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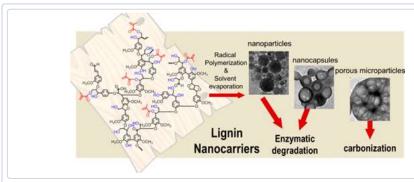
Morphology-Controlled Synthesis of Lignin Nanocarriers for Drug Delivery and Carbon Materials

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Abstract

Lignin is an abundant biopolymer that is mainly burned for energy production today. However, using it as a polyfunctional macromolecular building block would be desirable. Herein, Kraft lignin was modified through esterification of its hydroxyl groups with methacrylic anhydride. Then lignin nanocarriers with different morphologies (solid nanoparticles, core–shell structures, porous nanoparticles) were produced by a combination of miniemulsion polymerization and a solvent evaporation process. A UV-active cargo is used as a drug model to investigate the release behavior of the lignin nanocarriers depending on their morphology. To prove the enzymatic response of the lignin nanocarriers, we tested the enzyme laccase as a trigger to release the encapsulated cargo. Furthermore, porous lignin nanoparticles with high surface area were produced by carbonization. The carbon material has a high potential as an adsorbent, which was studied by adsorption tests with methylene blue. These biodegradable nanocarriers based on the polyfunctional bioresource lignin may find useful application as novel drug delivery vehicle in agriculture or as carbon materials for water purification.

Keywords: drug-delivery; laccase; lignin; miniemulsion; nanocarrier

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