



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Amelie G. Leviant	Project Number J0114
Project Title Polyvinyl Alcohol Slimes: Measuring How pH Correlates to Viscosity in a Non-Newtonian Fluid	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project is to explore how the viscosity of slime (a non-Newtonian Fluid that happens to be fun) changes as the pH of the cross-linking solution (sodium tetraborate) increases, with the ultimate goal of determining the pH level at which the maximum degree of viscosity is obtained for any fixed volume of cross-linking solution.</p> <p>Methods/Materials Used weight measured quantities of sodium tetraborate mixed into distilled water to create solutions of sodium tetraborate ranging from 1 to 7 percent. In multiple trials for each solution strength, the pH of the sodium tetraborate solution was measured, and then 10ml of sodium tetraborate solution was mixed into 100ml of 4 percent polyvinyl alcohol (PVA) solution. After a cross-linked polymer was formed, the viscosity was measured in multiple trials by timing the descent of a metal bearing through the PVA slime to the bottom of a cylindrical container.</p> <p>Results For a ration of 10ml of sodium tetraborate solution to 100ml of 4 percent polyvinyl alcohol (PVA) solution, viscosity measurements plateaued at the 4 percent sodium tetraborate solution concentration and pH were observed to plateau just above that concentration, at the 5 percent sodium tetraborate solution concentration.</p> <p>Conclusions/Discussion For purposes of identifying polyvinyl alcohol (PVA) slime with optimal characteristics, understanding how different parameters impact viscosity permits the formulation of a recipe that is best suited to the application. For example, PVA-type slimes used for industrial clean-up purposes may have narrow ranges for operating viscosity because the slime must be piped over substantial distances. For commercial or recreational purposes, a child using slime as a toy would likely prefer an intermediate viscosity product that is highly elastic but still cohesive (cohesion also likely important to a parent, as the ability to clean up slime would depend upon its viscosity).</p>	
Summary Statement I showed that the viscosity of polyvinyl alcohol slime increases and then plateaus as the concentration of sodium tetraborate in a cross-linking solution is increased to locate an optimal viscosity point for a fixed mixture ratio.	
Help Received My science teacher, Mrs. Cathy Grimes, discussed experimental approaches with me, but I developed the idea of measuring viscosity myself after reading about the chemistry involved in creating non-Newtonian polymer slimes.	