

Identification Tests for Organic Compounds

Understanding the chemistry of living organisms is an important part of biology. The structures of cells are made up of many different molecules. Cell metabolism involves the production and breakdown of many types of molecules. Most of the common molecules found in living things belong to four classes of carbon-containing molecules, or biomolecules: carbohydrates, lipids, proteins, and nucleic acids.

Objectives

- Determine the presence of starch by a chemical test
- Analyze solutions for the presence of simple sugars
- Analyze a sample of vegetable oil for the presence of lipids
- Analyze solutions for the presence of protein

Materials

- | | | | |
|--------------------|----------------------|---------------------------|-----------------------|
| • Pipettes | • Test-tube brush | • Benedict's solution | • 2% gelatin solution |
| • Test tubes (3) | • Brown paper | • Hot Plate | • Iodine solution |
| • Test-tube rack | • Wax marking pencil | • 2 Liter Beaker | • Stop Watch |
| • Test-tube holder | • Vegetable oil | • Soluble starch solution | • Hot hands |
| • Biuret reagent | • Water | • Glucose solution | • 95% Ethanol |

Procedure

Part A. Test for Carbohydrates

Test for Starch

1. Put on goggles and an apron. Label three test tubes "1", "2", and "3", respectively. Place them in a test-tube rack.
2. Use a separate pipette for each solution.
 - a. Add 10 drops of soluble starch solution to test tube 1
 - b. Add 10 drops of glucose solution to test tube 2
 - c. Add 10 drops of water to test tube 3
 - d. Record the color of each test tube's content in Table 1
3. Add 3 drops of Iodine solution to each test tube. **CAUTION: If iodine is spilled, rinse with water and call your teacher immediately.**
4. Record in Table 1 the color of each test tube's contents after the addition of iodine. A blue-black color indicates the presence of starch.
5. Discard the contents of the test tubes according to your teacher's directions. Gently use the test-tube brush and soapy water to clean the three test tubes and rinse clean water.

Test for Simple Sugars

1. Fill the 2 Liter Beaker halfway and heat the water to boiling on the hot plate.
2. Label three test tubes "1", "2", and "3", respectively.
3. Using a separate pipette for each solution
 - a. Add 10 drops of starch solution to test tube 1
 - b. Add 10 drops of glucose solution to test tube 2
 - c. Add 10 drops of water to test tube 3
 - d. Record the color of each tube's contents in Table 2
4. Add 20 drops of Benedict's solution to each of the three test tubes and place in a boiling water bath for 3 minutes. **CAUTION: If Benedict's solution is spilled, rinse with water and call your teacher immediately.**

Benedict's solution tests for the presence for simple sugars (monosaccharides and some disaccharides, but not polysaccharides). Thus, a color change might or might occur when Benedict's solution is added to a carbohydrate and heated. A change from blue to green, yellow, orange, or red occurs if a monosaccharide or disaccharide is present. The original blue color will remain after heating if a polysaccharide or certain other disaccharides are present.

5. Remove the test tubes from the water bath using a test-tube holder and place them in a test-tube rack to cool. **CAUTION: Be careful not to burn yourself.**
6. Record the color of each tube's contents in Table 2.
4. Discard the contents of the test tubes according to your teacher's directions. Gently use a test-tube brush and soapy water to clean the three test tubes and rinse with clean water.

Part B: Test for Lipids

Brown Paper Test for Lipids

1. Place a drop of water on a small piece of brown paper. Allow the paper to dry for a few minutes.
2. Place a drop of oil on another small piece of brown paper. Allow the paper to dry for a few minutes.
3. Hold both pieces of paper up to the light. If a semi-transparent (translucent) spot is evident, the sample contains lipids.
4. Record the appearance of each spot in Table 3.

Solubility Test for Lipids

1. Label two test tubes "1" and "2", respectively.
2. Using separate pipettes for each solution.
 1. Add 20 drops of 95% ethanol to test tube 1
 2. Add 20 drops of water to test tube 2
 3. Add 5 drops of oil to test tubes 1 and 2 and stopper each tube
 4. Shake each tube well and then let the mixtures settle.
 5. Record in Table 4 whether the oil is soluble in either solvent.

Lipids are soluble only in non-polar solvents because lipids, themselves, are non-polar. Water is polar; ethanol is not.

5. Dispose of the contents of each test tube according to your teacher's directions. Gently use a test-tube brush and soapy water to clean the two test tubes and rinse with clean water.

Part C: Test for Proteins

1. Label three test tubes "1", "2", and "3", respectively.
2. Using separate pipettes for each solution
 - b. Add 30 drops of 2% gelatin solution to test tube 1
 - c. Add 30 drops of glucose solution to test tube 2
 - d. Add 30 drops of water to test tube 3
 - e. Record the color of each test tube's contents in Table 5
3. Add 10 drops of Biuret reagent to each test tube. **CAUTION: Biuret reagent is extremely caustic to the skin and clothing. If Biuret reagent is spilled, rinse with water and call your teacher immediately.**

When Biuret reagent is mixed with a protein, it will produce a lavender to violet color.

4. Record in Table 5 the color of each tube's contents after adding Biuret reagent.
5. Discard the contents of the test tubes according to your teacher's directions. Gently use a test-tube brush and soapy water to clean the test tubes and rinse with clean water. Wash your hands.
6. Fill in the last column of all five tables with the correct interpretations of the test results.

Data and Observations

Table 1

Test for Starch				
Test Tube	Substance	Color at Start	Color After Adding Iodine	Starch Present (+ / -)
1	Starch			
2	Glucose			
3	Water			

Table 2

Test for Simple Sugars				
Test Tube	Substance	Color at Start	Color After Adding Benedict's Solution	Sugars Present (+ / -)
1	Starch			
2	Glucose			
3	Water			

Table 3

Brown Paper Test for Lipids		
Substance	Translucent Spot on Brown Paper	Lipids Present (+ / -)
Water		
Oil		

Table 4

Solubility Test for Lipids			
Test Tube	Substance	Dissolves? (yes / no)	Lipids Present (+ / -)
1	Oil in ethanol		
2	Oil in water		

Table 5

Test for Proteins				
Test Tube	Substance	Color at Start	Color After Adding Biuret reagent	Protein Present (+ / -)
1	Gelatin			
2	Glucose			
3	Water			

Analysis

1. What is used to test for the presence of starch? _____
2. How can you tell by using this test that a substance contains starch? _____

3. What is used to test for the presence of simple sugars such as monosaccharides?

4. How can you tell by using this test that a substance contains simple sugars?

5. List two ways to test for the presence of lipids in a substance:

6. What is used to test for the presence of proteins?

7. How can you tell by using this test that a substance contains proteins?

8. Biuret reagent will turn the skin brownish-purple. Explain why this occurs.

9. Why was water used for each chemical?

10. When greasy food is spilled on clothing, why is it difficult to clean with water alone?
