Organic Compounds and Food Analysis

Objective: The purpose of this lab is to identify the organic macromolecules in the foods we eat. (Indiana State Academic Standards: Biology, 1.3, 1.4, 1.6, & 1.9)

Background:
Matter is anything that takes up space and has mass. Organic matter is matter that is living, was once living, or is a product of a living thing. These compounds contain the element Carbon and are divided into four major groups: carbohydrates, lipids, proteins, and nucleic acids. Common foods, which often consist of plant materials or substances derived from animals, are also combinations of these organic compounds. Simple chemical tests with substances called indicators can be conducted to determine the presence of organic compounds. A color change of an indicator is usually a positive test for the presence of an organic compound.

I. Carbohydrate Analysis

Materials:
- 11 test tubes
- Benedict’s Solution
- Test tube rack
- Iodine Solution
- Test tube holder
- Food Samples (Various)
- 1 600mL beaker
- Spot plate

Part A: Testing for Starch

Procedure:
1. In your lab journal, write: the title of this lab, the objective and materials needed as shown in the Lab Journal Format.
2. Mark the wells of a spot plate 1 - 11.
3. Place a drop of water in well number 11 of the spot plate. Place a drop of food in each well in the same order they appear on Table 1. USE ONLY ONE PIPETTE PER FOOD SAMPLE!
4. Add a drop or two of iodine solution to each well. ***Iodine will change from yellow brown to blue-black if starch is present in the food.
5. Be careful! Iodine stains hands and clothing!!!!
6. Cut out Data Table 1 on the dotted lines and paste it into your lab journal.
7. In the Data Table, place a check mark next to the substances testing positive for starch.
8. Wash the spot plate thoroughly using soapy water.

Part B: Testing for Glucose

Procedure:
1. Set up a water bath by filling a beaker half way with water and heat the water to a gentle boil.
2. Label test tubes #1 - 11.
3. Fill test tube #11 with approximately 5 ml of distilled water.
4. Each of the other 10 test tubes should have approximately 5 ml of foods in Table 1.
5. Add one squirt of Benedict’s solution to each tube. Gently shake the contents of each tube.
6. Place each tube in the hot water bath and heat each tube for 3 - 5 minutes. When heated, Benedict’s solution will change color from blue to green, yellow, orange, or red in the presence of a simple sugar (monosaccharide). BE CAREFUL WHEN HANDLING HOT GLASSWARE. USE THE TEST TUBE HOLDERS & WEAR GOGGLES WHILE HEATING SAMPLES!
Using the test tube holder, remove each tube and place them in your test tube rack. In the Data Table, record changes and place the appropriate check marks next to the substance(s) containing the simple sugar using the scale shown below.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>O</td>
<td>blue</td>
<td>no sugar present</td>
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<tr>
<td>✓</td>
<td>yellow</td>
<td>a little sugar present</td>
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<tr>
<td>✓ ✓</td>
<td>green</td>
<td>a medium amount of sugar present</td>
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<tr>
<td>✓ ✓ ✓</td>
<td>orange</td>
<td>a lot of sugar present</td>
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<tr>
<td>✓ ✓ ✓ ✓</td>
<td>red</td>
<td>a huge amount of sugar present</td>
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Wash the test tubes thoroughly using a test tube brush and soapy water.

II. Lipid Analysis

Background:
Lipids are a chemically diverse group of substances that include fats, oils, and waxes. Beef fat, butter, and olive oil are examples of lipids. Like carbohydrates, lipids contain carbon, hydrogen, and oxygen. Lipids are classified together because they are all insoluble in water. In living things, lipids serve mainly as storage of energy. Lipids are also part of cell membranes and thus help regulate what enters and leaves cells.

Materials:
brown paper
food samples

Procedure: Testing for Lipids

1. Obtain a piece of brown paper.
2. Draw lines to divide the paper into 12 sections. Write your name and period in the lower right-hand corner.
3. Label each square with the name of the food to be tested. See the Table 1 for the order of the foods.
4. Use a small sample of each food to smear a spot in the corresponding square on your paper.
5. Set the paper aside to let it dry overnight. Examine it the next day. If the spot is translucent when place up to the light (i.e. the light can be seen through the spot), fat was present in your sample.
6. In the Data Table, record your observations and place a check mark next to the substance(s) testing positive for lipids.
7. Throw away the paper when finished.

II. Protein Analysis

Background:
Proteins are organic compounds composed mainly of hydrogen, oxygen, carbon, and nitrogen. Formed from the bonding of monomers called amino acids, proteins are of universal importance in cells and thus in organisms. There are two groups of proteins: structural proteins and functional proteins. The skin and muscles of animals are made up mostly of proteins. All cell membranes have protein as a vital part of the structure. Functional proteins, also called enzymes, are the chemicals that are essential for the life processes in both plants and animals. All life structures are made through chemical reactions and all life functions occur because of chemical reactions. Enzymes help control these chemical reactions. Each species of organism has thousands of unique proteins.
Materials:
spot plate
Biuret Solution
food samples

Procedure: Testing for Protein
______1. Obtain a spot plate and number the wells.
______2. Get a sample of each of 11 foods on the spot plate. Be sure to get them in the order listed on the data chart so you do not get them confused.
______3. Place 3 - 4 drops of Biuret solution on each food.
______4. Observe the color of Biuret in water.
______5. Compare the color of Biuret Solution in each of the other foods. A purple color indicates the presence of protein.
______6. In the Data Table, record your observations and place a check mark next to the substance(s) testing positive for protein.
______7. Clean the spot plate when finished.

Analysis Questions:
Answer the following questions in your lab journal using complete sentences.
1. Which substance(s) contained starch?
2. Which substance(s) contained glucose?
3. Starch and glucose are both types of carbohydrates (sugars). Were their foods that only had one of these? If so, which foods?
4. Explain how you can determine whether there was high or low amounts of monosaccharide (sugar) in food samples.
5. Which substance(s) tested positive for lipids?
6. Why did we test water in this lab?
7. Which substance(s) tested positive for proteins?
8. According to the background information, what are the functions of carbohydrates, lipids and proteins in organisms?

Lab Journal Format:

| Title: ____________________ |
| Purpose: _________________ |

| Data Table 1 |
| substance |   |   |
|           |   |   |
|           |   |   |
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| Analysis Questions: |
| #1-8 Using Complete Sentences. |
Cut along the dotted lines and paste in lab journal.

Data Table 1

<table>
<thead>
<tr>
<th>Substance</th>
<th>Iodine Test</th>
<th>Benedict Color after heating</th>
<th>Sugar present (√) (o)</th>
<th>Lipid Test (Translucent) Yes or No?</th>
<th>Biuret Protein Test</th>
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