

一步法从六种未经处理的生物质木质纤维素中制备含木质素的纳米纤维素

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摘要: 含木质素的纳米纤维素 (LCN) 在制备高性能生物基材料方面具有巨大潜力, 而合适的原材料可以以更经济的方式生产 LCN。因此, 对六种生物质木质纤维素 (构树皮、毛竹、藤材、轻木、杨木和杉木) 的形态、化学成分和超分子结构进行分析研究, 并利用草酸二水合物 (OAD) 对其直接水解制备 LCN。结果表明, 构树皮是一种富含纤维素的天然原料, 纤维素含量极高, 木质素含量低, 纤维素链连接松散。与其他五种生物质木质纤维素相比, 使用 OAD 在不经任何预处理水解构树皮制备的 LCN 产率更高, 粒度分布更均匀, 粒径更小; 且从构树皮中提取的 LCN 具有更高的结晶度和热稳定性。LCN 的产率很大程度上取决于原料纤维素的含量, 原料纤维素含量越高, LCN 产率越大; 当纤维素含量为 75.9% 时, LCN 产率可超过 50%; 细长柔软的木质纤维原料会使所制备的 LCN 的粒度较小且分布均匀。该研究结果表明, 与其他木质纤维原料相比, 未经任何预处理的构树皮是一种有利于高产 LCN 的原料, 这为利用 OAD 水解法从未经预处理的构树皮中高效、高产地制备 LCN 提供了一种经济可行的方法。

Production of lignin-containing nanocellulose from six types of untreated lignocellulosic biomass by a one-step process

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Abstract: Lignin-containing nanocellulose (LCN) shows great potential in the fabrication of high performance bio-based materials, and suitable raw materials may achieve the production of LCN in a more economical approach. Therefore, in this study, the morphology, chemical and supramolecular structure of six types of lignocellulosic biomass (*Broussonetia papyrifera* bark, moso bamboo, rattan, balsa wood, poplar wood and fir wood) were analyzed for the production of LCN by using pure oxalic acid dihydrate (OAD). The results revealed that BPBs is a natural available cellulose-rich materials with extremely high cellulose content, low lignin content, and loosely connected cellulose chains. Compared with the other five types of lignocellulosic biomass materials, the hydrolysis of BPBs without any pretreatments by using OAD produced higher yield of LCN with much more uniform size distribution and smaller size; LCN from BPBs had higher crystallinity and thermal stability than that from the other five lignocellulosic biomass. The higher yield of LCN depended largely on the higher cellulose content of raw materials. When the cellulose content is 75.9%, the LCN yield can be more than 50%. The LCN prepared from slender and soft wood raw material exhibited smaller particle sizes with uniform distribution. The finding in this study indicated that *Broussonetia papyrifera* bark without any pretreatment was a favored material for high yield production of LCN compared with the other woody materials, which provided a economically realizable method on the efficient and high yield production of LCN from untreated BPBs by using OAD hydrolysis.