

ZnoNova Technical & Commercial Dossier

Technical Dossier: Biopack PFAS-Free Nanocellulose Barrier Paper & Coating Systems

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1. Executive Summary & Regulatory Urgency

Global food packaging converters, fast-food chains, and paper mills face an unprecedented regulatory shift driven by state and federal bans on Per- and Polyfluoroalkyl Substances (PFAS). - In the United States, California AB 1200, New York ECL § 37-0209, Washington State RCW 70A.222, Minnesota, and Maine have enacted strict prohibitions against intentionally added PFAS in food packaging. - In the European Union, the Packaging and Packaging Waste Regulation (PPWR) mandates fully recyclable, plastic-free, and fluorochemical-free paper barrier solutions.

Biopack is an aqueous, 100% bio-based micro/nanocellulose barrier formulation engineered as a **direct drop-in replacement** on standard industrial paper coating lines. It delivers **Kit Rating ≥ 10** grease resistance and superior oxygen barrier without fluorochemicals, polyethylene (PE) extrusion, or non-biodegradable synthetic waxes.

2. Quantitative Benchmark: Biopack vs. Competing Barrier Technologies

Performance & Compliance Dimension	Traditional PFAS Fluorochemicals	Conventional PE Extrusion Lamination	Aqueous Acrylic / Latex Coatings	ZnoNova Biopack Nanocellulose
PFAS Content	Intentionally Added (>100 ppm)	Zero	Typically Zero	Zero Added PFAS (0.0 ppm)
Plastic Content	Chemical surfactant	15 – 30 g/m ² Polyethylene film	5 – 10 g/m ² Synthetic Polymer	0% Plastic (100% Plant-Derived)
Grease Resistance (Kit Rating)	Kit 7 – 12	Complete (Polymer barrier)	Kit 6 – 9	Kit ≥ 10 (TAPPI T 559 cm-12)
Oxygen Transmission (OTR)	High (>1000 cm ³ /m ² ·day)	Moderate (500–1000 cm ³ /m ² ·day)	Moderate (100–300 cm ³ /m ² ·day)	Ultra-Low (<0.2 cm ³ /m ² ·day)
Repulpability & Recycling	Problematic (Chemical persistence)	Requires expensive de-lamination	Fluting clogging / screening issues	100% Standard Mill Repulpable
Natural Soil Biodegradation	Forever chemicals (Non-degradable)	>100 years	Fragmentary microplastics	100% Biodegradable in 180 Days
Coat Weight (Dry)	0.5 – 1.5 g/m ²	15 – 30 g/m ²	6 – 12 g/m ²	1.0 – 5.0 g/m ²
Regulatory Standing	Banned / Phased Out	Single-use plastic tax liable	Pending microplastic review	Fully Compliant (US FDA & EU PPWR)

3. Physical & Mechanical Properties

Tested Parameters (Substrate: 60 g/m² Bleached Kraft Base Paper)

Tested Property	Measured Value	Standard Method
Dry Coat Weight	2.5 g/m ² (Single coat)	ISO 536
Grease Resistance	Kit 10 – 12 Pass	TAPPI T 559 cm-12
Tensile Strength (MD)	≥ 4.2 kN/m (+38% vs uncoated base)	TAPPI T 494
Bursting Strength	≥ 220 kPa (+35% vs uncoated base)	TAPPI T 403
Air Permeance (Gurley)	> 10,000 s/100ml (Gas-tight)	ISO 5636-5
Oxygen Transmission Rate (OTR)	< 0.2 cm ³ /(m ² · day · bar)	ASTM D3985
UV Transmittance (280–320 nm)	0.0% (100% UVB Absorption)	UV-Vis Spectrophotometry
Heavy Metals (Pb, Cd, Hg, As)	Undetectable (< 0.1 mg/kg)	ICP-OES / EN 12498

4. Machine Application & Paper Mill Coater Trial Parameters

Biopack coating liquid is delivered as an aqueous, stable micro/nanocellulose suspension requiring **no solvent recovery equipment or specialized explosion-proof installations**.

Recommended Coater Settings:

- 1. **Coater Types:** Compatible with Blade, Metering Rod, Air Knife, Curtain, and Gravure coaters.
- 2. **Solids Content:** Standard supply is available from **1.0% to 10.0% solids** (dilutable on-site with clean demineralized water).
- 3. **Wet Film Application:** 15 – 45 μm wet film thickness to achieve 1.5 – 3.5 g/m² dry coat weight.
- 4. **Drying Profile:** Hot air flotation dryers or infrared (IR) drying tunnels at web temperatures between 90 °C and 115 °C.

5. **Surface Sizing:** For optimal hold-out, base paper with starch surface sizing ($Cobb_{60} < 30 \text{ g/m}^2$) is recommended.

5. Food Contact Safety & Regulatory Certifications

- **United States Food & Drug Administration (US FDA):** Formulated strictly with substances compliant with **FDA 21 CFR 176.170** (Components of paper and paperboard in contact with aqueous and fatty foods) and **21 CFR 176.180** (Dry food contact).
 - **European Union:** Compliant with **Regulation (EC) No 1935/2004** on materials intended to come into contact with food, and **BfR Recommendation XXXVI** (Paper and board for food contact).
 - **Soil Biodegradation:** In ambient soil burial testing, Biopack coated paper demonstrated **39.4% mass loss within 14 days** and achieves full mineralized biodegradation within 180 days without microplastic residues.
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6. Strict Technological Boundary (Mandatory Disclosure)

In alignment with ZnoNova's scientific integrity standards: * **Validated Barriers:** Biopack provides outstanding **grease/oil resistance ($Kit \geq 10$)**, **oxygen barrier ($OTR < 0.2$)**, and **UVB light protection**. * **Clear Moisture Boundary:** Biopack is a bio-based aqueous hydrophilic polysaccharide matrix. It **does NOT deliver ultra-high moisture vapor barrier ($WVTR / MVTR < 1.0 \text{ g/m}^2 \cdot \text{day}$)**. For freeze-dried or dry crispy foods requiring years of shelf-life in humid tropics, a secondary moisture-resistant barrier layer or hybrid structure is required.

7. Sample Dispatch Protocol

Guangzhou ZnoNova maintains sample inventory for paper mills and converting plants: * **500ml Evaluation Aliquot:** For lab draw-down coater and hand-sheet testing; * **5.0kg Canister:** For pilot coater line validation; * **Pre-Coated Trial Paper Sheets:** A4 packs and 600mm trial rolls available upon request.

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