

**Contract No. BM0-001-001**  
**“Developing a Biomaterials Industry in North Dakota”**

Submitted by North Agricultural Experiment Station, North Dakota State University  
Principal Investigator: Dr. F. Larry Leistritz

**PARTICIPANTS**

<b>Sponsor</b>	<b>Cost Share</b>
North Dakota Industrial Commission	\$ 800,000
MBI (including USDA ARS funding)	\$ 828,000
NDSU (including USDA funding)	\$ 139,998
Great River Energy (In-Kind)	<u>\$ 25,000</u>
Total Project Funding	\$1,792,998

Project Schedule – 12 months  
Contract Date – August 15, 2008

Project Deliverables:  
Status Report: December 31, 2008 v  
Final Report: December 31, 2009

**OBJECTIVE/STATEMENT OF WORK:**

The goal of this project is to complete a front end engineering and design (FEED) study for a pilot scale plant to demonstrate the commercial potential of technology to produce materials and fuel from biomass feedstock. Initial efforts will be focused on technical and economic requirements for commercializing technology to produce bio-based cellulose nanowhiskers. Specific objectives include:

1. Completing detailed investigations to define:
  - a. Scalable process design
  - b. Mass and energy balances necessary to determine process cost
  - c. Analysis of the structural materials available from wheat straw
  - d. A system for analyzing the structural enhancements of polymers from the inclusion of wheat straw fibers
2. Refining the initial investment analysis for the business as data is added to key parameters regarding capital costs and manufacturing yields.
3. Preparation of a strategic business plan for integration of public and private sector resources to provide investment for pilot plant construction and, when appropriate, construction of commercial manufacturing facilities.

**STATUS**

Interim status report has been received. The full interim report is posted on the Industrial Commission website. The interim report states in part:

The CAFEX II pretreatment system has been designed and constructed. All safety systems are installed and tested. Initial trials have been conducted to assess operational processes including: 1) feeding and pumping of biomass; 2) introduction of moisture and ammonia; 3) mixing of biomass with water and ammonia; 4) mixing and heating; and 5) maintenance of temperature and pressure within the reactor. In this system ammonia is not recovered. Samples are taken at the end of the reactor and the rest of the material is quenched with water and acid and discarded. Our approach has been to demonstrate the CAFEX concept using DDGs and corn fiber, which can be pumped using current equipment, while at the same time developing techniques to pump high-impact feedstocks. Tests with DDGs in the continuous reactor during the reporting period revealed problems with pressure and temperature control. With the original configuration we typically observe a relatively stable temperature that is significantly lower than the target, and widely fluctuating reactor pressure. Also during this period, the physical characteristics of wheat straw such as water absorption saturation capacity and hydraulic conductivity were measured. Pumpability of wheat straw slurry was tested with our current pump. Even at high moisture levels the current pump was not able to pump the wheat straw slurry. However, using additives to modify the slurry properties improved the pumpability of the wheat straw. Quantitative recovery of  $\text{NH}_3$  from AFEX-pretreated wheat straw was investigated during this period.

In regards to the development of a strategic business plan, activities have focused on identifying potential private sector investors who have a strategic interest in commercializing this technology. Initial interactions have been encouraging, and more detailed discussions with one or more investors will be pursued in the coming months. The study team has also begun to investigate public sector resources that could be mobilized for a commercialization effort.

June, 2009. A request was made and granted for a no-cost, six-month extension for the submission of the final report.

6/09