

BIOMASS COMPOSITION

LAB OVERVIEW

Grade Level: 9-16

Time to Completion: Two 180 Minute Sessions

Prior Knowledge: Spreadsheet Skills, Basic Chemistry Concepts Including: Molarity, Percent Yield

Topics Covered: Energy Content, Colorimetric Analysis, Biochemical Composition, Hyrdolysis

In this lab investigation, students will measure the carbohydrate contents of biomass types as percentages of total mass. Additionally, students will determine the ratio of water soluble to water insoluble carbohydrates.

Upon completion, students will be able to:

1. Quantify simple sugar concentrations in their acid hydrolyzed and hot water extraction samples using a colorimetric method.
2. Utilize this information and Beer's Law to create a standard absorbance curve with a standard glucose solution.

MATERIALS REQUIRED

Acid Hydrolysis

- Biomass Samples (Dried at 65°C overnight and milled with Wiley Mill through #40 sieve, 200 mg per sample)
- 72% Sulfuric Acid, Reagent Grade (3mL per sample)
- Analytical Balance (± 0.0001 g)
- BENCHTOP AUTOCLAVE
- 3.0mL Pipet
- 125mL Erlenmeyer Flasks (1 per sample)
- 400mL Beaker (1 per sample)
- 100mL Graduated Cylinder
- 500mL Volumetric Flasks
- Filter Flask
- Buchner Funnel
- Filter Paper (sized to fit Buchner funnel)
- Vacuum Nozzles Or Pumps
- Vacuum Hosing
- Aluminum Foil
- Wash Bottles
- Spatulas
- Parafilm

Hot Water Extraction

- Biomass Samples (dried at 65°C overnight and milled with Wiley Mill) Through #40 Sieve (150mg per sample)
- Crushed Ice
- Analytical Balance (± 0.0001 g)
- Hot Plates
- Centrifuge
- Vortex Mixer
- 15mm x 125mm Test Tubes (2 per sample)
- 13mm x 100mm Test Tubes (4 per sample)
- 5.0mL Pipet
- Thermometer
- 400 mL Beaker
- 25 mL Volumetric Flasks (2 per sample)
- Thin Neck Funnel
- Whatman #1 Filter Paper
- Stir Rod
- Spatulas
- Ice Bucket
- Markers
- Rubber Bands

Colorimetric Sugars Analysis

- Acid Hydrolysis Sample (~ 1mL per group)
- Ethanol Extraction Samples (~ 2.5mL per sample per group)
- 18.3M Concentrated Sulfuric Acid (45mL per group)
- 2.1% (w/w) Phenol (1mL USP certified $\geq 89\%$ liquefied phenol in 49mL water, 18mL per group)
- 1.0 mg/mL Glucose In Water (~ 0.5mL per group)
- Fume Hood
- UV/Vis Spectrophotometer
- Vortex Mixer
- 18mm X 150mm Test Tubes (12 per group)
- Test Tube Racks
- Cuvettes
- 1 – 10mL Adjustable Pipet And Tips
- 200 – 1000 μ L Adjustable Pipet And Tips
- 50 – 200 μ L Adjustable Pipet And Tips
- 500mL Erlenmeyer flasks
- 1000mL Beakers
- Safety Gloves
- Kim Wipes