SWEETGUM: AN IDEAL FEEDSTOCK FOR A BIOCHEMICAL REFINERY PLATFORM IN THE SOUTHERN USA

Angele Djioleu[1], Elizabeth M. Martin[1], Matthew Pelkki[2], D. Julie Carrier[1]

Liquidambar styraciflua L., commonly called American sweetgum, is a natural occurring understory hardwood in US southern pine forests. As sweetgum is widely found in southern pine forests, it competes with pine for critical natural resources, It is estimated that the management of southern pine forest in view of eliminating competition can cost up to $150 millions per year to the timber and lumber industry. Therefore, as opposed to be a nuisance, sweetgum can be harvested and used as a feedstock for the production of fuels and chemicals in a biochemical refinery.

Wood from mature sweetgum trees, grown in Drew County Arkansas, was determined to contain 42% glucan and 20% xylan. These complex carbohydrates were converted into fermentable sugars, using dilute acid pretreatment and enzymatic hydrolysis. Results showed that this two-step hydrolysis process yielded 82% and 86% of available xylose and glucose, respectively. Overall, 72% of total fermentable sugars were successfully extracted from sweetgum wood. With the objective of increasing biorefinery revenues, hydrolysis of carbohydrates was also investigated in sweetgum bark. Although it was determined that 93% of xylose contained in sweetgum bark could be recovered, hydrolysis of glucan bark was more difficult. However, it was observed that bark contained extractable phytochemicals that displayed interesting biological activities. Using disc diffusion assays, sweetgum bark hot water extracts inhibited growth of Staphylococcus aureus and Listeria monocytogenes, with zones of inhibition up to 17 mm and 11 mm, respectively. Additionally, at a solid concentration of 16 g/L, the sweetgum hot water extract completely inhibited copper-induced oxidation of human low-density lipoproteins.

The above results indicate that sweetgum wood and bark could be good candidates as biochemical refinery feedstock, where wood would provide sugars that could be fermented into ethanol or other biobased compounds, while its bark could be a source for value-added compounds.

[1] Department of Biological and Agricultural Engineering, University of Arkansas, 203 Engineering Hall, Fayetteville, AR 72701
[2] School of Forest Resources, University of Arkansas, Monticello, Monticello, AR.