High Strength Lignin-based Plastics

Lignin-based plastics are eco-friendly alternatives to traditional petroleum-based plastics. However, current lignin-based plastics, and especially their mechanical properties, leave much room for improvement. Previous processes are limited in the amount of lignin that can be incorporated into the final plastic. These materials exhibit significant degradation in properties with lignin content higher than 35-40%.

Description of the Invention

Researchers at the University of Minnesota have developed a new generation of lignin-based plastics using processes that can be easily scaled to industrial volumes. For the first time, innovative lignin plastics with very high lignin content exhibit properties comparable or even superior to conventional polystyrene and poly(methyl methacrylate) plastics.

The lignin-based plastics contain at least 80% lignin, and their mechanical properties can be enhanced by adding small quantities (<2%) of low molecular weight plasticizers or blending with other polymers. The process provides a significant value-addition to biorefineries by allowing the commercialization of biofuel production byproducts.

Benefits and Features

- More durable lignin-based plastic
- Environmentally friendly
- Properties comparable or even superior to conventional polystyrene and poly(methyl methacrylate) PMMA plastics
- Tensile strength >50 MPa
- Higher lignin content than most lignin-filled plastics
- Fully biodegradable, resulting in reduction or even elimination of plastic film or netting residues in agricultural or soil erosion control applications
- Made from kraft lignin, lignosulfonates or from raw lignin extracted from wood
- Increased economic value of lignin sources from fuel to plastic replacement

Potential Applications

- Polystyrene replacement in engineered plastic
- Non-packaging applications such as automotive, furniture, appliance and other durable goods
- Soil erosion control or crop protection applications where plastic film or nettings are used and biodegradability is desired