

MWP – Young Researcher Abstract 2026

Project title: High-performance materials derived from forest-based cellulose nanofibers	
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Abstract (approx. 200 words): Forest-derived cellulose nanofibers (CNFs) can be engineered into high-performance materials and serve as an effective alternative to conventional materials due to their renewability. My research establishes design principles that enable CNFs to replace resource-intensive materials in advanced applications. These principles are based on the finding that CNF interfacial interactions govern performance across diverse materials and applications. I have investigated complementary aspects of CNF-based materials: mechanical reinforcement in polymer composites, structure formation in CNF filaments, and functional performance in low-dielectric CNF-polymer composite substrates. Notably, the low dielectric substrate shows reduced dielectric constant and thermal expansivity, indicating potential for next-generation telecommunication devices for high-speed data transmission and integrated electronics. Rather than viewing sustainability and functionality as competing objectives, my research shows that both can be achieved through rational materials design. These contributions support the replacement of petroleum-, mineral-, and carbon-based materials while promoting sustainability and enabling high-value utilization of wood resources, thereby expanding the role of forest-based materials in advanced industries. Ultimately, my goal is to transform renewable forest resources into a design platform for next-generation advanced materials, within sustainable forest-based value chains.	
Key words: Cellulose nanofiber, Polymer composite, High-performance materials	