

Organic Substances

Summary

Students will design and perform an experiment related to the properties of organic substances. The lab can be quite extensive or relatively short in duration depending on the number of substances tested and the number of tests desired by the teacher.

Time Frame

3 class periods of 60 minutes each

Group Size

Small Groups

Materials

- [student answer sheet](#)

(attached)

Organic substances: carbohydrates such as flour, crackers, sugar, potato, corn chips; lipids like vegetable oil, butter, lard, proteins: egg white, tofu, beef jerky, gelatin, hard cheese, powdered soy protein, also lettuce may be used to show a substance with few positive tests.

labware:

- beakers
- test tubes
- tongs
- evaporating dish or crucible
- heat source
- wire or ring stand
- test tube rack

lab chemicals:

- dilute acid (HCl) or vinegar dilute base (NaOH) or ammonia
- water
- litmus paper
- Benedicts solution
- iodine
- Sudan III stain
- diphenylamine reagent

Background for Teachers

Time Required:

Variable, one period needed for students to design lab and one or two more periods depending on the amount of tests.

Note to Teacher:

This lab is written with an inquiry approach. If more structure is desired, add a list of materials, write the procedure by providing procedures for each test you'd like the students to perform and put headings on the data table.

Heating the substances is a good property to test but does involve some risk. Hot plates work best but are often in limited supply. If open flame is used, care should be taken to use small quantities of substances in heat resistant glassware. Oil may spatter and can create fire hazards. Students may be asked to bring substances from home to test if desired. The types of properties students may test for

include:

- reaction to water, acid or base
- reaction to heat
- appearance, feel or texture
- result when rubbed on paper towel (fat test)
- reaction to Benedict's solution and heat (sugar test)-Benedict's turns from blue to yellow, orange, green or red (this does not work for sucrose)
- reaction to iodine-brown turns to black in starch
- lipids turn red in Sudan III stain.
- nucleic acids may be tested with diphenylamine reagent. It turns blue in the presence of DNA and green in RNA.

Student Prior Knowledge

Students should know what organic substances are and what a property is. They should be familiar with safety practices in the lab and basic experimental techniques.

Instructional Procedures

Allow students time the first day to investigate ways they might test for properties of organic molecules. They may find help in their text, the library, the Internet or from reference materials. Students should begin their write up and identify who will bring what substances. If you wish to supply the food substances, tell students what will be available. Students may bring substances that are mixtures of macromolecules as most foods are and they will be harder to classify. Tell students how many properties or tests they should do on each food. (4 is suggested) The second day of the lab should be devoted to testing the properties of the substances. Depending on the number of foods and tests, this may take additional days. Summarize the class results and allow time to finish analysis questions.

Assessment Plan

Scoring guide.

1. Students identify three tests for properties of organic substances....3 pts
2. Students make correctly stated hypothesis.....2 pts
3. Procedures are clearly written.....10 pts
4. Data collected and recorded on 4 food types.....10 pts
5. Analysis questions answered correctly.....7 pts
6. Conclusion accurately drawn.....3 pts

Answers to Analysis questions:

Answers will vary. Most proteins will change consistency in heat (denature), dissolve somewhat in acid, base or water. Proteins do not leave a clear spot when rubbed on towel.

Answers will vary. Most carbohydrates burn black and smoke and steam are given off when heated. Some dissolve in water, acid and base. In Benedict's solution different sugars will turn different colors when heated. Do not leave a clear spot when rubbed on towel. Starches turn black with iodine.

Answers will vary. Most fats smoke and burn in heat. They will not dissolve in water or acids but may in bases. Do not turn characteristic colors in Benedict's or lipid tests. Do leave clear spots when rubbed on towel.

The tests involving chemical changes may seem most specific but others such as the paper towel test are also valid.

Answers will vary.

The food industry is required to tell consumers what is in their products.
Plants make sugars and starches from sunlight, water and carbon dioxide.

Bibliography

Lesson Design by Jordan School District Teachers and Staff.

Authors

[Utah LessonPlans](#)