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Valorizing lignin

The advent of commercial cellulosic ethanol production facilities globally, has brought to the forefront the need to address lignin valorization technologies. (1) Historically, the kraft pulp and paper industry addressed lignin generation issues by developing advanced combustion technologies to recover energy and cooking chemicals. But even this industry has begun to implement lignin recovery technologies and examine the use of lignin for material and chemical applications. (2) In the biofuel industry, lignin represents ~15-30% of the starting material and currently the only practical solution is combustion and yet this provides limited value while incurring high capital costs. Since lignin, is nature's primary polyaromatic bioresource it is clear that better solutions are needed. The historical challenges to utilization of lignin are several folds including variation of structure due to feedstock, broad variations in molecular weight and functionality and alterations in structure due to process isolation technologies. Currently, several of these are now being resolved, analytical advances facilitate precise determination of structure, lignin fractionation technologies provide control of the structure of lignin and novel catalytic conversion methodologies are being developed. (3) Our research studies have identified fractionation/pretreatments that predispose lignin for oleaginous organisms that utilize lignin to biosynthesize lipids which are a natural resource for biodiesel. (4) Likewise, lignin can be used for material applications and one of the promising routes is for green insulation as a lignin-based polyurethane foam. In this presentation we will examine these two conversion technologies and how they complement each other and how advances in lignin analytical chemistry help guide our conversion chemistry.

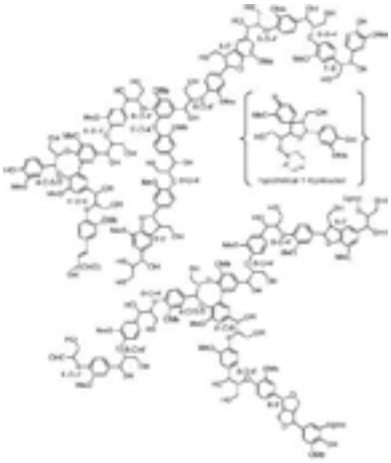

Figure 1: Native Softwood Lignin

Biography

Arthur Ragauskas held the first Fulbright Chair in Alternative Energy and is a Fellow of American Association for the Advancement of Science, the International Academy of Wood Science and TAPPI. In 2014, he assumed a Governor's Chair for Biorefining based in University of Tennessee's Department of Chemical and Biomolecular Engineering, with a complementary appointment in the UT Institute of Agriculture's Department of Forestry, Wildlife, and Fisheries. He serves in the US Energy and Environmental Sciences Directorate, Biosciences Division, at ORNL. His research program is directed at understanding and exploiting innovative sustainable bioresources. This multifaceted program is targeted to develop new and improved applications for nature's premiere renewable biopolymers for biofuels, biopower, and bio-based materials and chemicals.

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