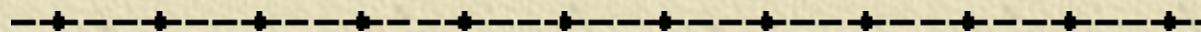


# Mississippi Technology Alliance: Strategic Biomass Initiative

## **MS Biomass Utilization: University-Based Research and Development Project**

A Mississippi Research Consortium Project

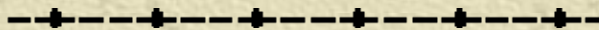


**Clint Williford and Charles Burandt**

**Department of Chemical Engineering and  
National Center for Natural Products Research**

**University of Mississippi**

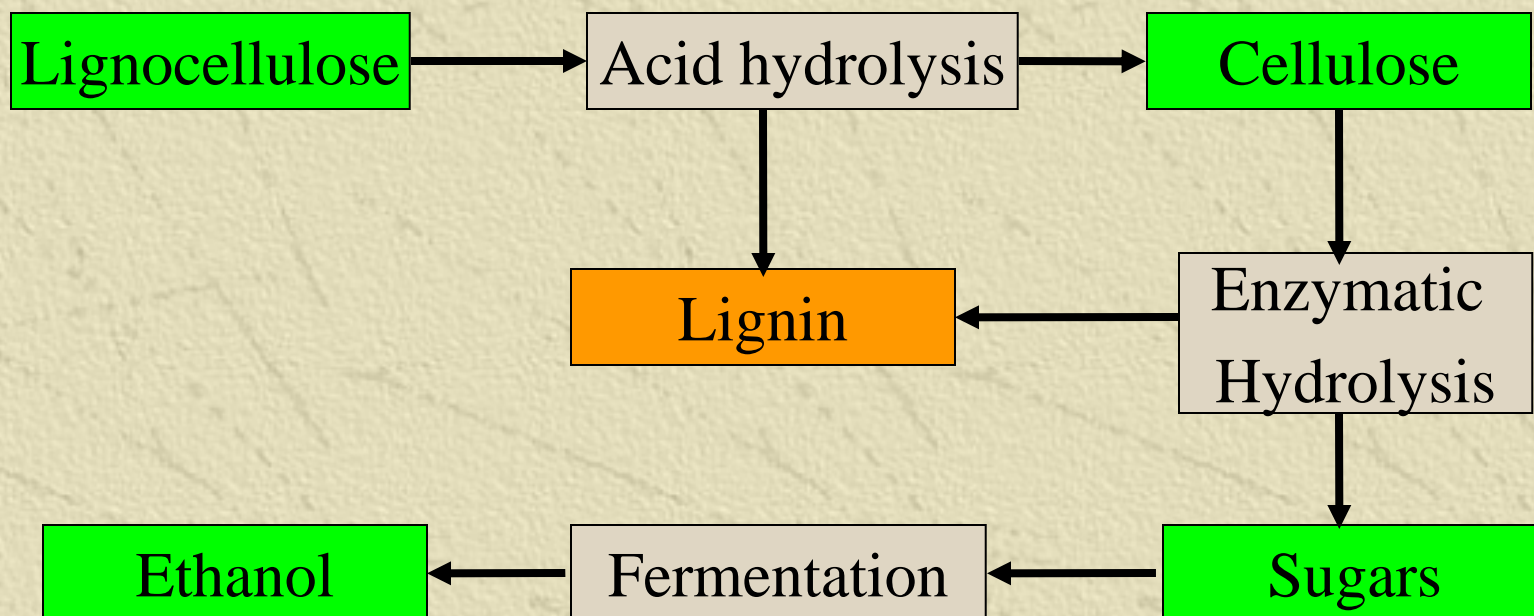
**4/17/2006**



# What This Project Is

✦ University-Based, R&D on Biomass to Fuels and Chemicals

- Lignocellulose-derived ethanol and lignin
- Biodiesel
- Solid fuel



US DOE "Sugar Platform"

# “A High Level Overview”

- ✦ Origins of the project proposal
- ✦ 1-2 Slide Summary of each project
- ✦ For the unified project
  - Biomasses
  - Products Made
  - Science and Technology Advancement

# Purpose

- ✦ “Foster viable commercial enterprises based on Mississippi’s natural biomass resources and developing near-term technologies through university-based applied R&D.”

# MTA-SBI Goals

- ✦ Promote existing biomass research at Mississippi universities
- ✦ Bring research closer to market, collaborating with commercial entities
- ✦ Partner Mississippi based biomass companies partner with Mississippi universities to overcome technical challenges and further develop products or processes with market value.

# MTA-SBI Criteria

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- ✦ Near-term (or late-stage) technology with potential for commercialization in two years or less
- ✦ Must pursue “enabling” developments,
- ✦ Must be able to clearly identify future products and markets
- ✦ Funds may provide for salaries, equipment, project materials, federally approved overhead and fringes.

# MTA and University Research

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## Jackson State University

*Depolymerization of Lignocellulose by Fungal Cells and Immobilized Enzymes*



## Mississippi State University

*Development of a Bioadsorbent for the Biodiesel Industry*



## The University of Mississippi

*High-Value Lignin Co-Products through Pretreatment and Microbial Conditioning*



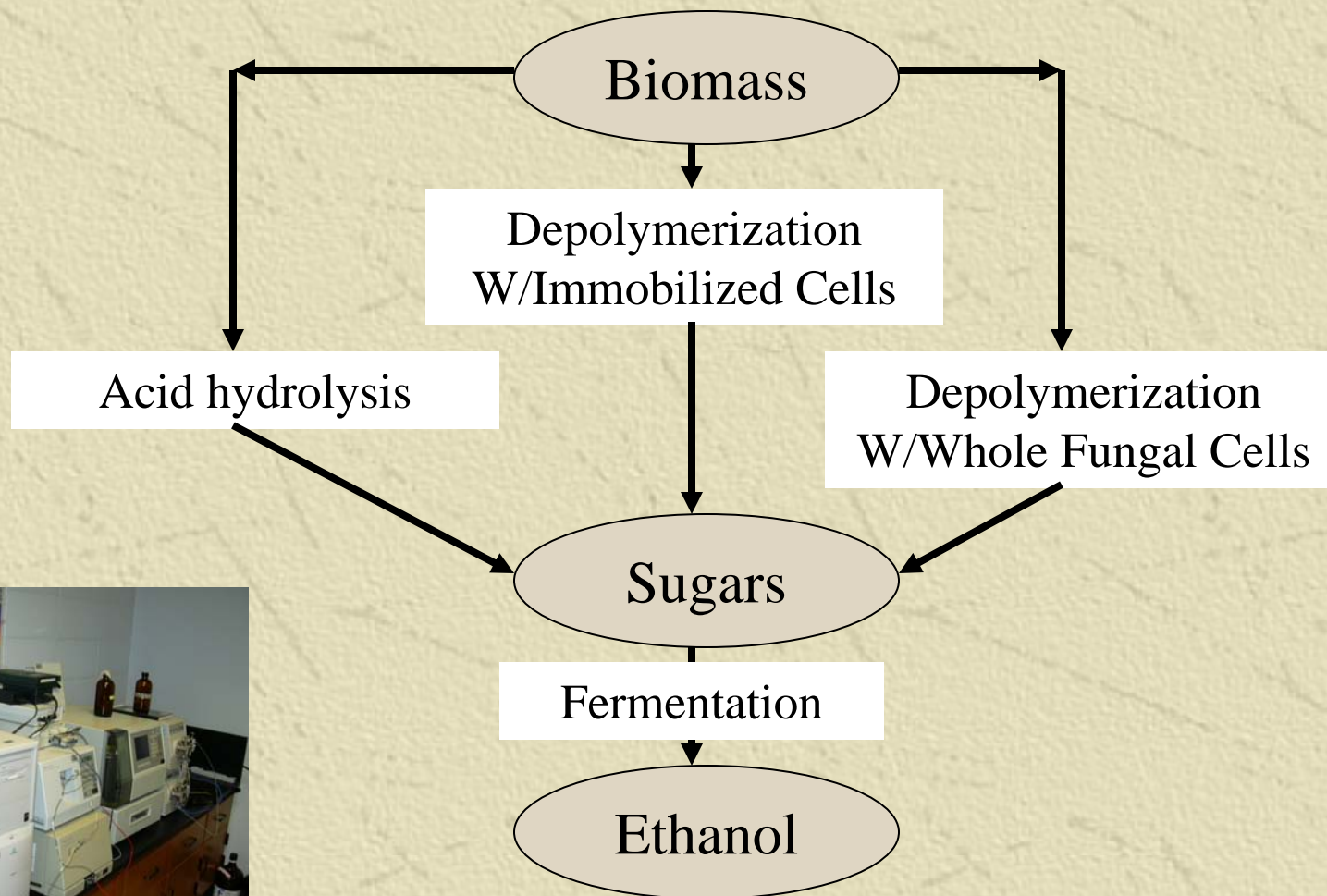
## The University of Southern Mississippi

*(1) Biomass Waste to Energy via Energy-Enhanced Biomass*  
*(2) Sawdust Conversion to Sugars Suitable for Fermentation to Fuel Grade Ethanol*

# Jackson State Project

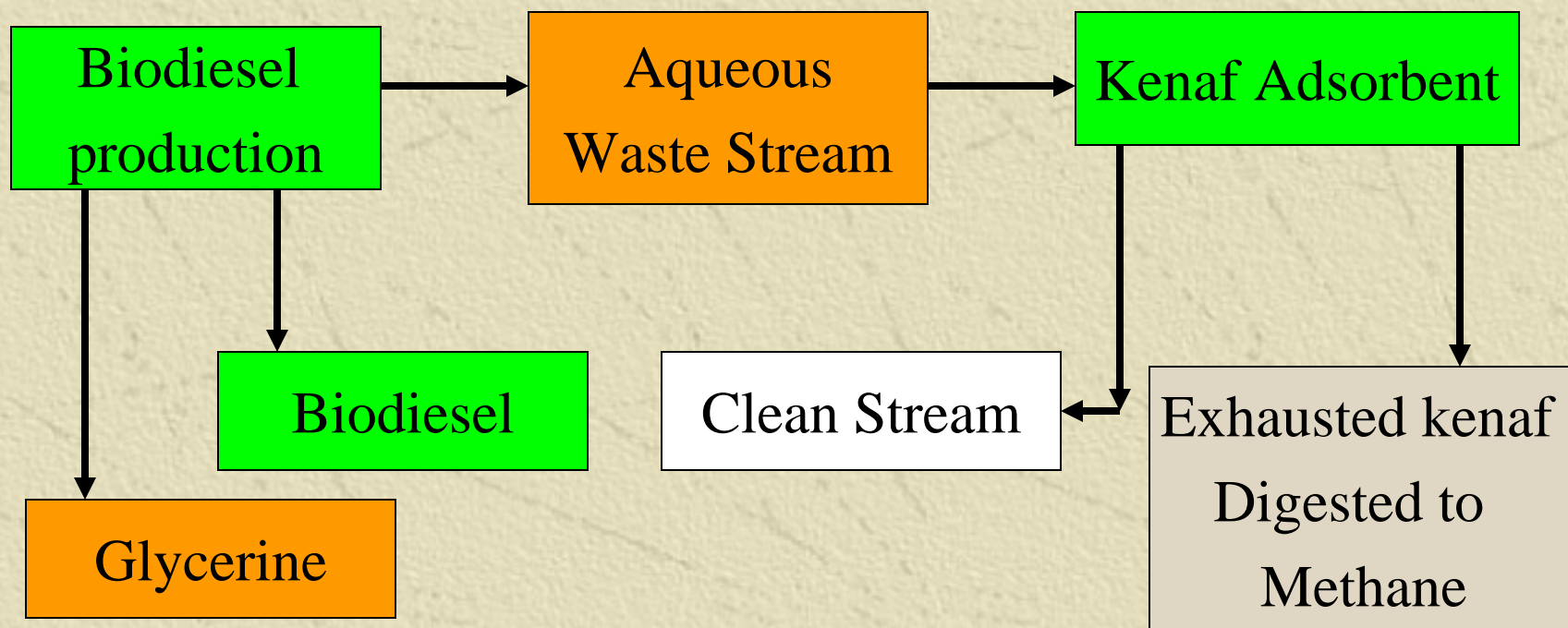


Compare feasibility and cost for 3 routes to ethanol



# Mississippi State Project

- ✦ Bioadsorbent for waste glycerine in water generated at biodiesel facilities

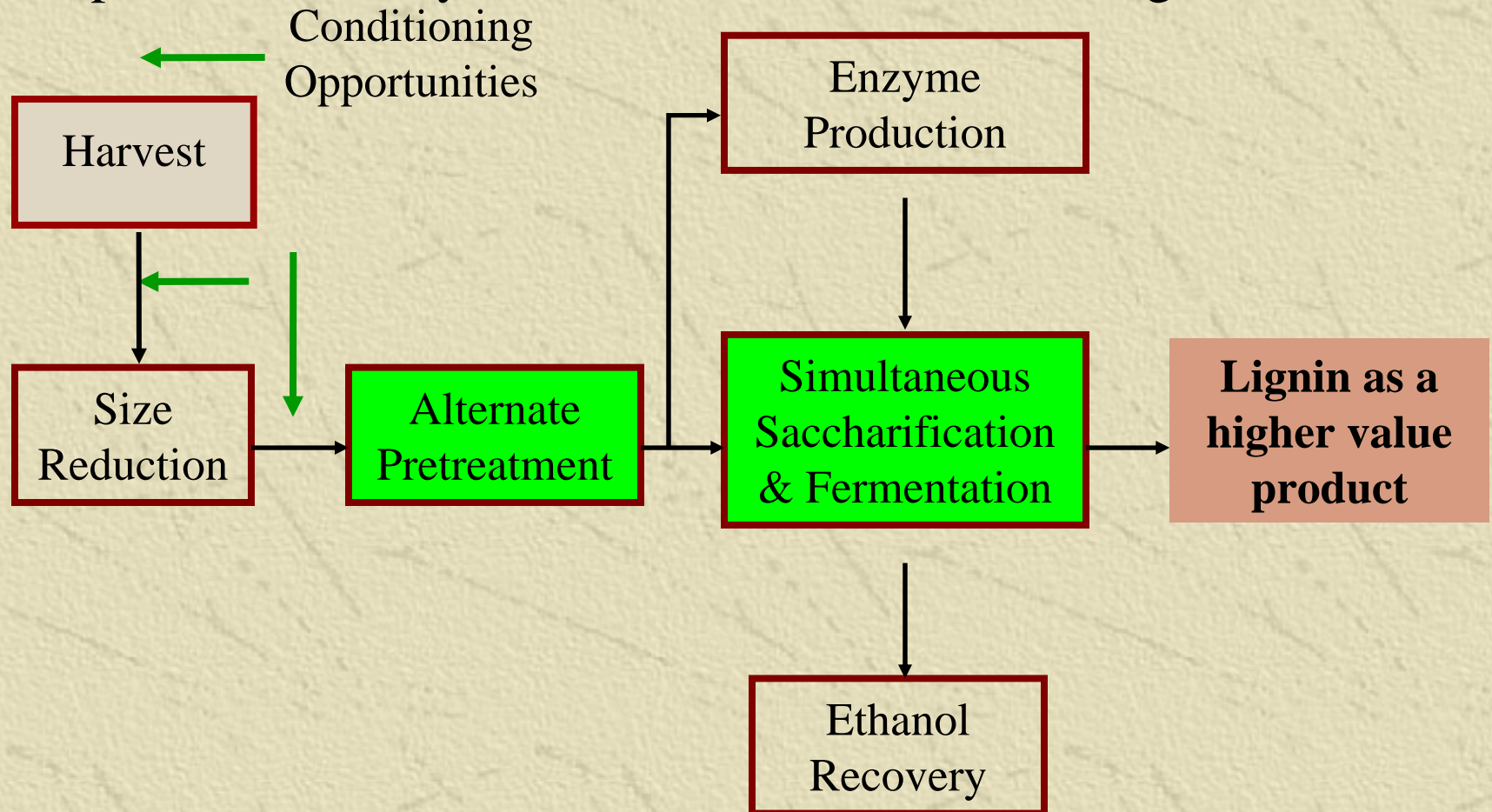


# University of Mississippi Project



Ole Miss.

Microbial conditioning with alternate pretreatment –  
improved ethanol yield, economics, and useable lignin adhesives





# UM Project: USM

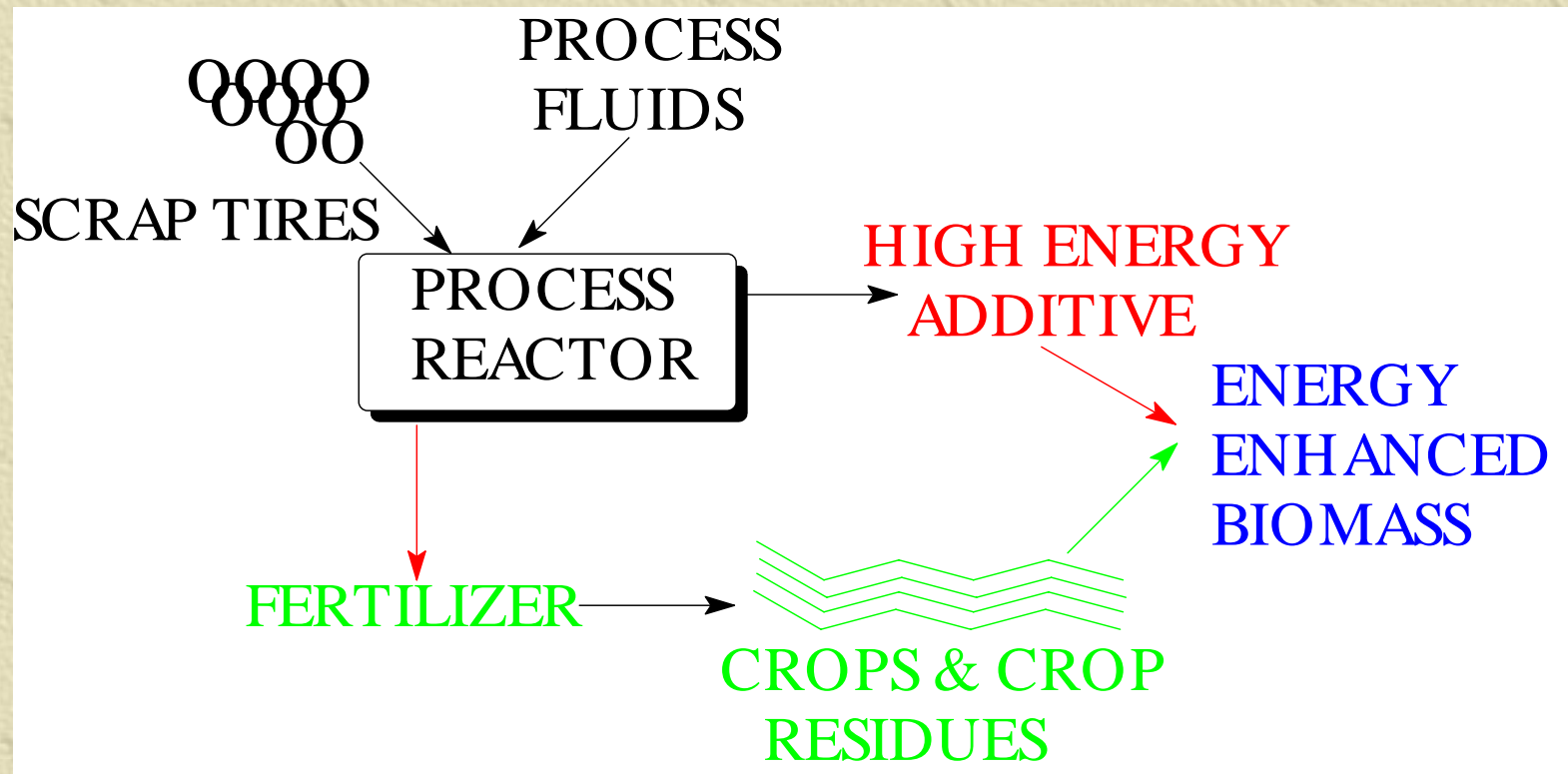
## Polymer Science Group Collaboration

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- ✦ Evaluate properties and potential of lignin co-products for coatings and wood composites (plywood)

# University of Southern Mississippi Project (1)

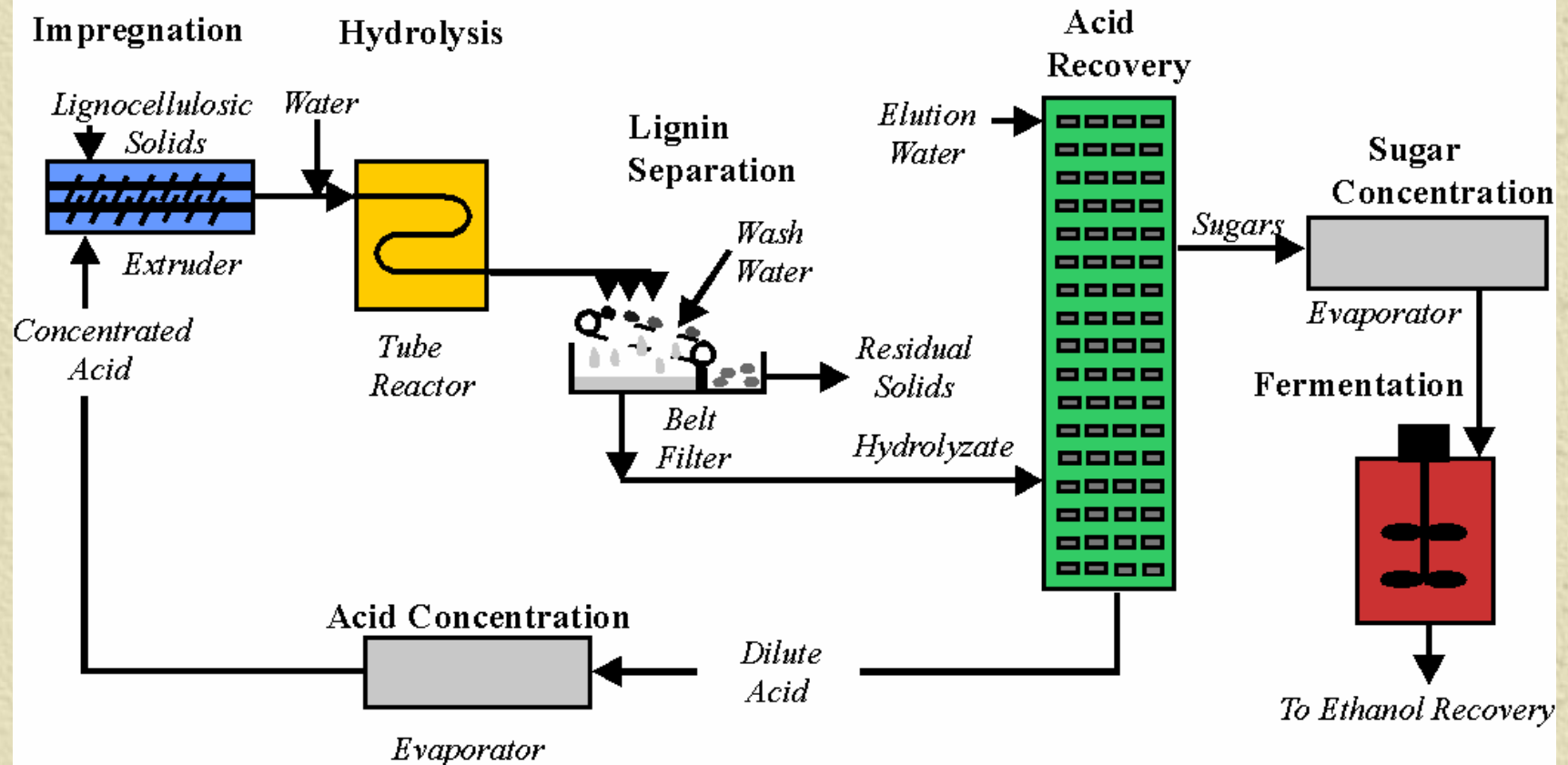
Combine crop/animal residue and recycled tire powder. Produce stable, clean-burning, high-value solid fuel, displacing higher cost utility fuels.



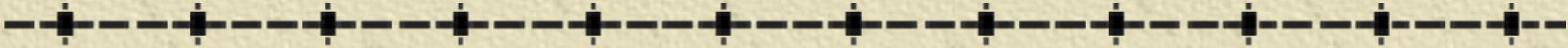
# University of Southern Mississippi Project (2)

Develop continuous concentrated acid hydrolysis process.  
Economically convert pine sawdust to fermentable sugars

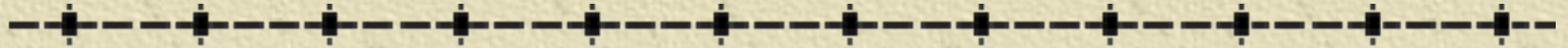
## Waste Wood to Ethanol Process Unit Operations



# Biomass to be Investigated

- 
- ✦ Corn stover
  - ✦ Switchgrass, sudan grass, *Miscanthus*
  - ✦ Sawdust
  - ✦ Sorghum hulls
  - ✦ Cogon grass
  - ✦ Municipal wastes
  - ✦ Soybean/oil crops

# Products (made or enabled)



- ✦ Ethanol
- ✦ High-value solid fuel
- ✦ Biodiesel
- ✦ Methane
- ✦ Adhesives and coatings

# Science and Technology Advancement

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- ✦ Technology for glycerine adsorption onto biomass,
- ✦ Solid fuel formulation
- ✦ Production of a high value lignin-co-product
- ✦ Microbial conditioning of biomass to enhance conversion
- ✦ Simplification and cost reduction for lignocellulose pretreatment
- ✦ Acid hydrolysis of wood to ethanol

# Commercial/Industrial Partners

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- ✦ Commercial Partnerships and Collaboration
- ✦ MBI International
- ✦ American Biorefining
- ✦ Adhesive and coatings companies in Mississippi
- ✦ Kengro Corporation of Charleston, MS and other biodiesel facilities (Nettleton, Pearl, and Meridian) and investment groups (planned facilities in Aberdeen, New Albany, and Vicksburg)
- ✦ Noetics Technology, Inc. (Hattiesburg)
- ✦ OMNI Instruments, Inc. (Biloxi)
- ✦ Mississippi Power Co.-The Southern Company
- ✦ Antek Research, Inc. (Biloxi)
- ✦ Compact Power (a British company)

# Anticipated Benefits

## At the local, rural level

- ✦ Increased harvesting/processing lignocellulose and oil crops.
- ✦ Products to meet local and state needs for fuel and chemicals.
- ✦ Commercial opportunities – ethanol production, transportation and solid fuel blending, engineered wood products, and biodiesel production.
- ✦ In-state know-how and intellectual property rights to generate commercial opportunities regionally and nationally.

# Impacts and Issues ???



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## ✦ Technology

- ◆ Feedstocks: wood, grasses, oil seed
- ◆ Process: biochemical and thermal
- ◆ Process scale: “biorefining” or moonshining”

## ✦ Regulations

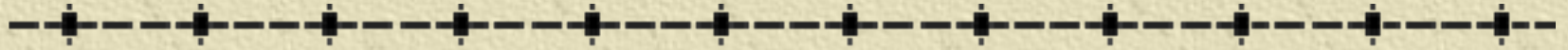
- ◆ Environmental, shipping, safety, liability, crop subsidies

## ✦ Business model (Raw material provider or processor?)

- ◆ “Farmgate, Elevatorgate, Biorefinerygate”

## ✦ Stakeholders and bagholders

- ◆ Who gets the value-added?



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