“MELT-COMPOUNDED” BIOMASS: A UNIQUE PRETREATMENT FOR CELLULOSE SACCHARIFICATION AND LIGNIN EXTRACTION

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Accessing polysaccharides in the cell wall of lignocellulose biomass to generate cellulosic sugars for a bioeconomy is a key challenge that has re-emerged over the past decade. A novel pretreatment method is described by combining industrially proven polymer-processing equipment with a non-toxic solvent that plasticizes and disrupts the cell wall structure. Particle size, temperature, and time are initial variables used to determine how these conditions affect glucan digestibility of the biomass and yield of the extracted lignin. Milled sweet gum (*Liquidambar styraciflua*), a candidate for short rotation woody crops, and milled corn stover were chosen as two starting materials that represent deciduous and agricultural biomass, respectively. Melt compounding was shown to enhance saccharification for both feedstocks. After melt processing biomass at elevated temperatures, enzymatic digestibility of available glucan for the extracted substrate reached 90% conversion after 72hrs. The presence of lignin in the sample retarded the rate in the enzyme-based saccharification, although digestibility for the pretreated fiber without post-extraction or washing was 80% after 72hrs. Furthermore, lignin was extracted in good yields and had several novel characteristics related to its molecular weight and structure; the Mark-Houwink-Sakurada exponential constant had a value near that of randomly coiled polymer in a theta solvent. Hence, melt compounding of biomass offers a route to access the polysaccharide component within the cell wall and enable the fractionation of lignin that has unique polymer characteristics for value added applications.