BIOMASS INTO BIOPRODUCTS

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Tree bark is usually not considered an ideal candidate for biorefinery feedstock, mainly because it is not a substantial source of carbohydrate compared to tree wood. However, using the whole tree would simplify supply chain processing and conversion. Although dilute acid pretreatment is corrosive, it is emerging as one of the leading chemical pretreatments. When sweetgum bark (*Liquidambar styraciflua* L.) is pretreated in non-stirred reactors at 160°C for 60 min in 1% (v/v) sulfuric acid, 10 and 139 mg per g of biomass of glucose and xylose, respectively, were recovered. If sweetgum bark was soaked at 85 °C for 18 h prior to pretreatment as described, 15 and 105 mg per g of biomass of glucose and xylose, respectively, were recovered. Soaking the bark prior to pretreatment increased glucose recovery. In addition to aiding in the recovery of glucose, soaking the biomass prior to pretreatment, decreased inhibitory compound formation. The soaking process reduced formic acid concentrations by 28% in the hydrolysates and wash waters. Reducing the concentration of xylose prior to pretreatment may be more important than initially anticipated due to the likeliness of xylose degrading to formic acid. The degradation rate constant from xylose to furfural and from xylose to formic acid was calculated as 0.0128 and 0.0235 min^{-1}, respectively, indicating a preference for formic acid accumulation. Formic acid is a potent enzymatic hydrolysis inhibitor. Using Accellerase ®1500 with cellulose powder as substrate, addition of 5 or 10 mg/mL formic acid reduced glucose recovery by 34% and 81%, respectively, in comparison to the control.

In addition to the advantage of decreasing formic acid concentrations, soaking waters may contain value added compounds that could warrant this extra step. Soaking water, reconstituted in dimethyl sulfoxide, inhibited low density lipoprotein oxidation activity, demonstrated through the thiobarbituric reactive substances (TBARS) assay, at concentrations of 12.5 mg bark extract per ml of or higher. Although unknown at this point, these results suggest that there may be biologically active compounds that could be worth extracting from the soaking waters.

In conclusion, results indicate that while the use of bark may be problematic, especially in terms of formic acid formation, the accumulation of this inhibitor could be circumvented by the implementation of a water soaking step prior to pretreatment.