Sun Grant Western Regional Center
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New Concept to Obtain Higher Yields of Pyrolytic Sugars for Ethanol Production

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Overview

The diverse nature of biomass resources in the Pacific Northwest requires suitable technologies for the conversion of dispersed feedstocks, especially forest residues. Dr. Garcia-Perez proposes a new model that uses distributed pyrolysis units located close to biomass resources and centralized refineries where second generation transportation fuels and high value chemicals can be obtained taking advantage of economies of scale.

Progress to Date

The research team has evaluated samples of Douglas fir, hybrid poplar, and wheat straw for their content of ash, extractives, acid insoluble lignin, acid soluble lignin, arabinose, galactose, glucose, and Mann/xylose. The team then collaborated with the Englund research team to perform tests to identify the effect of pretreatment conditions and pyrolysis temperature on the production of anhydrosugars. The preliminary results suggest that the removal of alkaline elements and a mild pyrolysis process could be viable methods to enhance the production of anhydrosugars from Douglas fir.

Auger Pyrolysis (using a rotating device to move material through the system) of untreated Douglas fir resulted in 45.5 mass % of liquids, 21.4 mass % of char and 33.0 mass % of gases. The formation of two liquid phases (oily phase and an aqueous phase) and the low yield of oil obtained are clear indications that the dehydration and polycondensation reactions predominates. Auger Pyrolysis of pre-treated Douglas Fir (set with diluted sulphuric acid) resulted in a higher yield of liquid (54.6 mass %), a similar yield of char (20.6 mass %) and lower yields of gases (24.8 mass %). Surprisingly the oil obtained with pretreated biomass was formed by a single oily phase. This result is a clear indication that the pretreatment condition used mitigates the dehydration reactions. The results obtained with pretreated samples are very important because they prove that the Auger pyrolysis of pre-treated samples could lead to the production of oils with properties comparable (a single oily phase) to those reported for the fast pyrolysis (which requires very high temperatures and thus more energy) of untreated samples

Some of the preliminary results have been presented at international conferences. Four peer-review publications and a patent disclosure are in development.

Collaborators

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