Bioinspired formulation of Lignocellulosic composites for preparation of bio-based materials

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Climate change hazards have a significant impact on the composition of lignocellulosic materials, altering the chemical distribution of the primary carbon biopolymers in straw and affecting the yield and quality of agronomic systems. To mitigate climate change, bio-based construction materials are a viable option for achieving neutral carbon emissions by emulating natural processes.

Natural lignocellulosic fibers such as cellulose, hemicellulose, and lignin, are considered as the model fibers due to their exceptional mechanical properties. However, the use of lignocellulosic byproducts presents a disadvantage due to the size and non-uniform distribution of fibers. One solution to improve the mechanical properties and structure of bio-based materials is to incorporate natural additives such as carbohydrates and lignans to simulate plant structures. Green chemistry processes can also be applied to modify the surface of materials and reinforcements to enhance durability and meet construction standards.

Overall, these findings suggest that utilizing bio-based materials can be a viable solution to mitigate the impact of climate change on agronomic systems and promote sustainable construction practices. In this study, a wheat field trial was conducted under high carbon dioxide and drought conditions. The straw compounds (lignin, cellulose and hemicellulose) have been quantified to determine the effect of drought and CO_2 uptake that may have affected wheat growth on the compound's distribution and the formation of new agrocomposites. Lignosulfonate, polysaccharides, and wheat fibers were used as the matrix and the reinforcement, respectively, to produce bio-based composites. The mechanical properties of the composites were validated, and surface modifications were performed using chemo-enzymatic processes to enhance mechanical strength and permeability.

Bibliographic references:

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