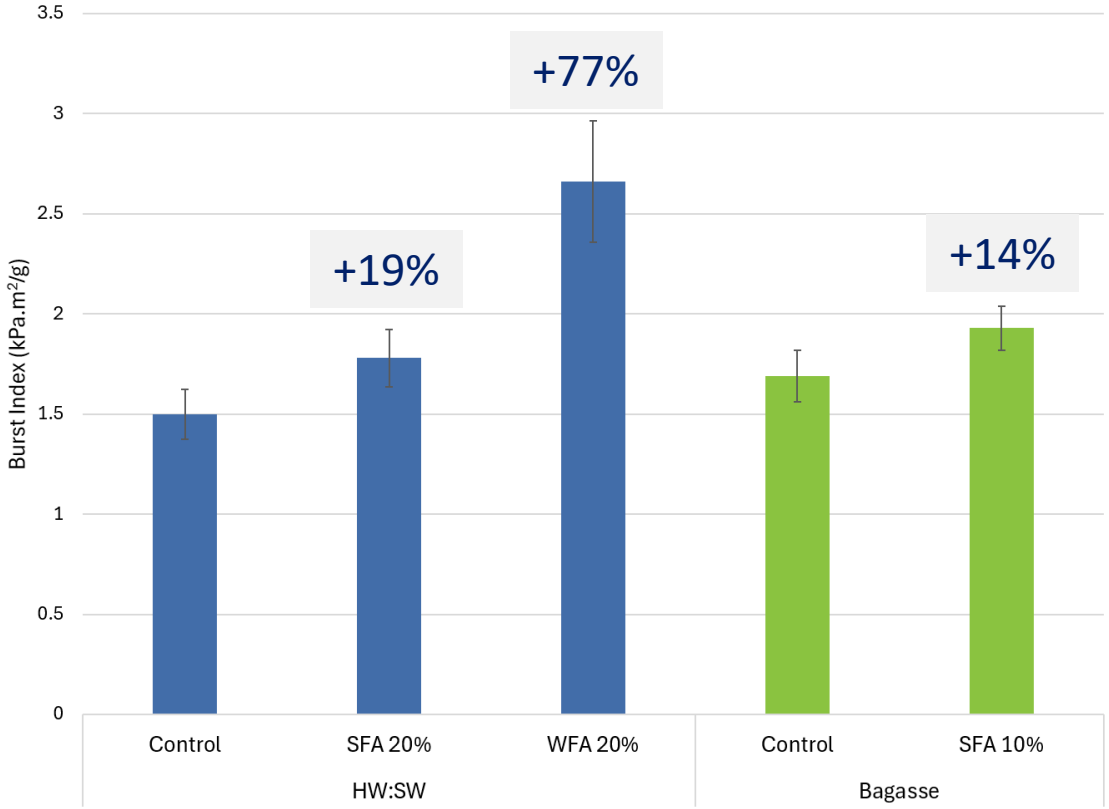
Proprietary business information of ADM.

Advancing Alternative Fibers into Molded Packaging

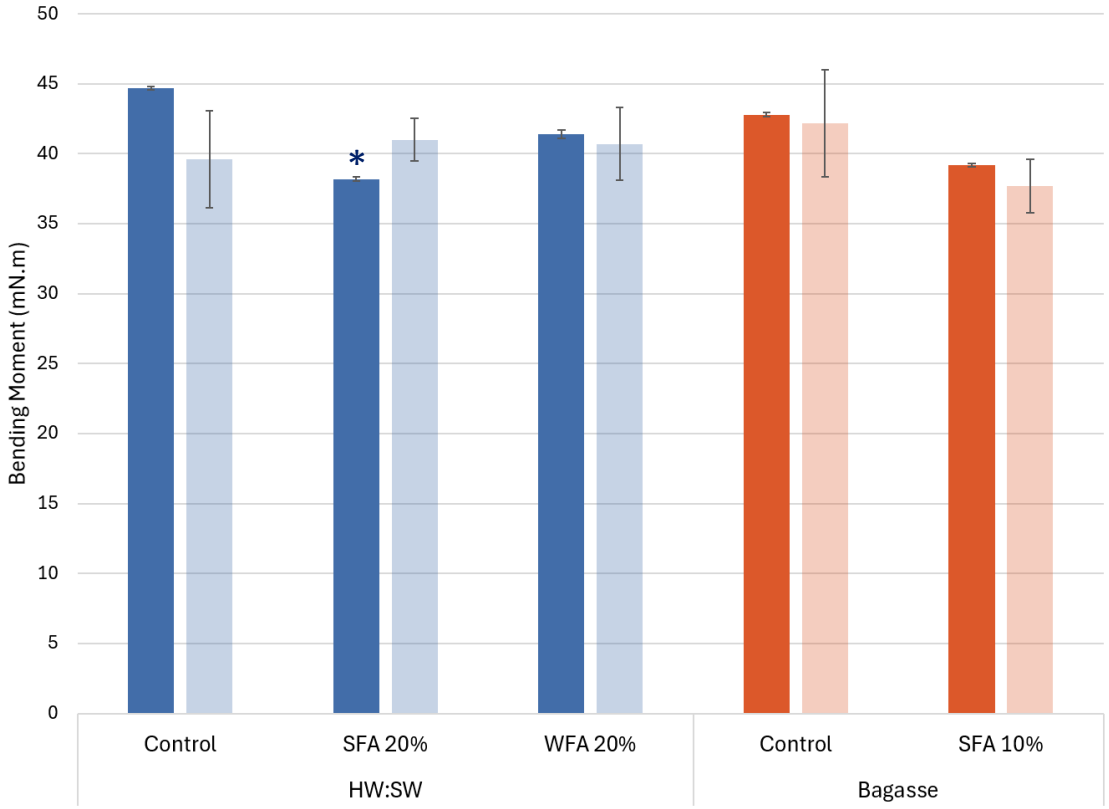


Soy and Wheat Fiber Alternatives

Mechanical Performance of Molded Fiber Trays



Chemicals added



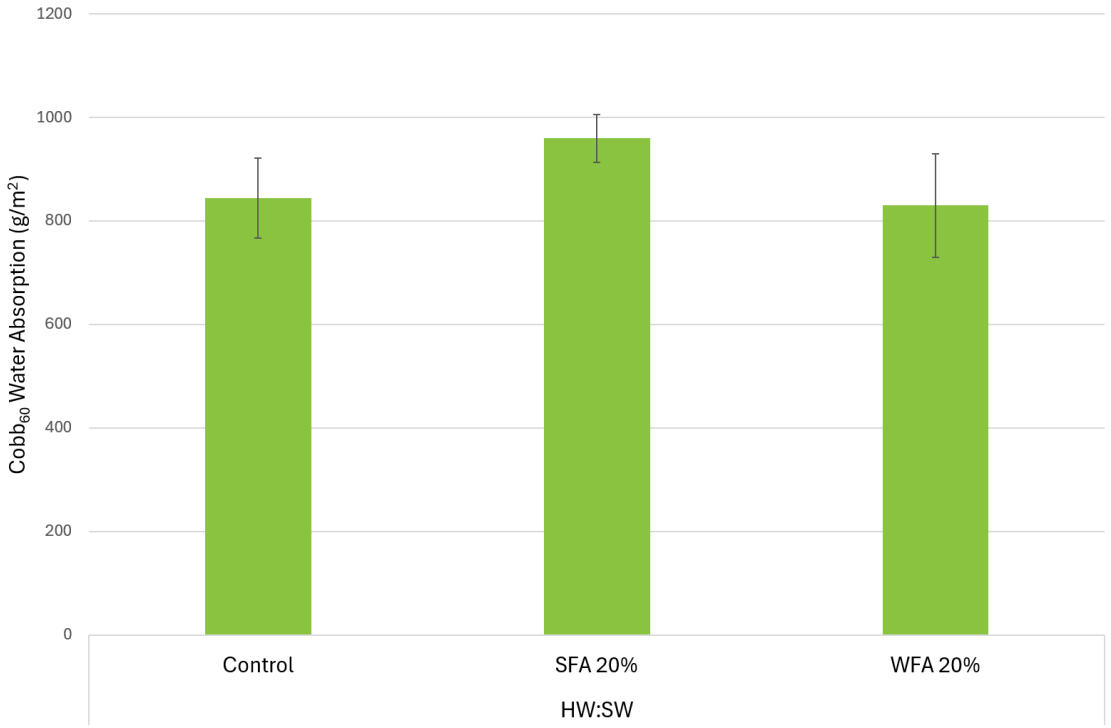
Solid fill → Longitudinal measurement
Light/transparent fill → Transverse measurement

Agro-based fiber incorporation increased burst strength while maintaining bending stiffness

Soy and Wheat Fiber Alternatives

Water Resistance & Wettability

Water Absorption



Surface Wettability

Sample	Contact Angle (°)
Control	61
WFA 20%	100
SFA 20%	75

No chemicals added



Agro-based fiber maintains bulk water absorption performance while increasing surface repellency

Soy and Wheat Fiber Alternatives

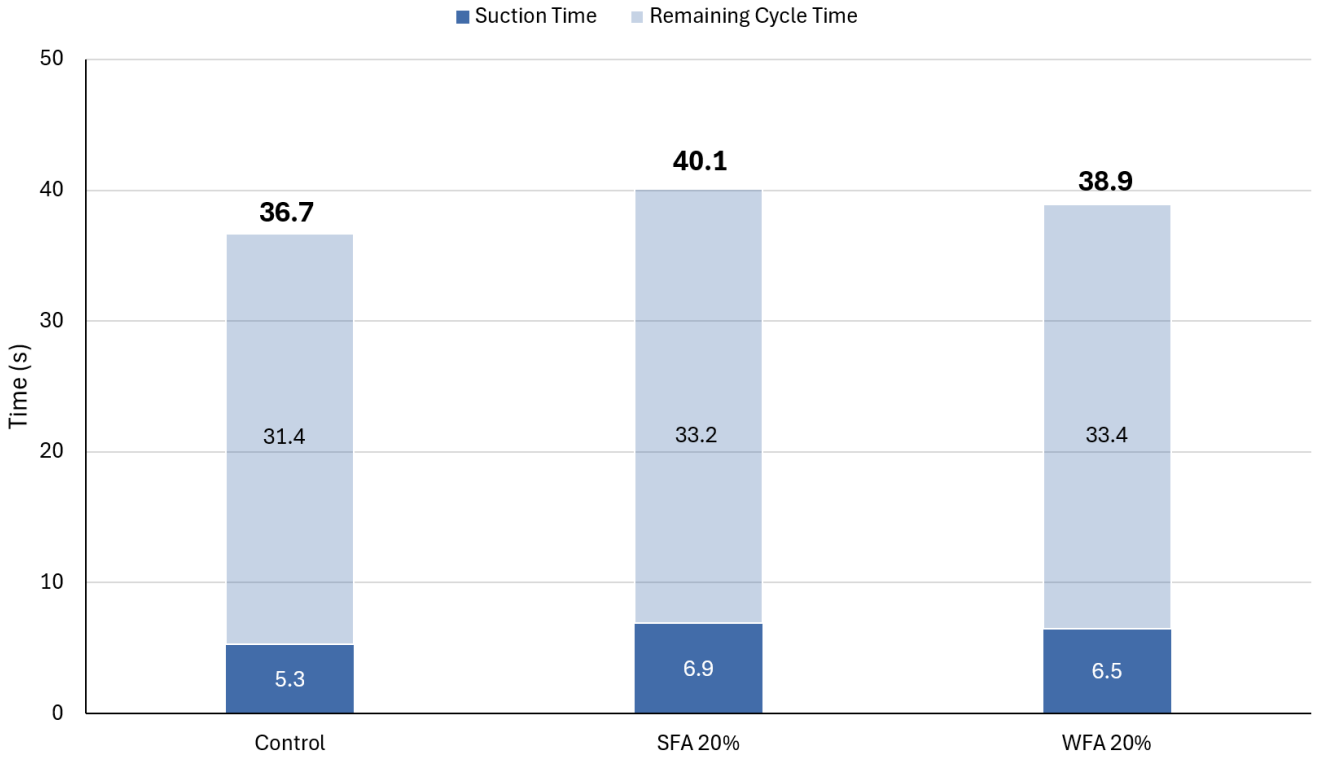
Molded Fiber Runnability



SFA 10%



WFA 10%

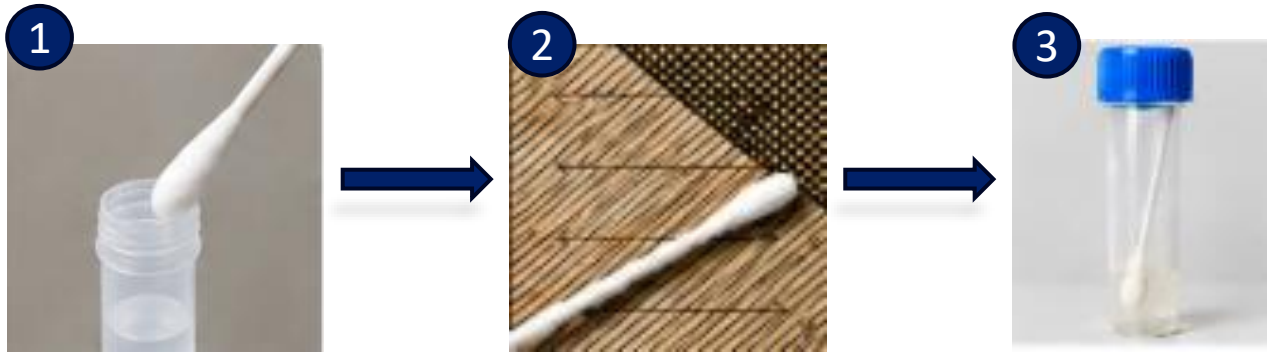


- No adhesion to the hot press
- No clogging of the suction tool mesh

Agro-based fiber maintained stable forming and machine runnability

Proprietary business information of ADM.

Allergen Testing



Gluten & Soy Protein

Analysis	
Samples Tested	Trays and Handsheets
Targeted Allergens	Gluten and Soy Protein
Analytical Method	ALLER-TEK® ELISA Tech - **Gluten** RIDASCREEN FAST ELISA Tech – **Soy Protein**
Quantifiable Range	Gluten 2.5 - 80.0 ppm (Gliadin and Glutenin Fractions) Soy Protein 2.5 - 20.0 ppm
Results	**Not Detected** **(Below detection limit)**

Key Highlights & Conclusions

- **Agro-based fiber alternative** demonstrated **strong potential as a partial replacement for kraft pulp**
- **Successful incorporation into molded-fiber products** without major processing limitations
- **Mechanical performance was maintained or improved**, supporting structural packaging requirements
- **Improved water interaction and surface properties** provide additional functionality beyond fiber substitution
- **Comparable machine runnability** indicates compatibility with molded-fiber processing
- **New fiber source while reducing reliance on virgin wood pulp**
- **Reduced seasonality** compared with harvest-dependent non-wood fibers

Agro-based fiber alternative can partially replace kraft pulp while maintaining processability and delivering equal or enhanced molded-fiber performance.

Thank You!

Questions?

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