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Project title: Turning forest biomass into circular, multifunctional textile fibers

Author(s): Yidong Zhang, Wangfang Deng, Bin li, Chunlin Xu, Xiaoju Wang

Corresponding author:	Affiliation:	E-mail:
Chunlin Xu, Xiaoju Wang	Åbo Akademi University	Chunlin.xu@abo.fi, Xiaoju.wang@abo.fi

Abstract (approx. 200 words)**:**

The textile sector urgently needs renewable fibers that combine sustainability with the performance required for real applications. My research develops a mild, room-temperature formic acid platform to transform forest-derived biopolymers into multifunctional filaments through wet spinning, regeneration and controlled stretching. Cellulose/chitosan filaments show high dry and wet mechanical strength, water-triggered shape response, strong antibacterial activity, biodegradability and closed-loop recyclability through re-dissolution and re-spinning. Cellulose/polycaprolactone filaments further overcome the poor wet stability of regenerated cellulose, while adding water-triggered shape programmability and polarization-dependent, dye-free optical coloration.

Building on this platform, I aim to incorporate lignin, an abundant aromatic polymer from wood and pulping streams, into spinnable fiber systems. Lignin can provide natural color, UV shielding, antioxidant activity, hydrophobicity and additional mechanical or interfacial functionality, enabling fully forest-based filaments with both structural and active performance.

Together, this work shows how molecular design, polymer compatibility and filament orientation can convert forest biomass into robust, recyclable and functional fibers. My vision is to develop scalable forest-based textile technologies that reduce reliance on petroleum-based synthetics, microplastic pollution and dye-intensive manufacturing, while creating new value for the forest industry and sustainable society.

Key words:
Forest-based fibers; Cellulose filaments; Lignin valorization; Sustainable textiles; Circular bioeconomy