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Chitosan Coating as an Auxiliary Raw Material for Fast Fashion Longevity and Sustainability.

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The fast fashion (FF) industry thrives on rapid trend cycles, prioritizing aesthetics over durability, which exacerbates environmental issues through excessive textile waste and resource-intensive production. A key contradiction within FF lies in the imbalance between material durability and product lifespan. This study explores the potential of chitosan bio-coating as a sustainable auxiliary raw material that enhances textile functionality, promotes safe disposability, and aligns with circular design principles. By integrating chitosan-based coatings into FF textiles, this research seeks to bridge the gap between sustainability and performance, enabling short-lifespan garments that are biodegradable while maintaining aesthetic and functional qualities.

Chitosan, derived from chitin — the world's second most abundant biopolymer (Rinaudo, 2016) — is biodegradable, biocompatible, and biofunctional, making it a promising candidate for sustainable textile applications. Chitosan has been applied in textile finishing for shrink resistance, antimicrobial properties, UV protection, fire retarding and enhanced dye uptake (Julia et al., 1998; Hahn et al., 2019). This study leverages chitosan's film-forming capability, biodegradability, and natural affinity for textiles to develop coatings that balance product longevity with controlled biodegradation, aligning with circular economy principles.

To assess chitosan' s potential in FF applications, this research integrates chitosan coatings with craft techniques such as screen printing and natural dyeing on cotton fabrics. The coated textiles undergo a comprehensive evaluation of their environmental impact, functional properties, and mechanical performance through:

- Material Characterization: SEM (surface morphology), FTIR (chemical interactions), UV-Vis spectrophotometry (UV protection).
- Functional Performance: Antioxidant activity, antimicrobial resistance, and biodegradability (soil degradation).
- Mechanical & Aesthetic Properties: Tensile strength, elasticity, dye uptake, and color fastness (wash, rub, and light resistance).
- Lifespan Assessment: Analysis of different chitosan formulations to determine optimal life-speed scenarios for balancing durability with compostability.

This study hypothesizes that chitosan coatings can redefine FF by enabling biodegradable, performance-enhanced textiles, reducing reliance on non-biodegradable fibers and toxic pre-treatment chemicals. By

embedding sustainability into the material design process, this research contributes to the development of bio-based textile solutions that align with sustainable innovation and circular economy goals.