K-12 Project

AICHE

Slime

1) Theoretical framework

No matter the age, everyone loves the goo and magic of slime. But within the messy art project lies a science demonstration. Probably most students have made slime but don’t know the reaction behind sticky mess. Slime is great way to teach students about polymers, non-Newtonian fluids, and viscosity.

2) General Objective

 2.1) Explain the fundamental concepts of a polymerization

3) Specific Objectives

 3.1) Learn what a polymer is

 3.2) Understanding a non-Newtonian fluid

 3.3) Understand viscosity

4) Materials

 a) Elmer’s school glue

 b) Borax

 c) Disposable bowls and spoons

 d) Warm water

 e) Washable paint

5) Procedure

1. Add approximately 1 cup of glue to a bowl and 1tablespoon of desired paint color and mix.

2. In a separate container mix together warm water and borax until you have a saturated solution.

3. Slowly mix together the borax mixture and the glue mixture. Start with a spoonful of borax mixture into the glue mixture. Continue to add one spoonful and mix.

4. After the glue starts to come together and can’t be mixed with a spoon, pick up the ball and kneed it like dough. If the mixture is still sticky add more of the borax mixture until the slime stays together. Tip: to keep the students hands cleaner, first pour some of the borax solution on their hands so that when they pick up the still somewhat sticky slime it won’t stick to their hands.

6) Explanation

This reaction is a demonstration of polymerization. Slime is polymer which means it is made up of repeating monomers (or depending on the audience, it is made up of very long chains of molecules). The borax reacts with an ingredient in the glue, polyvinyl acetate. The key to this experiment is to use something in the boron family (for example you could switch the borax with liquid starch). The borate ions from the borax solution will cross link with the polyvinyl acetate in the glue to pull the slime together. The chains in the slime have a much harder time sliding past each other than they did as glue which is what makes the slime more viscous than the glue.

Another teaching moment for this demo is to introduce a non-Newtonian fluid. A non-Newtonian fluid is a substance that changes its viscosity based on stress. When you are gentle with the slime and pull it slowly, the slime will easily stretch. However pulling quickly with force will cause the slime to snap.

A third teaching moment is to explain viscosity. As the bowls are being prepared you could discuss the difference between how the glue pours out versus how the water pours. Viscosity is a fluid’s resistance to flow. The glue pours slowly and thus more viscous, the water pours quickly and therefore less viscous.