Sustainable functional bioproducts development using lignocellulose

Feng Jiang
Sustainable Functional Biomaterials, Department of Wood Science, the University of British Columbia, Canada

With the pressing energy and environmental crisis resulting from the production and utilization of petroleum-based products, it is urgent to develop bioproducts from lignocellulosic sources as sustainable alternatives. In this presentation, I will discuss the recent progress made by my research group, the Sustainable Functional Biomaterials Lab at the University of British Columbia, in developing high-performance bioproducts using lignocellulose.

Our lab has developed several green and sustainable solvents, such as deep eutectic solvents, organic acids, and anhydrides, to efficiently isolate lignocellulosic nanomaterials from biomass. These methods feature high isolation efficiency, uniform morphologies, tunable surface chemistry and charge densities, and controllable composition of the isolated lignocellulosic nanomaterials. Utilizing these lignocellulosic nanomaterials as building blocks, we have devised several innovative strategies for fabricating hierarchical structures across different dimensions, including fibers, films, and 3D constructs.

We have developed three-dimensional foams, including aerogels, foams, and 3D-printed monoliths, using nanocellulose. These products show promising applications in thermal insulation, thermal energy storage, protective packaging, sensors, and structural uses. Structural elasticity is one of the critical features we are focusing on in these 3D constructs. The elasticity of these structures has been enhanced through various strategies, including controlling the elasticity of the building block fibers and tuning the interactions between fibers and water, which will be discussed in this presentation.