**Modeling module for Biology Standard 3.1**

**Measurement of the Absorbance of Light by Different Types of Olive Oils**

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**Driving Questions:**

1. How do plants capture the sun’s energy?
2. Do different plants capture different amounts of light energy?
3. What causes the differences in light absorption?

**Summary of the Investigation:**

A Vernier Spectrophotometer can measure light absorbance of photosynthetic pigments (the part of the plant that collects light). Chlorophyll a, the most common photosynthetic pigment, has peak absorbance at 450nm and 660nm. Students will measure the peak absorbance of three types of olive oil. Absorbance at these wavelengths is proportional\* to the amount of chlorophyll in the oil.

**Science Standard:**

B3.1 (first part); “Describe how some organism capture the sun’s energy….”

**Equipment used:**

Vernier Spectrometer (or other spectrophotometer) computer; one cuvette, plastic; Beral pipets;

three olive oil standards: extra virgin, regular and light;

distilled water; isopropyl alcohol



**Description of Procedures:**

1. Obtain and wear goggles.

2. Use a USB cable to connect a Vernier Spectrometer to a computer.

3. Start the Logger Pro 3.4.5 program on your computer.

4. Obtain small volumes of the three standard olive oils to be tested.

5. To set up the spectrometer, open the Experiment menu and select Connect Interface → Spectrometer → Scan for Spectrometers.

6. Calibrate the spectrometer.

 a. Prepare a *blank* by filling an empty cuvette æ full of distilled water.

 b. Open the Experiment menu and select Calibrate → (Spectrometer). The following message appears in the Calibrate dialog box: “Waiting xx seconds for the device to warm up” After 60 seconds, the message changes to: “Warmup complete”

 c. Place the blank in the cuvette holder of the spectrometer. Align the cuvette so that the clear sides are facing the light source of the spectrometer. Click ìFinish Calibrationî, and then click ok.

7. Conduct a full spectrum analysis of an olive oil sample.

a. Empty the blank cuvette and rinse it twice with small amounts of extra virgin olive oil. Fill the cuvette full with the olive oil and place it in the spectrometer.

b. Click collect. A full spectrum graph of the olive oil will be displayed. Review the graph to identify the peak absorbance values. Click stop to complete the analysis.

c. To save your data, select Store Latest Run from the Experiment menu.

8. Repeat Step 7 with the remaining olive oil standard samples.

9. Obtain an unknown sample of olive oil. Repeat Step 7 with the unknown.

10. (Optional) Print a copy of each graph for your lab report.1.

11. Select Exit from the File menu to close down LoggerPro 3.

12. (Optional) Rinse and clean the cuvettes and other oil-bearing containers with isopropyl alcohol.

**Data:** fill in chart

|  |  |  |  |
| --- | --- | --- | --- |
|  | Sample Observations | Color Seen | Wavelength Range |
| Control |  |  |  |
| Extra Virgin |  |  |  |
| Light |  |  |  |
| Regular |  |  |  |
| Unknown |  |  |  |

**Follow-up questions:**

Describe the graph for each sample.

How closely does your graph match the graph below (insert graph from the other paper).

Which olive oil contains the most chlorophyll? Which contains the least?

**Scientific Questions:**

1. At what wavelengths do chlorophyll molecule absorb?
2. What happens to light energy at other wavelengths?
3. Are there other substances in plants that absorb light? If so, what is their purpose?
4. If a plant absorbs all visible wavelengths, what color would it be?
5. What is happening when leaves change color in the fall?

\*There may be other pigments contributing to the absorbance at the two wavelengths, but for the purposes of this experiment we will assume that the absorbance in almost entirely due to chlorophyll a.