

RENEWABLE BARRIER POLYMERS FROM CARBOHYDRATES

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There is an ongoing international effort to develop circular alternatives to conventional plastics, particularly in the packaging sector. One way to achieve a circular economy of materials is to derive materials from renewable resources, waste materials, or recycled content. At the end of life, economical mechanisms should enable circulation of the carbon and other components back into production via chemical, physical or biological pathways. Plastic multilayer barrier primary packaging is a large contributor to unrecyclable or difficult-to-recycle waste. This talk describes innovations in production of barrier polymer coatings suitable for food, pharmaceutical and electronics packaging, based on combinations of renewable cellulose and chitin. Specifically, we consider both nanoscale fibers and crystals, as well as soluble forms. These abundant materials, sourced from plant biomass (forest or agricultural residue waste) and/or industrial food waste streams, are highly crystalline and have excellent potential as gas barrier materials for packaging. The talk will discuss four innovations in process-structure-property relationships: 1. mode of combination of CNCs and ChNFs: alternating layers versus direct blends, 2. mode of deposition: spray, blade and slot die coating, and 3. chemical modifications of particles to manage oxygen barrier and water vapor barrier properties. Attention will be paid to the structure-property relationships and challenges to industrial implementation, including a discussion of future potential approaches to overcome these challenges.