

Idaho National Laboratory Advanced Multi-stream Sorting Facility

Idaho National Laboratory (INL) has expertise with research specialization in supply and logistics, analysis, preprocessing, and characterization of materials and chemicals relevant to manufacturing processes.

Our extensive capabilities are available to facilitate research activities through the Biomass Feedstock National User Facility (BFNUF), which provides access to the Process Development Unit (PDU) and a state-of-the-art characterization laboratory.



The Process Development Unit (PDU) is a modular, fully integrated, full-size biomass preprocessing system for design and scale-up of bioenergy facilities. The PDU offers toll processing, piloting, third party equipment testing and preprocessing R&D. The PDU has a maximum process rate of five tons per hour and allows partners to test grinding, drying, pelletizing, cubing, torrefaction, and mechanical and chemical separation options.

Commercial plants that process bulk solids, such as e-waste, fibers and papers, polymers, and chemicals, typically operate at a fraction of design capacity during their first year. One of the primary reasons is poor feed handling. A single feed handling problem—ranging from plugged augers to broken equipment—may bring the plant to a standstill until the problem is resolved. The Process Development Unit (PDU), is a full-size, fully-integrated preprocessing system. The PDU allows industry partners to test a variety of grinding, drying, pelletizing, cubing, torrefaction, and mechanical and chemical separation options during design and scale-up of manufacturing facilities. The PDU analyzes various methods of feedstock operations and preprocessing prior to conversion. In each case, tight tolerances on the particle-size distribution and precise preprocessing conditions is required. The Feedstock PDU capabilities are grouped into five categories, with a variety of equipment types and sizes available in each: size reduction, separation/fractionation, thermal treatment, chemical treatment, and densification. A unique capability of the Feedstock PDU is to test and develop fully integrated and instrumented industrial-scale preprocessing systems. Continuous processing and data collections enables:

- Identification of preprocessing bottlenecks
- Exploration of the interaction and synergies of preprocessing operations affecting feedstock specification and conversion performance
- Optimization of integrated preprocessing system

INL Advanced Multi-stream Sorting Facility Equipment List

Feedstock Preparation and Separation

- Grinding
- Drying
- Pelletizing
- Cubing
- Torrefaction
- Mechanical separation
- Chemical Separation

Characterization and Analysis Equipment

- Particle-Size Distribution and Morphology — Various methods and instruments are used to determine particle size, size distribution, shape and density. Methods include a Camsizer that can determine geometric mean diameter length and width, sphericity and aspect ratio.
- Microscopy and Imaging — Digital, confocal laser, scanning electron and Fourier-Transform infrared microscopy help researchers develop mechanical and chemical preprocessing and densification options that impact the chemical and physical attributes of the feedstocks.
- Particle Characteristics — Pycnometry determines the true density. Gas sorption analysis determines surface area, pore volume, average pore size, and pore size distribution of microporous and mesoporous solids using classical BET helium void volume. Mercury porosimetry is also available.
- Rheology — Rheology capabilities include a rheometer, 2- and 3-D image analysis of size and shape distribution of bulk solids, an automated Schulze ring shear tester, uniaxial compressibility and springback analysis, air permeability analysis, auger feeding tests and hopper flow tests.