



# Bio-Materials & Technology Lab

## About BTL:

Bio-Material & Technology Lab (BTL) is one of the three key laboratories of Bio-Processing & Industrial Value Added Program (BIVAP). The BTL is a multi-functional laboratory, located in the BIVAP building of the Department of Grain Science and Industry, Kansas State University. The BTL has professional staff and well-equipped facilities, which has the capability of performing design, formulation, processing, analyzing, and testing of various bio-based materials, and converting agricultural commodities/by-products to value-added materials. The BTL works closely with departments, universities, and various industries to provide research, technical consulting and service, and teaching/education in the field of bio-material science and technology.

## BTL Mission and Goal:

Our mission is to promote widespread use of bioproducts from agricultural resources to meet future national and environmental needs. Our goal is to research and develop value-added bioproducts from the agricultural resources, and to provide education and technical service in the field of bio-material science and technology.

## BTL People:

### Director

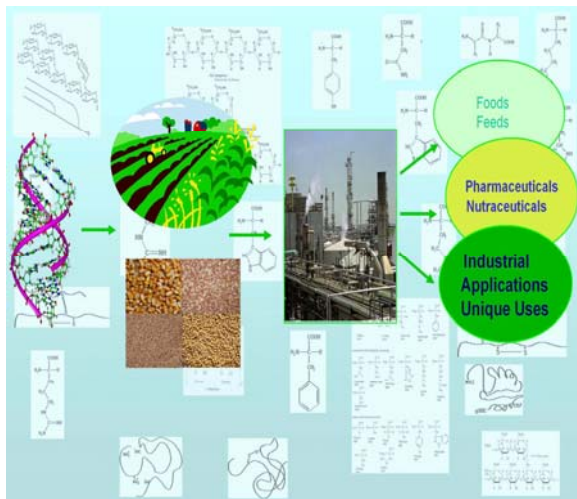
Dr. Xiuzhi Susan Sun  
Professor  
Phone: 785-532-4077  
Email: [xss@ksu.edu](mailto:xss@ksu.edu)

### Associate Director

Dr. Donghai Wang  
Assistant Professor  
Phone: 785-532-2919  
Email: [dwang@ksu.edu](mailto:dwang@ksu.edu)

### Technical Manager

Dr. Zhikai Zhong  
Research Scientist  
Phone: 785-532-6573  
Email: [zzhong@ksu.edu](mailto:zzhong@ksu.edu)



## BTL R & D Focus:

- Bio-Materials Processing and Modification
- Rheology and Phase Transitions of Bio-Materials
- Structure and Functional Properties of Plant Polymeric Materials
- Bio-Nano Materials
- Biobased Adhesives, Resins, and Composites
- Soy Protein Polymers
- Biomass Conversion into Chemicals and Fuels
- Soybean and Sorghum Varieties Screening for Industry Uses
- Integrated Utilization of Agriculture Materials

***I. Contract research (6 months ~ 2 years)***

The service focuses on transforming agricultural materials and by-products into value-added products and their characterization, including, but not limit to, adhesives, resins, composites, film, foams, fibers, ethanol, functional polymers, chemicals, thermoplastics, etc

***II. Short-term research (1 ~ 6 months)***

Preliminary testing and feasibility studies of converting agriculture materials and by-products into value added products



mentioned in item I.

The short-term research also includes service of using of our facilities. This service includes equipment usage, related lab space, minor lab tools, and technical operational assistance.

***III. Technical consult***

Provide information, knowledge and technical solutions, and help to solve problems related to agriculture materials utilization and processing, charged on an hourly basis or at negotiated rate per case.

***IV. Characterization and Testing (not limited to what listed below)***

We provide detailed testing service with our state-of-the-art facilities. The Service cover various materials, including solid, viscoelastic materials, liquid or solution, petroleum materials, biobased materials, plastics, film, adhesive and composite, and food/feed materials and products. The tests include general property measurements, purity analysis, additives analysis, chemical reactions, pyrogenation, compatibility, and fermentation properties. Specific measurement services are described below:

**1. Consumer products performance ASTM standard testing**

Adhesives; Thermoplastics & Thermosets; Extrusion and injection molding; Flowability; Films; Foams; Composites



**2. Characterization of food/feed & their ingredients**

Thermal/rheological/mechanical properties; Structure & texture; Performance; Phase transitions, Aging; Water activity & relations

**3. Thermal behavior**

Melting points/profiles; Glass transition (softening point); Sub-T<sub>g</sub> transitions; Crystallization temperature, rates, times, crystallinity; Enthalpy; Heat capacity; Gelation; Protein denaturation; Starch gelatinization and retrogradation; Amylose-lipid complexation; Thermal history/processing conditions; Polymorphic transitions;





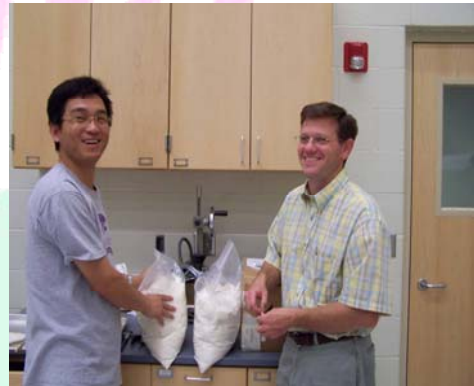
Heat dissipation properties; Thermal reaction and thermal cross-linking, Degree of cure; Thermal stability; Thermal decomposition; Loss on drying; Shrinking behavior and dimension stability; Thermal plasticity and thermal setting; Physical Aging; Flowability, Melting index

#### 4. **Mechanical properties of materials**

Young's modulus, Tensile strength, Elongation; Compression strength, Modulus of Elasticity, Modulus of Rupture; Flexile modulus, Flexile strength; Internal bonding strength; Adhesion strength, shear strength, peel strength; Stiffness and resilience; Impact resistance, Toughness

#### 5. **Viscoelastic properties**

Storage modulus, Loss modulus, and Complex modulus; Storage compliance, Loss compliance, and Complex compliance; Damping, Tan Delta, Phase angle; Acoustical and vibrational damping; Oscillation, Multiwave oscillation, Rapid frequency sweeps; Cure analysis and Gel point (ASTM D4473); Stress relaxation; Stress growth



#### 6. **Rheological properties**

Viscosity; Reduced viscosity and intrinsic viscosity; Flow behavior, Newtonian, Shear thinning, Shear

thickening, Bingham plastic; Creep test, Creep-Recovery test; Compliance; Zero shear viscosity, and Molecular weight; Elasticity and Molecular weight distribution; Stress relaxation, Relaxation time; Stress growth; Multiple frequency oscillation; Time dependent rheological properties, Thixotropic analysis; Temperature dependent rheological properties



#### 7. **Surface properties of liquid**

Contact angle; Surface tension; Wettability

#### 8. **Water relations in biopolymers and bio-materials**

Water activity; Water diffusion and evaporation behavior; Non-freezing water (bond water); Moisture content; Vapor pressure; Conductivity and pH of solution; Functional properties in relation to water content

#### 9. **Protein Characterization**

Molecular weight of protein and subunit; Isoelectric point; Protein purification; Protein comparison; Protein separation

#### 10. **Crop variety screening** (for ethanol, organic acids, adhesives, thermoplastics, and oil production)

#### 11. **Fermentation**

Macro scale at 5 - 10 liter; Micro scale at a few grams; Chemical composition analysis; Purification; Separation



12. **Powder and biopolymer analysis:** Particle size and distribution, particle shape, density, solubility

13. **Accessible Instruments**

Scanning electron microscopy; Fourier transform infrared spectroscopy; Ultraviolet-visible spectroscopy; Laser scanning light microscopy; Transition electron microscopy; Circular Dichroism spectroscopy; X-ray Diffraction, and many unmentioned instruments on campus.

 **BTL State-of-the-Art Facility**



**Materials & Products Testing**



**Materials & Products Processing**



**Bioconversion**



**Food Processing**

 **Contact us**

Bio-Material & Technology Lab  
101 BIVAP Building, 1980 Kimball Ave.  
Kansas State University  
Manhattan, KS 66506-7100

Tel: (785) 532-4077, (785) 532-6573

Fax: (785) 532-7193

Email: [BTLab@ksu.edu](mailto:BTLab@ksu.edu)

Webpage: <http://www.grains.ksu.edu/btl>