**Supplemental Lesson: Polymers and Plastics**

**Problem Statement:** How can school lunches be modified to require less energy? This lesson introduces students to the idea of the carbon footprint: that all daily activities require energy and contribute to carbon dioxide to the atmosphere. Students will consider school lunches as one component of energy usage that they can have an impact on.

**Learning Objectives:**

Students will be able to:

* Explain the chemistry behind plastics.
* Identify the different types of plastics.
* Compare and contrast petroleum based plastics and bioplastics.

**Materials:** Laptops or iPads (one per student), PowerPoint; 2 wooden stir sticks 2 small bags, 2 small cups (reused), 1 black marker, Graduated cylinder, PVA solution, BORAX solution, 1 tablespoon, cornstarch, 2 drops corn oil, Zip-lock plastic bag, 1 tablespoon water, Food coloring, Microwave oven

**Lesson Preparation:** PowerPoint, prepare solutions for labs

**Time Required:** Two 50 minutes periods

**Procedure:**

**Engagement:**

Students will take notes on polymers. Key terms: monomer, polymer, polymerization, natural, synthetic, petroleum, types of polymers, recycle classification of plastics, problems and concerns related to petroleum based plastics.

**Super Slime Polymer (Mrs. Tracy Trimpe; Havana Junior High School)**

Materials

2 wooden stir sticks   
2 small bags

2 small cups (reused)  
1 black marker

Graduated cylinder

PVA solution  
BORAX solution

Instructions

1. Use a clean graduated cylinder to measure out 20 ml of the PVA solution and pour into a clean plastic cup.
2. Use a clean graduated cylinder to measure out 4 ml of Borax solution and pour it into the cup. Stir with a stick.
3. Once the Super Slime is formed, remove from the cup and knead with your hands for several minutes to get it to the right slime consistency.
4. Put your Super Slime into a small plastic bag. Use a marker to label your bag of slime and place in the correct area.
5. Use a dry paper towel to wipe out your cup and clean your hands. Save the cup if you want to make another batch of slime. Do not wash your cup or hands in the sink until you have wiped off all of the slime gunk

**Evaluation: Bioplastics**

Students will take notes on bioplastics. This will include a simple discussion of how these plastics are made and how the differ from petroleum based plastics. Students should discuss the concerns and benefits of making and using petroleum based plastics. Students will create samples of a corn-based bioplastic

**Corn-based Bioplastic (ChemMatters, April 2010, page 12)**

Materials

1 tablespoon cornstarch

2 drops corn oil

Zip-lock plastic bag

1 tablespoon water

Food coloring

Microwave oven

Instructions

1. Place the cornstarch in a plastic bag.
2. Add corn oil and water.
3. Seal the bag and mix the ingredients by rubbing outside the bag with your fingers.
4. Add two drops of food coloring.
5. Seal and mix again.
6. Open the seal slightly and place the bag in the microwave.
7. Microwave on high 20-25 seconds.
8. While the plastic is still warm, shape it into a ball.
9. Is it biodegradable? Place it in water and leave for the week.

**Homework: Reflection**

1. What is a polymer?
2. What are the properties that make polymers so successful in our society?
3. Do plastics have a place in our society?
4. How should plastics be used in our society?
5. Are bioplastics better that petroleum based plastics?

**Assessment:**

Formative assessment: Observations and Reflection.

**Accommodations:**

**Extensions:**

**Next Generation Science Standards Grades 9-12 (Ages 14-18)**

**Students who demonstrate understanding can:**

* HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
* HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
* HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.\*
* HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.\*
* HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

**References/Resources:**

ChemMatters, April 2010, page 12