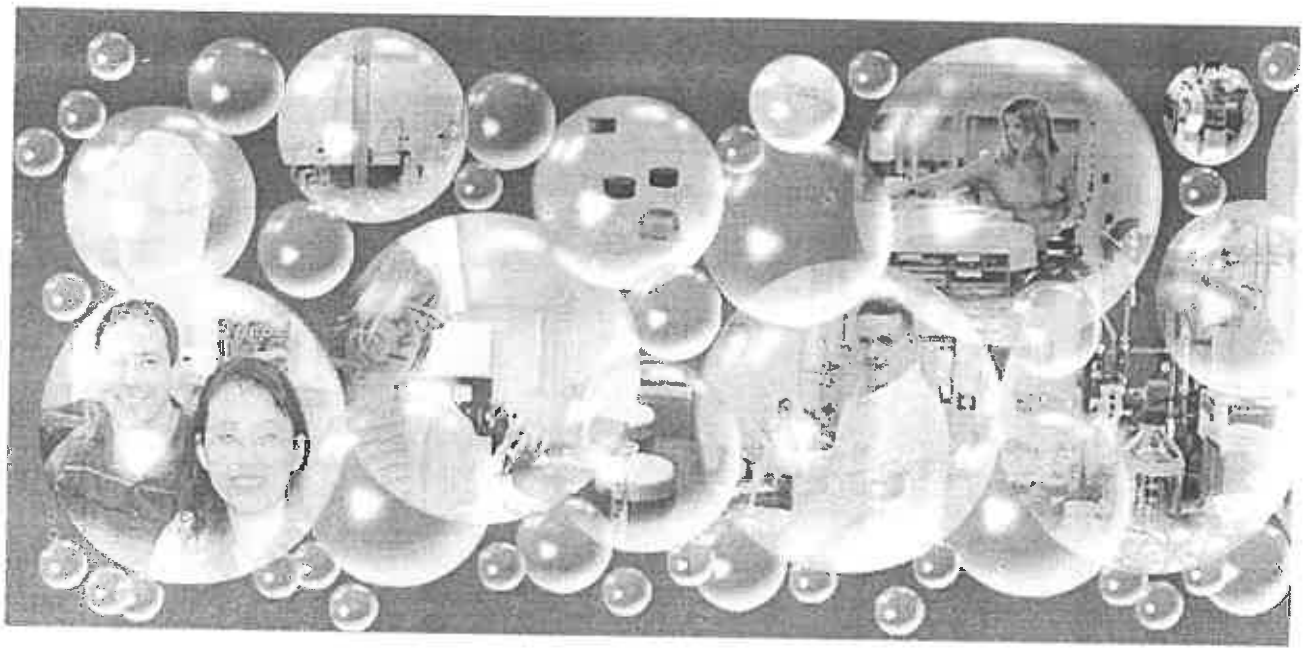


Biobased Products

indicates that the ethanol cost could be reduced by 17% if the glucose potential of the biomass feedstock was increased by selective fractionation.

Development of a Mild Solvent Extraction System for the Production of Value-Added Chemical and Materials from Biomass

The thermochemical conversion of agricultural and forestry biomass into value-added chemicals and materials holds great promise for improving industrial sustainability and increasing markets available for US crop producers. This proposed project will investigate the conversion of biomass to value-added chemicals and materials by mild solvent extraction (MSE). MSE is an extractive process which utilizes a heavy solvent to directly convert biomass to liquid products, gases, and solid chars without the need for hydrogen overpressure or catalysis at conditions which favor the formation of heavy products such as pitch.

In summary, the project seeks to overcome the inherent deficiencies of traditional biomass thermochemical processes (liquefaction, pyrolysis, and solvolysis) by investigating the utilization of mild solvent extraction (MSE) with biomass as a feedstock. The goals of the project include:

- Increasing the utilization of biomass to produce chemicals and materials, offering new markets for US crop producers with an opportunity to increase farm income and produce jobs in rural communities.
- Developing a "green", carbon neutral processes for producing chemicals and materials that are currently being produced from fossil sources.
- Producing marketable and performance competitive high value chemical feedstocks, high value carbon materials, and pitches from biomass, a low cost and abundant renewable resource, via a low energy, low cost solvent extraction process (MSE).
- Developing the extraction process to yield an indigenous heavy solvent, minimizing solvent costs and eliminating the problem of expensive solvent makeup or solvent refining prior to recycle.
- Processing the pitch resulting from MSE of biomass via low cost air blowing or thermoprocessing to yield high value binder pitches, pitch-derived carbon fibers, and activated carbon fibers.

Effect of Source of Biomass

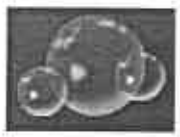
A range of biomass types (e.g., corn stover, hybrid poplar, and fescue) will be selected to investigate the sensitivity and efficiency or process variables on the overall economics of the process. MSE is proven to be a viable route for the conversion of coal into chemicals and materials. The extension of this low cost process to the conversion of biomass, although offering new challenges, is a logical choice for reducing domestic dependence on foreign

Analysis of Products

The recovered products may have economic values that are substantially greater than that of the starting biomass. In this case, even though their yields may be modest, their value makes recovery economically feasible. Valuable products that fall into this category include:

Pitch. The low severity extraction step could produce a pitch suitable for use as a binder in the manufacture of anodes for aluminum smelting or alternatively as a carbon fiber precursor. Binder pitches are high value ($0.33/kg), high volume (5,200 metric ton per day, worldwide consumption) commodities. Carbon fiber precursors are even more valuable with the potential for dramatic demand and growth if production costs can be significantly reduced.

Phenol. Phenol is used extensively across a wide range of disparate industries. It is used in the manufacture of resins including phenolic (used to make plywood, for example), epoxy, and polycarbonate. It is also a component in the production of nylon 6 and in many pharmaceutical and agricultural chemicals. Phenol's current selling price is $0.88/kg. Such high value, high volume materials are attractive targets for byproducts of this conversion processes.



Activated carbon. One of the fastest growing markets for carbon products is in environmental applications. Enormous interest has been generated by ecological awareness and regulation and the need to find relatively low cost solutions for environmental protection and remediation. In this respect, the materials of interest are predominantly activated carbons. Activated carbons can be produced with a wide range of properties and physical forms for use in numerous applications

Conductive Fillers. The polymers used in conjunction with electronic components and devices can suffer from charge accumulation during production which when discharged may cause damage to the component. The addition of conductive fillers to polymers is commonly used to control electrostatic charge accumulation. The conductive filler provides a conductive pathway in the polymer. Carbonized biomass char maybe a suitable low cost alternative to carbon black for electrostatic discharge control in polymers.

Fuel. Residues from this extraction process are solid fuels (char), suitable for generating process heat or as feed to a power generation plant. As a MSE product, this fuel has been stripped of its more valuable products prior to combustion. The mild conditions utilized should produce a solid fuel residue with more than adequate calorific value, which is significantly higher than