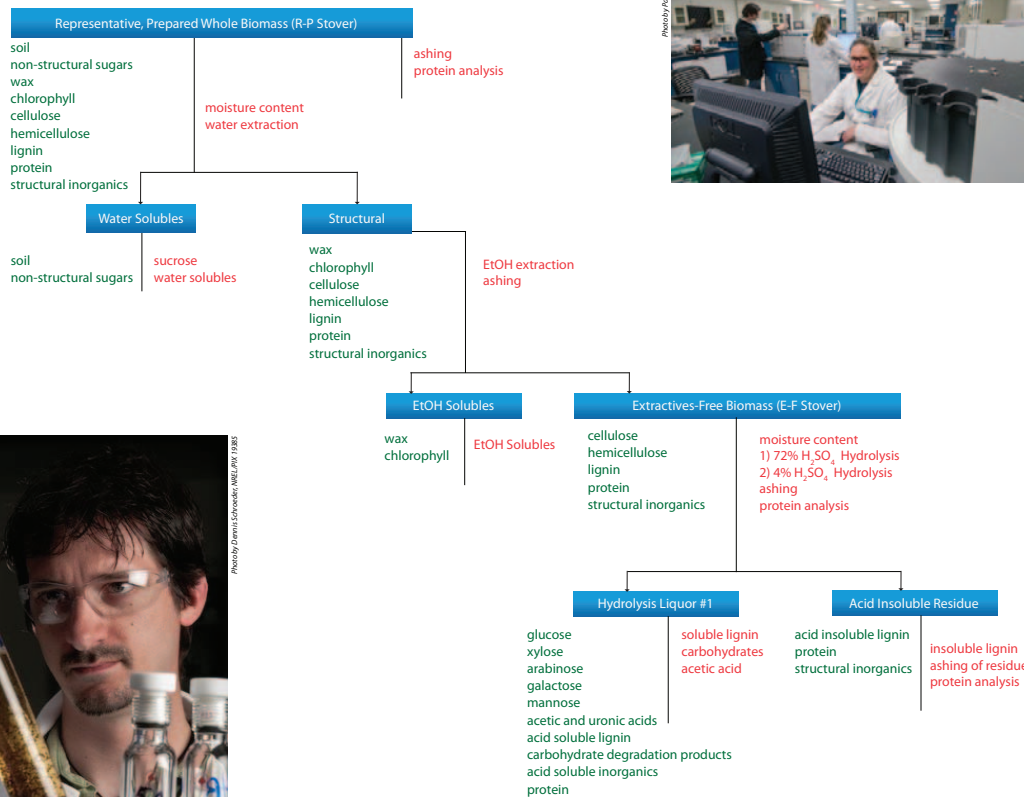![NREL — NATIONAL RENEWABLE ENERGY LABORATORY]

Compositional Analysis Laboratory

Determining the chemical composition of biomass feedstocks, intermediates, and products

Flow Chart of Feedstock Analysis

Photo by Pat Corkery, NREL/PIX 18653

Representative, Prepared Whole Biomass (R-P Stover)

- soil
- non-structural sugars
- wax
- chlorophyll
- cellulose
- hemicellulose
- lignin
- protein
- structural inorganics

ashing
protein analysis

moisture content
water extraction

Water Solubles

- soil
- non-structural sugars

sucrose
water solubles

Structural

- wax
- chlorophyll
- cellulose
- hemicellulose
- lignin
- protein
- structural inorganics

EtOH extraction
ashing

EtOH Solubles

- wax
- chlorophyll

EtOH Solubles

Extractives-Free Biomass (E-F Stover)

- cellulose
- hemicellulose
- lignin
- protein
- structural inorganics

moisture content
1) 72% H_2SO_4 Hydrolysis
2) 4% H_2SO_4 Hydrolysis
ashing
protein analysis

Photo by Dennis Schroeder, NREL/PIX 19385

Hydrolysis Liquor #1

- glucose
- xylose
- arabinose
- galactose
- mannose
- acetic and uronic acids
- acid soluble lignin
- carbohydrate degradation products
- acid soluble inorganics
- protein

soluble lignin
carbohydrates
acetic acid

Acid Insoluble Residue

- acid insoluble lignin
- protein
- structural inorganics

insoluble lignin
ashing of residue
protein analysis

Three specialized laboratories staffed by a team of experienced scientists

- Provide customized analytical method development for a wide variety of feedstocks and process intermediates
- Derive comprehensive biomass analysis results backed by 20 years of experience supporting the biomass conversion industry
- Write publicly available Laboratory Analytical Procedures, several of which have been adapted by ASTM International and used and referenced worldwide
- Provide training classes on biomass analysis and method development to help companies and institutions rapidly improve their analytical results

Compositional analysis procedures

- For analyzing solid samples to measure structural carbohydrates (glucose, xylose, galactose, arabinose, and mannose), lignin, extractable materials, protein, and ash
- For analyzing liquid samples to measure oligomeric and monomeric carbohydrates, lignin, and byproducts including organic acids and sugar degradation products

Rapid analysis methods

- Near infrared spectroscopy coupled with multivariate statistics to produce calibration models for several different biomass types including feedstocks and pretreated materials
- Models dramatically decrease the time required for and cost of routine compositional analysis
- Customized with clients for specific applications

Integrated Biorefinery Research Facility | NREL, Golden, Colorado | December 2011 | NREL/PO-5100-53597