Which Slime Is Best For Use In The Classroom?

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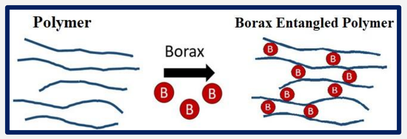
Introduction

Slime can be a useful classroom tool that keeps students engaged and provides hands-on learning to discuss many complex concepts such as polymers, non-Newtonian fluids, chemical reactions and even ratios as the students combine chemicals to create their slime.

As useful as slime can be in the classroom, there can be inherent issues with using it. The goal is to find a slime recipe that will be

- easy to prepare
- inexpensive
- easy to remove from clothing
- an ideal flow rate

to be best for use in the classroom.



Background

Most slime recipes use glue and borax as the main ingredients. Most school glue is made of polyvinyl acetate: a long, chain-shaped molecule which is called a polymer. These molecules can easily slide over and around each other, in a way, like a fresh-cooked pot of spaghetti. This makes the glue fluidic. When mixed with Borax (chemical name Sodium Borate), the Borate ions form weak bonds between the polymer chains in a process called cross-linking (see polymer diagram above). This makes it more difficult for the polymer chains to slide around, making the glue less runny and more rubbery, forming slime. Moreover, this reaction causes an observable change in properties, as two different substances are combined to make a new substance. You can add additional ingredients to your slime to give it additional properties. For example, you can use iron filings to make magnetic slime, or food coloring to make pastel slime.

Materials and Methods

Three slime recipes were used in testing:

1. 50 mL liquid glue, 50 mL liquid starch, 50 mL water
2. 50 mL liquid glue, 25 mL 4% borax solution, 50 mL water
3. ¼ tsp guar gum, 10 mL 4% borax solution, 100 mL water

Created samples of each slime recipe

Tested Flow Rate
- Used 10° inclined aluminum lanes with bumpers 5 cm in width
- Placed 15 mL sample of glue & starch recipe on incline
- Measured flow on incline in cm/s using ruler & timer

Process was repeated using remaining slime recipes at room temperature (~21℃), chilled in cold water bath (~0℃), and heated in hot water bath (~100℃)

Tested Removability
- Used 2 x 2 clothing swatches made from both 100% cotton & 50/50 cotton/poly blend.
- Used 5 swatches for each slime & each type of clothing material (total 30).
- Smeared 1 tbsp of slime on each swatch, scraped off using a craft stick, & let each swatch sit for 6 hrs.
- Treated each swatch with 10 mL of Tide, scrubbed with a soft-bristle brush for 3 minutes, & rinsed in warm water.

Process was repeated using all 3 slime recipes.

Measured Cost
- Materials costs were obtained online from the least expensive vendors and combined together to give a final cost for each type of recipe created.
- Total cost of each recipe was then calculated and divided by 30 based on a class size of 30 students.

Process was repeated using all 3 slime recipes.

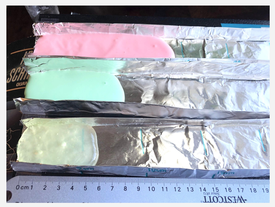
Measured Ease of Preparation
- Surveys were sent to each educator participating in the study via Google Forms.
- Participants were asked various questions all pertaining to the ease of preparation of each of the 3 recipes.

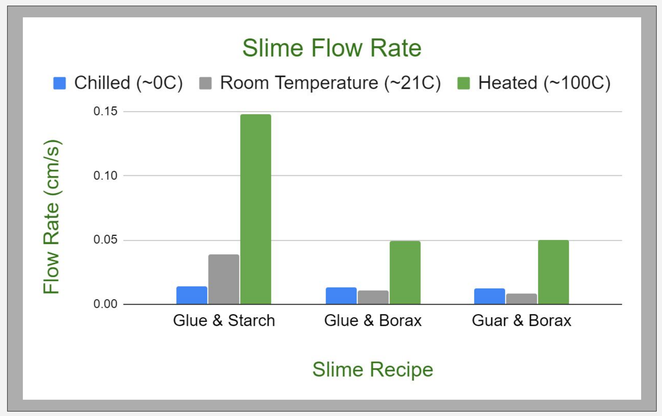
Process was repeated using all 3 slime recipes.

Results

Flow Rate

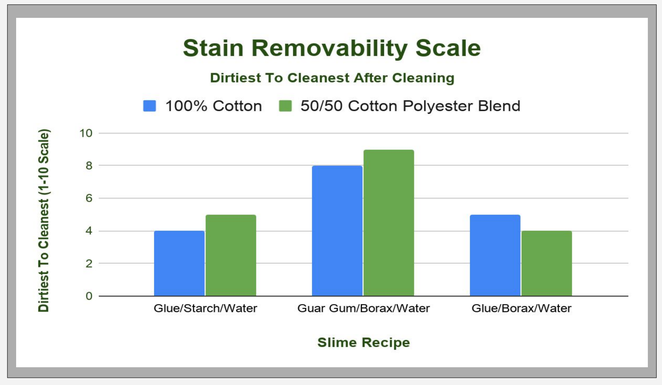
The rate of flow was tested for each slime recipe at three different temperatures on the aluminum inclined lanes shown at right. Results show that the glue and starch recipe had the greatest rate of flow.





Ease of Stain Removal

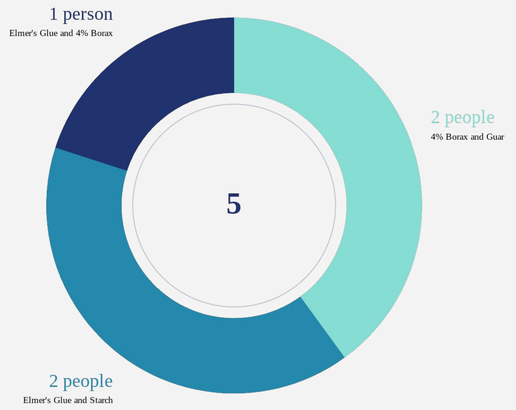
Stain removability of each of the 3 different types of slime was measured on both 100% cotton & on 50/50 cotton/poly blend clothing, as shown on the left. Results were converted to a 1-10 scale, with 1 being the dirtiest & 10 being the cleanest. Results show that the swatches smeared with slime made from the guar gum & borax recipe were the cleanest on both types of material tested.



Cost

Slime Recipe	*Items In Recipe*	*Items In Recipe*	*Total Cost (For 30 Students / Per Student)*
Elmer's Glue All and Starch	(1) Elmer's Glue All 1 Gallon/3.78 Liters $14.98	(1) Purex Stay Flo Liquid Starch 2 quarts/1.89 liters $2.97	$17.95 30 students ($0.59 per student)
Elmer's Glue All and Borax	(1) Elmer's Glue All 1 Gallon/3.78 Liters $14.98	(1) 20-Mule-Team Borax 1 Box/ 65 Oz. $4.95	$19.93 30 students ($0.66 per student)
Guar and Borax	(1) Guar Bag Powder 10 oz/286 grams $7.99	(1) 20-Mule-Team Borax 1 Box/ 65 Oz. $4.95	$12.94 30 students ($0.43 per student)

Ease of Preparation



After preparing the three slime recipes several times, the group of 5 teacher researchers voted on which recipe was the easiest to prepare. Statistically, the recipes were equally easy to prepare.

Conclusions

A choice was made to use: Glue-All and Borax; Glue-All and Liquid Starch; and Guar Gum and Borax.

- If your goal is low cost and / or ease of stain removal from clothing, our choice would be Guar and Borax.
- If your goal is highest flowability, our choice is Glue-all and Liquid Starch.
- Ease of preparation is a statistic tie between all recipes tested.

Acknowledgements

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