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Opportunities and challenges for polysaccharides in materials sciences and engineering – a chance to decarbonization

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Plenary: Polymer, resins, blends, and composites are increasingly important materials to support advances in energy, medical, food, transportation, and information technology. These fields have relied on non-renewable feedstocks contributing to greenhouse gases and other types of undesirable environmental impact. This presentation will discuss efforts to shift from a non-renewable petrochemical feedstock to alternative renewable feedstock that can contribute to decarbonization because renewable feedstock has a negative carbon footprint. Our previous research demonstrated that biomass (wheat straw) originating as a byproduct of food production can be a desirable source of renewable materials. While this is incredibly positive to reduce carbon footprint, there are other materials streams in agriculture that are undervalued or treated as waste. This creates an opportunity for discovery that will transform those undervalued streams into high valued products. More recent research in our group has addressed several types of polysaccharides: starch, cellulose and alfa-glucan. Although some of these materials have been known and used for a long time like starch and cellulose, novel technologies are being created to use nanoparticles of starch or cellulose; whereas alfa-glucan is a new material. The goal is to discover new strategies to enable these undervalued streams to be utilized in manufacturing vehicles, flexible electronics, batteries, or packaging for food for example. This presentation will discuss several cases of utilization of nanostarch, nanocellulose and alfa-glucan in combination with other polymers. It will also discuss the role of universities in collaborations with industry to accelerate the commercialization of new technologies.