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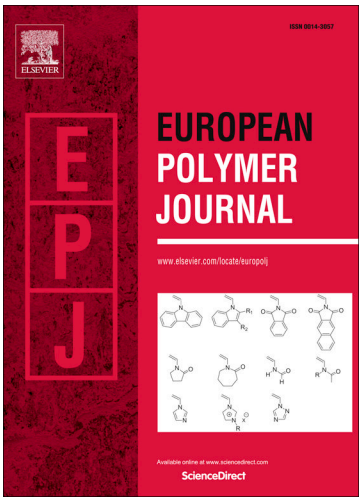

Lignin Nanoparticles as Nano-spacers for Tuning the Viscoelasticity of Cellulose Nanofibril Reinforced Polyvinyl Alcohol-Borax Hydrogel

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ABSTRACT:

To face the increasing demand of self-healing hydrogels with high performance for various applications ranging from bioscaffolds, culture matrices to responsive electronic devices, lignin nanoparticle-containing composite hydrogels are assembled via dynamic reversible didiol-borax linkages and linear polyvinyl alcohol (PVA) and cellulose nanofibrils (CNF). Lignin nanoparticles (LNP) acted as nano-spacers to fill the three-dimensional network, leading to enhanced viscoelasticity and thermal stability of hydrogel. With the increased LNP content, composite hydrogel exhibited the highest storage modulus and loss modulus of 8504 Pa and 3260 Pa, respectively, 28 times and 18 times greater than pure hydrogel without LNP. The resulting hydrogel showed porous network structure and excellent recovery behavior under continuous step strain. In general, this work demonstrates a facile approach to transfer nanoscale building blocks to 3D polymeric materials with tunable dynamic rheology properties and may provide a new prospect for the rational design of functional hydrogels for applications that require high rheological property.

Keywords: Lignin nanoparticles; Hydrogel; Polyvinyl alcohol; Cellulose nanofibrils; Rheological property; Self-recovery