Unit I – Basics of Biology

Chapter 5 Organic Compounds – Identifying Fats, Carbohydrates and Proteins

Lab #5 Identifying Monosaccharides, Starch, Proteins, and Lipids

Note to Teacher: *While students are engaged in their lab setting, have them listen to the music track and then the actual song of the Periodic Table Song. Brain research indicates that when we listen to something different while we are learning something new, neurons will be connected which will help us remember the information more efficiently.*

Strategy

You will conduct an experiment where you will test some of the materials listed below to determine whether they are carbohydrates, proteins, or lipids.

Teacher's Note: *In this exercise, pair up a left brain child with a right brain. This challenges the class to work in a real world scenario. This activity should take approximately 50 minutes. With some students, this activity may take longer.*

Arranging Materials: (A)

Test Tubes at least 120 Test Tubes (Each group of two should have 10 test tubes)
Test Tube Rack
12 Hot Plates
12 Brown Paper Bags
12 Bottles of Biuret Reagent
12 Bottles of Benedict's Solution
12 Bottles of Iodine Solution
Test Tube 1: honey and water mixture
Test Tube 2: egg white and water mixture
Test Tube 3: canola oil
Test Tube 4: lettuce and water mixture
Test Tube 5: corn starch and water mixture (Make sure the mixture is watery. More than 50 ml of water to 3 grams of corn starch.)
Test Tube 6: potato and water mixture
Test Tube 7: apple juice and water mixture
Test Tube 8: gelatin and water mixture (Make sure the mixture is watery. More than 50 ml of water to 3 grams of gelatin.)
Test Tube 9: flour and water mixture (Make sure the mixture is watery. More than 50 ml of water to 3 grams of flour.)

Test Tube 10: water

Teacher Note: *You should have at least a minimum of 120 test tubes. Monitor students to insure they are following directions.*

Since you are making many mixtures and will be testing them using heat (hot-water bath), make sure all your students wear goggles. Make sure they do not mix these substances! See Lecture One on Lab Safety. Make sure there is no playing around in the lab.
IV. Testing the Hypothesis: (T)

Score: _____

Name:_____ Date:_____

Class/Teacher:_____ School:_____

Procedure

I. Problem: What indicators are used to test for the presence of organic compounds? How are they used? (P)

II. Hypothesis: I believe those substances which contain poly starch are the carbohydrates. I believe those that contain amino acids are the proteins. I believe those that contain oils and fats are the lipids. They should be able to be identified with the respective testing solutions. (H)

Part I (Testing for Monosaccharides)

1. Obtain 10 clean test tubes and place them in a test tube rack.
2. Fill each test tube with 3 mL of one substance as indicated above.
3. Add 10 drops of Benedict's solution to each test tube.
4. Gently shake the contents of each test tube.
5. Place the test tubes in the hot-water bath for 3-5 minutes.
6. Remove the test tubes (using a test tube holder) and place them back in the test tube rack.
7. When heated, Benedict's solution will change color from blue to green, yellow, orange, or red in the presence of monosaccharides.

Create your own data table and record any color changes. Place a check mark next to any substances that test positive for monosaccharides.

Part II (Testing for Starch)

1. Obtain 10 clean test tubes and place them in a test tube rack.
2. Fill each test tube with 3 mL of one substance as indicated above.
3. Add 3 drops of Iodine solution to each test tube.
4. Gently shake the contents of each test tube.
5. Let the test tubes sit for 3-5 minutes.
6. Iodine will change color from yellow-brown to blue-black in the presence of starch.

Create your own data table and record any color changes. Place a check mark next to any substances that test positive for starch.

Part III (Testing for Proteins)

1. Obtain 10 clean test tubes and place them in a test tube rack.
2. Fill each test tube with 3 mL of one substance as indicated above.
3. Add 5 drops of Biuret reagent to each test tube.
4. Gently shake the contents of each test tube.
5. Let the test tubes sit for 3-5 minutes.
6. Biuret reagent changes color from yellow to blue-violet in the presence of protein.

Create your own data table and record any color changes. Place a check mark next to any substances that test positive for protein.

Part IV (Testing for Lipids)

1. Divide a piece of brown paper bag into 10 equal sections. In each section, write the test number of the substance.
2. Place 2 drops of each substance onto the brown paper in the appropriate section.
3. Wait until all spots have dried.
4. Hold the paper up to a bright light. Some foods leave a translucent spot on the brown paper. The translucent spot indicates the presence of lipids. In the data table, place a check mark next to any substances that test positive for lipids.

Questions--Answer all questions in complete sentences.

1. Which substances are monosaccharides and how do you know they are monosaccharides?

2. Which substances are starches and how do you know they are starches?

3. Which substances are proteins and how do you know they are proteins?

4. Which substances are lipids and how do you know they are lipids?

5. Which substances did not test positive for any of the organic compounds?

6. What is the purpose of using distilled water as one of your test substances?

7. What do all of the indicators that you have used, have in common?

8. What conclusions could you make if a positive test for any of the organic compounds occurred in the test tube containing distilled water?

9. How does an indicator detect the presence of only one type of macromolecule?

10. Is there a macromolecule that the tests in this lab did not test for? If so, list the kinds of macromolecules not tested for, and give one reason why they were not tested for.

Challenge

You are expected to go to the creative or synthesis level to actually excel in this lab. Your challenge now is to create your own lab using this lab as a model. You can do your own lab on other Organic Compounds that you did not test here with this lab. You must get with your teacher to do the challenge.

For those of you who learn easier through music, your challenge is to create your own version of a song that you can use with this lecture or lab. You can use other genres of music like Hip Hop Rap, Rock, Country, Tejano, Norteno, Folk, and Smooth Jazz. The sky is the limit when it comes to genres of music.

Check again with your teacher for this part of the assignment. If you create your own song, contact us at contact@virtualscienceuniversity.com Once we evaluate your song, we may want you to appear on our on-line Inter-Net Show. You may be able to perform with Professor Paul live at Virtual Science University.

<u>Analysis</u>

Collect Data and Analyze Results: For each substance, describe the color change that you observed. Based on this color change, indicate whether the substance is a monosaccharide, polysaccharide, protein, or lipid. (C) & (A)

honey
egg white

canola oil
lettuce
corn starch
potato
apple juice
geletin
flour
distilled water

Conclusion & Questions

Conclusion--Make sure you summarize your experiment. Use the mnemonic of PHAT CAC to summarize your experiment and give an analysis of your findings. (C)

References

Gardner, H. (1991). The unschooled mind: How children think and how schools should teach. New York: Basic.

McCarthy, B. (1987). The 4Mat system: Teaching to learning styles with right/left mode techniques. Barrington IL: EXCEL.

Science Education Program, The University of Iowa N259 Lindquist Center Iowa City, IA 52242