Bench-Scale Fermentation Laboratory

Bench-scale process development capabilities for the conversion of biomass to sugars, fuels, and chemicals

NREL’s bench-scale fermentation laboratory is home to a number of traditional fermentors, ranging in size from 500 mL to 5 L, and one high-solids bioreactor.

**NREL’s bench-scale fermentation laboratory provides:**

- Fermentation systems with pH, temperature, and dissolved oxygen control
- Data acquisition and recipe control for the Biostat Q and Q-Plus systems
- CO₂ and redox measurement capabilities
- At-line analytical equipment capable of monitoring glucose, xylose, ethanol, ammonium, and potassium ion with flexibility to measure other compounds
- Custom-built bioreactor for high-solid lignocellulosic biomass slurries (>10% insoluble solids).

**Bench-scale fermentation applications include:**

- Enzymatic hydrolysis and fermentation testing
- Microorganism evaluation and development
- Aerobic and heterotrophic algal process development.

---

**Equipment Type** | **Quantity**
--- | ---
500-mL small-scale Sartorius Biostat Q-Plus fermentor | 15
1-L Braun Biostat Q fermentor | 8
New Brunswick Bioflo 3000 fermentor with 1 L to 5 L interchangeable vessels | 4
4-L high-solids bioreactor | 1

NREL uses these 1-L Braun Q fermentors to study the fermentation performance of different microorganisms, such as *Zymomonas mobilis*. Photo by Patrick Corkery, NREL/PIX 16368
Applications

Enzymatic hydrolysis and fermentation testing
- Different enzyme mixtures
- Pretreated lignocellulosic feedstocks at low and high solid concentrations
- Aerobic and micro-aerophilic cultivation processes.

Microorganism evaluation and development
- Evaluating microorganisms for production of biofuels and bioproducts
- Producing inhibitor-resistant and high-product-tolerant microorganisms for biofuels production that improve conversion yields.

Aerobic and heterotrophic algal process development
- Studying the effect of the environment on algae growth and lipid production
- Using algae residue as a feedstock for biofuels production.

Glucose, xylose, and ethanol concentrations during enzymatic hydrolysis and fermentation of pretreated corn stover at 20% total solids. Figure by NREL

Associated publications


For more information, contact:
Dan Schell, 303-384-6869, Dan.Schell@nrel.gov
Nancy Dowe, 303-384-6849, Nancy.Dowe@nrel.gov