



EASTERN REGIONAL RESEARCH CENTER

THERMOCHEMICAL CONVERSION OF AGRICULTURAL RESIDUES AND ENERGY CROPS INTO RENEWABLE ENERGY CARRIERS

Background: One of the research initiatives within the Crop Conversion Science & Engineering Unit at ERRC is utilization of grains, agricultural residues and energy crops for conversion into bio-based products. The conversion technologies under investigation are grouped under two platforms: (i) Sugar – the use of crops such as corn and other cereal grains for ethanol production via saccharification and fermentation processes, and (ii) Thermochemical - thermal degradation or pyrolysis to obtain bio-oils (or pyrolysis oils), gasification for synthetic gas (syngas), which can be synthesized to Fischer Tropsch liquids, or the combustion of the biomass “as is.”

Objective: Economic competitiveness of renewable fuels derived from grains and related biomass

Thermochemical Research Goals:

- *Improve economics of ethanol production by replacing natural gas use with biomass energy opportunities through co-location of pyrolysis, gasification and combustion systems*
- *Develop improved pyrolysis and gasification processes to achieve efficient farm-scale systems*
- *Research pyrolysis and gasification for co-products suitable as carbon sequestering fertilizer support*
- *Establish test protocols to characterize the thermochemical potential for ARS bioenergy crops and feedstocks*

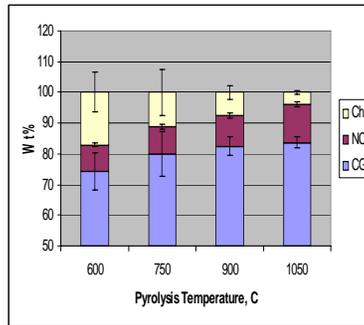
Research Approach:

- *Pyrolysis-GC/MS characterization of energy crops including alfalfa stems and perennial grasses such as switchgrass (SG), reed canarygrass (RCG), eastern gamagrass (EGG), etc.*
- *Develop a small-scale multi-purpose fluidized bed reactor for the production of pyrolysis oils (bio-oil), syngas via gasification, and hydrogen through steam reforming with catalysts*
- *Process evaluation and scale-up/scale-down for biomass energy opportunities on the farm and at ethanol plants*
- *Analytical characterization and upgrading of bio-oils for their stability and use as farm utility fuels and chemicals*
- *Surface and interfacial studies of pyrolysis derived charcoals via microscopy*

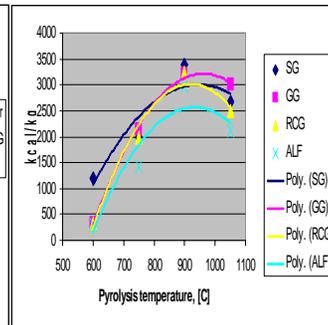
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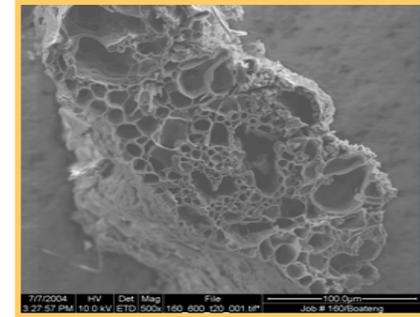
PY-GC/MS



Switchgrass: % Gas, Bio-oil & Char



Quality of Syngas from SG, RCG, ALF & EGG



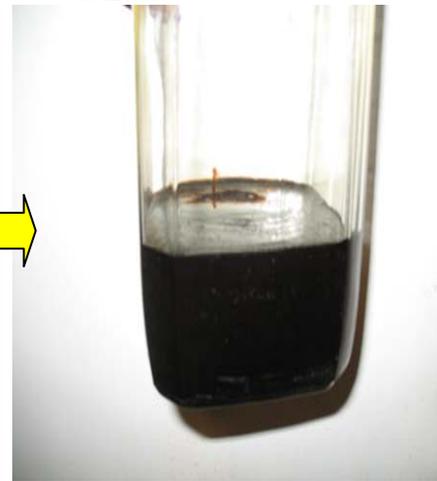
Char remaining from switchgrass pyrolysis



Switchgrass



Fluidized-Bed Pyrolysis Reactor "The Kwasinator"



Bio-Oil Produced from Switchgrass (L) and soft wood (R) at ERRC

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