Polymer Slime

**Grade Level / Subject:** Chemistry, adaptable to all grade levels

**Objective:**  To understand the meaning of a polymer and how they are made as well as perform an experiment in synthesizing a polymer.

**Teaching Notes:** To make experiment shorter solutions may be made before hand. An 8% polyvinyl alcohol (PVA) solution and 8% sodium borate (Borax) solution need to be made. The best results in making a PVA solution is to mix in the PVA to water on a hot plate at about 90°.

**Estimated Time:** About one hour

**Materials:**

1. 50 and 150 mL beakers
2. Disposable Cup
3. Stirring Rod
4. 2 Weighing plates
5. Metal Spatula
6. Solid PVA
7. Solid Borax
8. 10 and 50 ml graduated cylinders
9. Hot Plate
10. Magnetic Stirrer
11. Dilute Hydrochloric Acid (HCl)
12. Sodium Hydroxide (NaOH) Solution

**Safety:**

1. Goggles should be worn at all times
2. Both borax and PVA will burn the eyes. Hands should be washed at the end of the experiment.

Polymer Slime

**Objective:** To explore the physical properties of a cross-linked polymer formed from mixing polyvinyl alcohol (PVA) and sodium borate (Borax).

**Applications:**

The PVA polymer we are studying has many uses:

* Used for bags as containers for pre-measured soap you put in washing machines and dish washers.
* Used also as bags in hospitals to hold the cotton cloth used in operating rooms or to hold bed sheets or clothing of infected people.

**Vocabulary:**

|  |  |  |  |
| --- | --- | --- | --- |
| * Graduated Cylinder
* Gram
* Liquid
 | * Beaker
* Liter
* Solid
 | * Polymer
* Solution
* Dissolve
 | * Monomer
* Phase
* Crosslink
 |

**Materials and Supplies:**

1. 50 and 150 mL beakers
2. Disposable Cup
3. Stirring Rod
4. 2 Weighing plates
5. Metal Spatula
6. Solid PVA
7. Solid Borax
8. 10 and 50 ml graduated cylinders
9. Hot Plate
10. Magnetic Stirrer
11. Dilute Hydrochloric Acid (HCl)
12. Sodium Hydroxide (NaOH) Solution

**Safety:**

* Goggles should be worn at all times
* Both borax and PVA will burn the eyes. Hands should be washed at the end of the experiment.

**Procedure:**

1. Weigh out 3.2 grams (g) of the solid PVA on a blue weighing plate.
2. Using the 50 milliliter (mL) graduated cylinder measure out 36.8 mL of deionized water. Put his water into the 150 mL beaker.
3. Put the magnetic stirrer into the beaker and set the beaker on the hot plate/stirrer.
4. Turn on the stirrer (right knob) to about ¾ full and turn on the heat (left knob) to 95 °C.
5. Slowly pour in the PVA weighed out in Step 1 to this beaker.
6. Now weigh out 0.8 g of Borax on the other weighing plate.
7. Using the 10 mL graduated cylinder measure out 9.2 mL of water and put into the 50 mL beaker.
8. Now put the Borax from Step 6 into the beaker and stir until the Borax has dissolved. To help dissolve all of the borax one can set the borax solution onto the hot plate.

STOP – Presentation

1. Check solution from Step 5. If PVA is dissolved then take the solution off the hot plate and let cool.
2. Once cool add the PVA solution to a disposable cup. Now add a food coloring to this if you would like some color.
3. Now add the borax solution from Step 8 to this disposable cup as well and mix vigorously.
4. Make observations of the reaction in the data and analysis section (next page).
5. Soon the slime will be formed. Take some in your hand and stretch the slime slowly. Record your observations in the data section.
6. Now repeat stretching but do it fast. Record your observations in the data section.
7. Now take a small piece of the slime and put onto one of the weighing dishes used previously. **Wearing gloves**, with the plastic pipet add drop by drop of the dilute HCl onto the piece of slime stirring well after each drop. Once a change occurs record your observations in the data section.
8. Now with another plastic pipet add drop by drop the dilute NaOH onto the same weighing dish, stirring after each drop. Once a change occurs record your observations in the data section. Once a change occurs record your observations in the data section.
9. The slime is non-toxic, so you can put in a Zip-lock bag and take home. (Just don’t let anyone eat it!)
10. Now once finished wash your hands with soap and water.

**Data and Analysis:**

Observations from when reaction takes place:

Observation of slowly stretching the slime:

Observation of quickly stretching the slime:

Observation upon adding HCl:

Observation upon adding NaOH: