**Identifying Macromolecules:**

**PART 1 - Carbohydrates**

**Purpose:**

To test for the presence of carbohydrates in various foods.

**Background:**

The most common macromolecules (organic compounds) found in living organisms are lipids, carbohydrates, proteins, and nucleic acids. Common foods, which often consist of plant materials or substances derived from animals, are also combinations of these macromolecules. Some of these compounds can be detected by taste, while others cannot. Therefore, scientists use certain tests to identify the presence of macromolecules.

**Introduction:**

You’re a scientist at the Food and Drug Administration’s (FDA) Center for Nutrient Analysis in Atlanta, Georgia. You analyze food based on the label declaration. Tests are performed for proteins, lipids and carbohydrates. Recently, there has been fear of an attack by a new species of undead (similar to a zombie). Scientists believe that the only way to combat this attack is by feeding them a substance with high levels of complex carbohydrates and protein, since these macromolecules appear to kill the new species’ cells. Scientists have also found that the undead seem to thrive and grow rapidly when fed simple sugars. Your team is taking a break from the regular task of food label analysis in order to determine what will be the best food to fight off the invasion, based on the tests you will be performing over the next several days. It is up to you and your team to save Earth!

**Materials:**

- Test Tubes (5) - Distilled Water - Glass Marking Pencil - Graduated Cylinder - Apple Juice - Test Tube Rack - Pipette - Potato Solution - Hot Plate - Beaker - Test Tube Holder - Benedict’s Solution - Iodine - Cooking Oil - Gelatin Solution

**Procedure (GOGGLES MUST BE WORN FOR THE ENTIRE LAB PERIOD!)**

**Testing for Simple Carbohydrates (monosaccharides and disaccharides)**

1. Obtain five test tubes. Label each one of the following: distilled water, cooking oil, apple juice, gelatin solution, potato solution.
2. Use a graduated cylinder to transfer 5 mL of distilled water into the test tube labeled “distilled water.”
3. Repeat step 2 with each of the food substances. (Each test tube should contain only one food item.) **DO NOT USE THE SAME TOOLS FOR EACH SUBSTANCE - IT WILL CONTAMINATE THEM.**
4. Add 10 drops of Benedict’s Solution to each test tube.
5. Gently swirl the contents of each test tube.
6. Place the test tubes in the hot water bath for 3-5 minutes. Remove the test tubes using test tube tongs.
7. A rusty brown color in response to Benedict’s Solution and heating indicates a large amount of simple sugars. An orange color indicates a moderate amount and a green or yellow color indicates a small amount of sugar. A blue color indicates no sugar present. In the Data Table, write in what color it turned a “+” if simple carbohydrates are present or a “-“ if simple carbohydrates are not present.
8. Allow the test tubes to cool and then wash them thoroughly in the back of the room and place them upside down in the designated container.

**Complex Carbohydrate Test**

1. Obtain five clean test tubes. Label each one of the following: distilled water, cooking oil, apple juice, gelatin solution, potato solution.
2. Use a graduated cylinder to transfer 5 mL of distilled water into the test tube labeled “distilled water.”
3. Repeat step 2 with each of the food substances. (Each test tube should contain only one food item.) **DO NOT USE THE SAME TOOLS FOR EACH SUBSTANCE - IT WILL CONTAMINATE THEM.**
4. Add 5 drops of Iodine to each test tube.
5. Gently swirl the contents of each test tube.
6. Iodine causes complex carbohydrates to turn dark blue or black. Substances without starch are colored brown by the iodine, but do not react with it. In the Data Table, write what color it turned and a “+” if complex carbohydrates are present or a “-“ if complex carbohydrates are not present.
7. Wash the test tubes thoroughly, placing them upside down in the designated container.

**Lab - Identifying Macromolecules Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Pre-Lab Questions:** Read the background, introduction, & procedures. Answer the questions using complete sentences before you begin.

1. What is the purpose of using distilled water as one of your test substances?
2. What is the purpose of washing the test tubes thoroughly between uses?

**Data Table:** *Write in the color of the solution after the test. If the test is positive for the macromolecule enter a plus sign (+) if the test for the macromolecule is negative enter a minus sign (-) in the chart.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Substance** | **Simple Carbohydrates Present** | **Complex Carbohydrates Present**  | **Lipids Present** | **Protein Present** |
| **Distilled Water** |  |  |  |  |
| **Vegetable Oil** |  |  |  |  |
| **Gelatin Solution** |  |  |  |  |
| **Apple Juice** |  |  |  |  |
| **Potato Solution** |  |  |  |  |

**Prediction:** Using your data and the information at the beginning of the lab. Write a well-written explanation of what solution or combination of foods should be used to kill the zombie like creatures.Be sure to include evidence from your data and the background to support your claim.

**Analysis & Conclusions**: Answer the following questions using complete sentences. Be thorough in your responses, using lab data when applicable. If you need more space please attach another piece of paper.

1. You are getting prepared to take a “Man vs. Wild” hike. Using your data and your understanding of nutrition, test substances would provide the best fuel for your body to endure this long adventure? Explain in why you chose this substance.
2. Do the sugars in the apple juice need to be broken down by your digestive system before they can be utilized as an energy source for your body? Explain why or why not.
3. What conclusion(s) should you make if a test tube containing only distilled water tests positive for any of the macromolecules?
4. A very thin slice is removed from a peanut and treated with Sudan III stain. Then a drop of Biuret Reagent is added to the peanut slice. When you examine the peanut slice under a microscope, patches of red and blue-violet are visible. What conclusions can you draw from your examination?
5. When using the Sudan III Stain, what color indicates the presence of a lipid?
6. When using Iodine, what color indicates the presence of a complex carbohydrate?
7. When using Benedict’s Solution, what color indicates the presence of a simple carbohydrate?
8. When using Biuret Reagent, what color indicates the presence of a protein?
9. Describe at least two errors you may have made while completing this lab. Explain how these errors may have impacted your results.