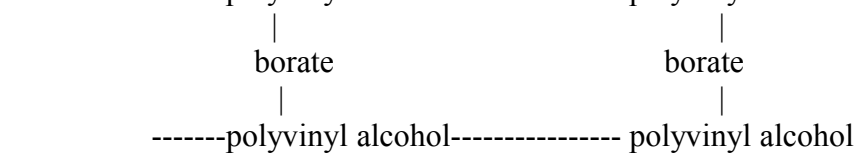
SLIME LAB

Theory: A polymer is a very large molecular that is like a chain of smaller often identical molecules linked together. When the sodium borate $Na_2(B_4O_5)OH \cdot 8H_2O$ is added to the polyvinyl alcohol, $(CH_2CHOH)_x$, a cross-linked polymer is formed. The new polymer is composed of strands of polyvinyl alcohol help together side by side (cross-linked) by the borate particles.



Background Information: A closer look at polymer molecules will help you understand why plastic and other products made from polymers exhibit remarkable properties. The geometry of the bonds in the long, stringlike polymer molecules causes the molecules to coil loosely. The molecules in a piece of rubber intertwine must like cooked noodles. In this form the polymer is flexible and soft. Your skin is made up of biological polymers. Gentle press the palm of your hand and watch the skin stretch and then move back in place when you remove your finger. Picture the same process when you stretch and then relax a rubber band or when you push on a piece of soft plastic. Image the large molecules uncoiling slightly and sliding a little to cause the material to stretch under pressure and then recoiling again when the pressure is removed.

Purpose: In this activity, two clear solutions will be mixed in a paper cup. You will produce a fluid polymer. If food coloring is added, the product will be like the chimerical polymer slime. You will examine the many properties of the polymer you synthesize.

Procedure:

For a group of 4,

1. Make a polyvinyl alcohol 4% solution. (4 g of alcohol to 100 mL of water – heat until solution is clear stirring occasionally. Don't boil and don't let it get above 70 deg C)
2. Make a sodium borate 4% solution. (4 g of sodium borate to 100 mL of water); If you want to add food coloring, add it to this solution.

Then, work individually or in pairs,

3. Place 20 mL of polyvinyl alcohol solution in a cup.
4. Add 3 mL of sodium borate solution.
5. Using a circular motion, stir vigorously with a stick. As the solution begins to solidify, continue to stir.
6. When a get has formed, remove it and continue to shape it with your hands.

Data: Observations of the properties of slime

Before the chemical reaction takes place, observe the solutions including smell.

Roll the material into a ball and drop it, what happens?

Does it float? Can it be flattened? Does it fracture? Does it get hot or cold when it flows? Will it bounce?

Write your name (felt tip pen) on a piece of paper and place your slime on your name and then lift it up, what happens?

Discussion:

1. Is the new material most like a gas, a liquid, or a solid?
2. What type of organic reaction takes place between the PVA and glue?
3. Where does bonding take place? (hint: functional group)
4. Due to crosslinking, there is a ____ (loss or gain) in entropy. Why? (hint: enthalpy)
5. Name some polymers used to produce common substances.
6. Considering the slow flow of the new materials, how would you rate the strength of the attraction among particles?
7. Does temperature affect the formation of polymers?
8. Using the kinetic theory of matter, how would you describe the closeness of matter in the material.

Resources:

Conclusion: