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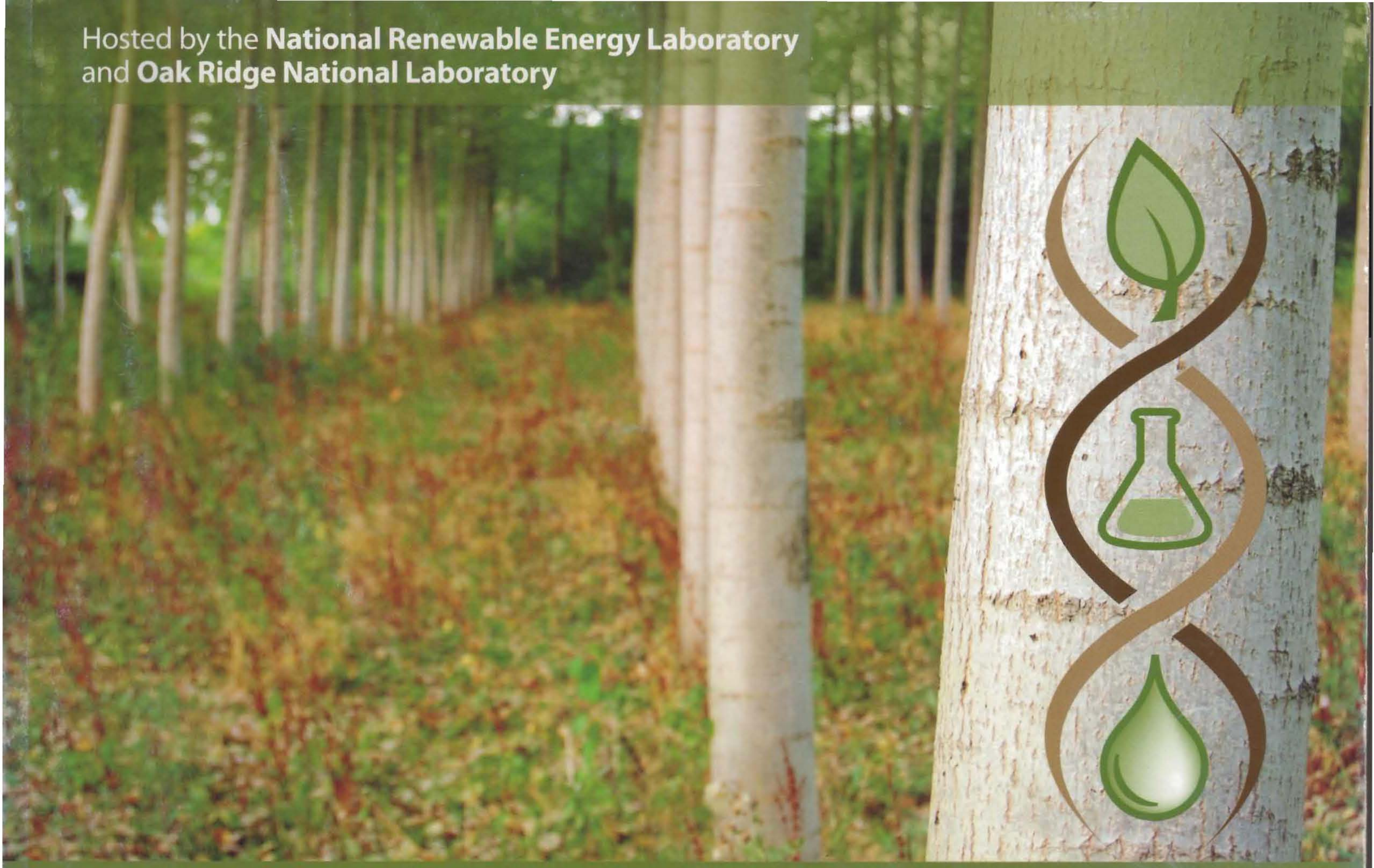

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Poster 3-66

A comparison of lime and sodium hydroxide pretreatment for delignification and enzymatic hydrolysis of rice straw

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Fresh-harvested and air-dried rice straw was pretreated either by hydrated lime ($Ca(OH)_2$) or by sodium hydroxide (NaOH) in sealed 250-ml containers. A full factorial experiment including parallel wash-only treatments was designed for both pretreatments to investigate the alkaline loading and pretreatment time for delignification. Alkaline loadings for lime pretreatments were 0, 5% and 10% of biomass, and 0, 2% and 4% of biomass for NaOH pretreatments. Reaction time was set at 1, 2 or 3 hours for both pretreatments. Water-to-dry biomass loading ratio was 10 g/g and 5 g/g for lime pretreatment and sodium hydroxide pretreatment, respectively. Reaction temperature was held constant at 95°C for the lime pretreatment and 55°C for the sodium hydroxide pretreatment. The range of delignification was 13.1 to 27.0% for lime pretreatments, and was 8.6 to 23.1% for NaOH pretreatments. Both alkaline loading and reaction time have a significant positive effect on delignification. Additionally, higher temperature also aids the effect of delignification. Delignification with water alone ranged from 9.9% to 14.5% for pretreatment at 95°C, but there was little effect observed at 55°C. The post pretreatment wash step is not necessary for subsequent enzymatic hydrolysis under the design pretreatment conditions. Cellulase and β-glucosidase were added at a dosage 15 FPU/g glucose and 15 CBU/g glucose for enzymatic hydrolysis of pretreated biomass. Hightest glucose yield was 176.27 mg/g 105°C dried biomass (48.53% hydrolysis yield) in lime pretreated and unwashed biomass, and was 142.26 mg/g 105°C dried biomass (39.17% hydrolysis yield) in NaOH pretreated and unwashed biomass.

Poster 3-67

Biodrying as a pretreatment of horticultural wastes

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In this work, biodrying process was studied as a technology to reduce mass of horticultural wastes in order to improve handle and transport of organic wastes. During biodrying water is evaporated and some organic matter is degraded by microorganisms, thus organic waste is stabilized. Six static piles were prepared inside a greenhouse, where three contained whole wastes, three with shredded wastes and a test pile outside. Ventilation duct was put in two piles for aeration improving.

Air temperature and relative humidity were monitored inside and outside the greenhouse. Mass loss, humidity, organic mater and total nitrogen in the wastes were measured. No difference in mass loss was observed between piles with and without ventilation duct, and between the shredded and whole wastes, but the loss of mass and weight were lower in the pile outside the greenhouse. Piles inside the greenhouse showed decreases of 80% and 75% in weight and volume, respectively. The data obtained in this work suggest that stabilization and volume reduction as result of biodrying improve the handle and transport of horticultural wastes minimizing the pollutant impact

Poster 3-68

Simplex optimization and mathematical modeling of wheat straw dilute acid hydrolysis

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Wheat straw is an interesting biorefinery raw material, due to its abundance, chemical composition, and cost. Among the different pretreatments suitable for its processing, dilute acid hydrolysis still presents some benefits due to its simplicity. Nevertheless, it requires a careful optimization to avoid excessive by-products formation and catalyst spending. An attractive and simple optimization approach is the Sequential Simplex Method, an iterative procedure that enables to rapidly screen a large area of operational conditions and effectively encircle the optimal.

In this work, dilute acid hydrolysis of wheat straw was optimized to selectively hydrolyze the hemicellulose fraction and obtain a pentose-rich fermentable hydrolyzate. The influence of time (up to 180 min), and sulfuric acid concentration (up to 4%, w/w) were studied. The hydrolyzates obtained in the optimized conditions mainly contain free sugars (total content higher than 46 g/L). The main potential microbial inhibitors found were acetic acid, furfural, and HMF, in concentrations lower than 4.8, 1.7 and 0.3 g/L, respectively.

Empirical models describing the influence of the studied variables on sugars and by-products formation were validated for the entire domain. Sulfuric acid concentration was found to be the most influential variable, although both variables are statistically significant for xylose recovery. Interaction effects play a significant (negative) role. Data was also modeled based on the combined severity parameter (CS) and the results of these two approaches are compared and discussed. These hydrolyzates were easily utilized by *Debaryomyces hansenii*, a natural pentose assimilating yeast.

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Poster 3-69

Biofuels Production with Cattails from Constructed Wetlands

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The feasibility of conversion of the cattails in the constructed wetlands of the North Carolina A&T Farm into ethanol and hydrogen was investigated. Using the cattails to produce renewable energy will add value to the land as well as reduce emissions of greenhouse gases by replacing petroleum products. Pretreatment of the dried cattails with hot water, dilute sulfuric acid or sodium hydroxide was followed by solid-liquid separation and enzymatic hydrolysis and fermentation of using *Saccharomyces cerevisiae* (ATCC 24858), *Yamadazyma stipitis* (ATCC 58784) and *Enterobacter aerogenes* HU101. Trials gave an average conversion efficiency of 43.4% for the pretreated solids alone which, in conjunction with the crop yield for the cattails, would give up to 4,012 liters ethanol per hectare, a favorable comparison with corn stover's 1,665 L/ha at a 60% conversion rate. Given the high potential – 9,680 L/ha at 60% conversion efficiency for solid and liquid streams – and the social and environmental benefits gained by adding value to the waste management system and reducing carbon emissions otherwise made by gasoline, it is recommended that further studies be made using cattails as a feedstock for biofuels.