**Understanding the Influence of Structural Sugar Content on Product Yields in a Forest Residue Biorefinery**

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Lignocellulosic biomass is a vast renewable resource with immense potential as an alternative feedstock to petroleum. Underutilized sources, such as forest residues, are available in vast quantities at low costs with minimal environmental damage. Structural carbohydrates consist mainly of cellulose and hemicellulose and often constitute >50% of the total biomass dry weight. They assist in the rigid framework of the plant cell walls and enable plant growth and development. Previous studies have shown that structural carbohydrates, particularly hemicellulose, can undergo dynamic changes in concentration and composition depending on both the species and phenophase. Understanding these feedstock dynamics is crucial as they can impact every step and process of a biorefinery. In this study, the influence of structural sugar dynamics in a forest residue biorefinery was investigated, specifically for bark, foliage, and twigs/branchlets. The structural carbohydrate compositions were measured using a standard National Renewable Energy Laboratory procedure, in which a two-step acid hydrolysis fractionates the biomass and hydrolyzes the sugars to enable quantification. The hydrolyzed sugar samples were analyzed *via* high-performance liquid chromatography (HPLC) to determine structural sugar content. Structural sugar compositions were then input into an integrated biorefinery process model to assess impact. The biorefinery model outputs were then utilized to determine the impact of structural sugar dynamics on overall biorefinery yields, profitability, and sustainability. Overall, understanding the influence of structural sugar content on forest residue biorefinery product yields is an integral part of expanding the bioeconomy and progressing towards a more sustainable future.