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The biomimetic approach for high-performance materials from renewable resources

The aim of my research is to combine environmental friendliness with high performance in novel biomaterials by the biomimetic approach. We are developing strong and tough nanocomposites from nanofibrillated cellulose and modified hemicelluloses. The research is focused on fundamental understanding of the non-ionic interactions between cellulose and water soluble polysaccharides.

The hypothesis is that the non-ionic interactions between cellulose and mannans will be beneficial in introducing especially the toughness that has not previously been obtained in approaches using e.g. ionic bonds. However, natural mannans may not have the ideal dissipative properties and thus they will be enzymatically and chemically modified. The modification is done purely in aqueous environment and the self assembly of the composite is done in an up-scalable efficient way as compared to e.g. layer by layer deposition.

The methods I mainly use to characterize the samples are gas chromatography - mass spectroscopy, tensile testing, quartz crystal microbalance with dissipation, surface plasmon resonance, atomic force microscopy, colloidal probe technique and wide angle x-ray scattering. I have also experience in other methods such as x-ray tomography and transmission electron microscopy.