**Valorization of Underutilized Lignocellulosic Biomass**

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Polymers and plastics are ubiquitous in modern life, but most are derived from petroleum. This factor poses a danger to our environment as fossil fuels are a leading global contributor to climate change. Lignocellulosic biomass (LCB) is an attractive alternative feedstock because it is the most abundant natural and renewable source of aromatic building blocks on Earth. Many LCB agriculture and forestry residues (*e.g.,* nut shells and leaf litter) are underused and currently composted, incinerated, landfilled, or left in the forest. In this work, seven underutilized LCB residues (pitch pine needles, arborvitae foliage, pecan shells, almond shells, walnut shells, hazelnut shells, and Brazil nut shells) were characterized to determine their valorization potentials. These residues were chosen because they are abundant at low cost and were expected to have high lignin content. First, the samples were milled, extracted with hexanes and ethanol, and dried. The processed biomass was then characterized using a high-throughput thermogravimetric analysis (TGA) method to measure the relative cellulose, hemicellulose, lignin, ash, and moisture contents. Reactive distillation-reductive catalytic fractionation (RD-RCF) was then conducted to deconstruct the biomass and generate bio-oils that contained the monophenolic products from lignin. The bio-oils were analyzed *via* gas chromatography-mass spectrometry (GC-MS) to determine the phenolic yields of the RD-RCF distillate products on an extractive-free, dry lignin basis. The phenolic product distributions in the bio-oils also were established from the ratios of syringyl (S), guaiacyl (G), and *p*-hydroxyphenyl (H) units. Together, these analyses provided the lignin content, phenolic yield, and phenolic product distribution for each underutilized LCB residue, which are crucial to evaluate the valorization potential of each biomass feedstock for the synthesis of lignin-derived polymers.