Food Analysis

Real World Energy Activity
Grade Level: 9-12

Main Objectives

This activity consists of three parts. The first part is based on the learner's reading of the backgrounder and answering the questions that follow it. The second part is applying the knowledge to a hands-on investigation involving a variety of food items. Learners will test for the presence of sugars, starches, fats and proteins in common food items. The third part consists of a lab demonstration of calorimetry, further expanding their knowledge of the make-up of food items.

Learning Outcomes

By the end of this activity, learners will:

- Describe the role of the major food molecules, their digestion and storage
- Describe the tests used to identify whether a food item contains sugars, starches, fats and proteins
- Describe the process used to test the heat content of food items

Length of Activity

3 hours

Materials List

Food Analysis Backgrounder
Food Analysis Learner Activity Instructions
Food Analysis Learner Worksheet
<u>For each learner group in lab experiment (all materials are based on using seven food items):</u>
16 test tubes (100 mL)
Test tube rack (to hold up to 8 test tubes)
Dropping pipette
4 Graduated cylinders (50 mL - to hold solutions and distilled water)
Stirring rods
8 Rubber stoppers for test tubes
9 Test (depression) plates (watch glasses)
Benedict's solution (24 mL)
Biuret solution (16 mL)
Iodine solution (10 drops)
Brown paper (e.g., paper grocery bag, parcel wrapping paper), 25 x 25 cm, cut into pieces – one piece for each food item plus one for the control
Hot plate
600 mL Beaker
Distilled water (3 mL)
Tap water (300 mL)
Food items such as apple juice, potato, margarine, onion, skim milk, regular and diet pop, hot dog, Jello (For each group, four pieces of each food type are required.)

<u>For demonstration:</u>
One soda can
Centigram balance
Stirring rod
Ring stand and iron ring
Paper clip
Thermometer, range to 110 degrees C
Aluminum foil
2-3 gram sample of each type of nut or snack food, such as Cheetos, chips, or marshmallows (Note: Be sure to check for nut allergies.)

Background

If a sample contains sugar, the Benedict's solution changes colour. In the starch test, the presence of starch (carbohydrate) in an iodine solution will make the food item change colour from red-brown to a deep purple-blue or black. The iodine will not change colour when mixed with a sugar (carbohydrate). In the protein test, the Biuret reagent reacts with the protein molecules, resulting in a colour change. The colour can change from pink to violet to purple depending on the amount of protein. For the translucence test, if a translucent spot forms, there is a presence of fats or oils. The calorimetry test will demonstrate a change in temperature in water depending on the amount of energy in the food item.

Procedure

Period 1

Part 1:

1. Have learners review background material and answer appropriate questions on learner worksheet.

Part 2: Hands-On Investigation

1. Prepare learners by reviewing the instructions for the different tests to be completed and how to read their results. They will be testing foods for sugars, starch, proteins and fats.
2. The learners will complete the tests in the following order: sugars, starches, proteins and fats. They will complete one test before moving on to the next. All items should be cleaned after each test.
3. Divide the learners into groups and distribute the materials.
4. When the data sheets are filled in with observations, you may wish to go over the lab or backgrounder questions with your learners to check comprehension.

Period 2:

Part 3: Lab Demonstration — Calorimetry

1. Prepare your learners by reviewing the instructions for the calorimetry demonstration. Learners should understand that burning foods and using calorimetry allows them to test various foods for their calorie content.
2. When the data sheets are filled in with observations, you may wish to review their understanding using the comprehension questions.

Tips and Extensions

Calorimetry: Be careful not to get burned. Check with learners for nut allergies if using nuts for the experiment. Black soot may form on the bottom of the can. If the soot is touched and rubbed on clothing, it may stain the clothing. **Safety:** Work in a well-ventilated area.

Biogas calorimetry: Build a biogas generator from GreenLearning's Re-Energy program. Visit here, https://programs.greenlearning.ca/course/build-a-biogas-generator for the plans and directions. When you have enough biogas in the generator, attempt to light a Bunsen burner under the calorimeter. Measure the amount of energy produced from the biogas. Investigate the types of plants that have the most heat energy. Decide on a given quantity of plants to use. Compare the heat energy of the different plants (e.g., sunflowers, corn and milkweed). Calculate the amount of calories per gram. Determine the usable heat energy that could be produced on an acre of land if certain crops were raised. This would require knowing the caloric value (cal/g) and the amount of biomass produced per unit area.

Comprehension

As your learners are working through the lab investigation and demonstration, or as you are explaining the procedures, you may want to test their comprehension on the basics of food as energy:

- What is the purpose of eating food? (to provide nutrients for the body and energy)
- What is food made of? (molecules)
- What types of molecules are found in food? (carbohydrates, proteins and fats)
- What is the unit of measurement for energy in food? (calorie)

- What types of foods contain proteins? fats? carbohydrates? (proteins: meat and dairy products; fats: bacon, butter, oils, nuts and seeds; carbohydrates: fruit, rice, potatoes, corn)
- What is a calorie? (amount of energy or heat required to raise the temperature of one gram of water one degree Celsius)
- How can we measure the amount of energy or calories in food? (by burning it with a device called a calorimeter)