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Development of cellulose materials from hardwoods maintaining hierarchical structure

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Cellulose is the most abundant organic compound on earth and is an eco-friendly polymer that is naturally synthesized by various organisms, including trees, and completely degraded by fungi. In addition to conventional paper products made from pulp, cellulose nanofibers, have been attracting attention in recent years, and their unpredictable functionality is boosting research and development. Once dispersed, it is so difficult to control the structure of pulp and nanofibers, and it is impossible to orient cellulose fibers. On the other hand, cell walls are formed by piling up sheets of oriented cellulose fibers, and these cells arrange in an orderly manner to form an anatomical structure. This optimized 3-dimensional architecture supports the huge body of the tree and enable a life of more than 1,000 years. In order to utilize the suprastructure to bring out the physical properties of cellulose materials, a top-down approach, rather than a bottom-up approach, would be the shortest distance to solving the problem. Therefore, the target of this study was to establish a preparation technique consisting of a single component while maintaining the hierarchical structure by incorporating a chemical pretreatment technique. Currently, a preparation method for a softwood from Japanese cedar has been established, but hardwoods are still unexplored. Therefore, this year we challenged to optimize the preparation conditions for cellulose materials from hardwoods.

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