

Explore Plastics with Slime

At-Home

There are many great slime recipes on the internet. This one is special because you give your glue mixture a bath in a chemical connecting solution and pull out slime. Like plastics, slime is made of long molecules called polymers. The special polymers in school glue combine with the chemical connecting power of a substance that was once a rock to make a super flexible skeleton for slime. Knowing a little about the chemistry of slime, gives you more control when exploring and inventing your own slime recipes.

Question to investigate

What makes glue and borax the key ingredients in many slime recipes?

Chemistry concepts

- Slime starts with polyvinyl acetate (PVA) which is a polymer and common ingredient in white and colorless school glues.
- PVA is made up of long skinny molecules that each are made up of many repeating units.
- Borax is the brand name for sodium tetraborate. It is a common ingredient in contact lens solution, laundry detergents, and liquid laundry starch.
- The network of loosely tangled and connected polymers holds water molecules and gives slime its flexibility.

Activity logistics

- **Ages:** This activity is best-suited for children ages 5 and up
- **Time:** As written, this activity takes about 30 minutes to complete. Allow more time for children to explore with different add-ins, such as shaving cream.

Be Safe

- Wear safety glasses.
- Wear disposable gloves while making slime and playing with it.
- Wash everything well including bowls, measuring spoons and countertop before and after conducting the activity.
- Store slime in a zip-closing plastic bag or container with a lid. If after days or weeks your slime begins to smell foul, separates into a liquid layer that floats on top of your slime, grows fuzzy mold, or develops black spots, dispose of slime in the regular trash immediately.

- Always wash hands before and after playing with slime. Before, prevents bacteria from entering and growing in your slime. After, prevents slime ingredients and bacteria from spreading to everything you touch.

What you'll need

- School glue, either white or colorless, any brand
- Borax, sodium tetraborate
- Water
- Color such as Colorations brand Liquid Watercolor or food coloring
- 1 teaspoon measure (5 mL)
- 1 cup measure (250 mL)
- ½ cup measure (125 mL)
- 2 bowls, (one at least 500 mL, one at least 1000 mL)
- 2 spoons or spatulas for mixing solutions
- Paper towels for spills
- Disposable gloves
- Zip-closing plastic bag

Procedure

Make the glue solution

1. Pour 1 cup of glue into the smaller bowl.
2. Add ½ cup (125 mL) water and stir with a spoon or spatula until well mixed.
3. Add a non-toxic water based coloring agent, such as food coloring or liquid watercolor. (The color can be mixed into either the glue solution or borax solution.)

Make the Borax solution

4. Measure 2 cups (500 mL) of water and pour into the larger bowl.
5. Add 2 teaspoons (10 mL) of borax.
6. Use a clean spoon or spatula to stir until the borax dissolves and the solution appears clear.

Mix to make slime

7. Slowly pour the glue solution into the borax solution. For best results, move the top bowl from side to side as you pour the glue solution so that it is spread out.
8. With gloved hands, reach into the bowl and pull out your new slime. Squish with both hands to encourage chemical connections to take place.

What did you observe?

- How did the glue solution change as you poured it into the borax solution?
- What was your glue solution like when you first pulled it out of the borax solution,
- How did your new slime change as you played with it?

How does it work?

Both white and clear school glues contain a key ingredient in making slime--PVA, also known as polyvinyl acetate. This ingredient is made up of long skinny molecules that are kind of like beads strung in a repeating pattern on a long string. The pattern repeats many times over and over, like the way groups of atoms repeat in a polymer molecule. This shape makes polymers really interesting and useful.

Borax is a brand name for a mineral that is mined in the desert in Nevada, California, and other parts of the world. Borax became really popular in the United States in the 1800s, because people used it to wash their clothes and make metal parts stick together when soldering or welding. People still use the mineral that chemists call sodium tetraborate, today. It is a common ingredient in contact lens solution, laundry detergent, and liquid laundry starch.

The great thing about sodium tetraborate is that it is very good at connecting parts of PVA polymers together! When you first poured your glue solution into the borax solution, the borate part of one solution began to connect with different sections of the polymers in the other solution. Your new slime was really goopy and sticky. But as you squished it, more connections were made that gave slime a nice structure. This process is called *cross-linking* and is a strategy used to make plastics strong and flexible.

Another key part to slime is water. In fact, there is more water in slime than any other single ingredient. Some slime recipes include water in the ingredient list, but others do not. This is because the water is already part of the other listed ingredients. Water is in common slime ingredients such as glue, water soluble paint, food coloring, contact lens solution, liquid laundry detergent, liquid starch, and shaving cream.

Water is a very important part of slime because it allows the loosely connected polymers to slide around. The interaction of the water molecules with the PVA polymer molecules and the borate ions are what work together to make slime so wonderful!

Slime FAQs

Can you make slime without borax?

You can make slime without using the powder sold under the brand name "Borax," however the chemical, sodium tetraborate which is sold as "borax" is an ingredient in many items such as contact lens solution, liquid laundry starch, and laundry detergent. If these items are used to make slime, the resulting slime will contain sodium tetraborate.

How can I minimize the risks associated with using sodium tetraborate?

Limit your exposure to sodium tetraborate as a powder. Use it in solution (for example in contact lens solution or liquid starch), or premake your own solution. Limit the time your skin touches slime that contains sodium tetraborate. If you have sensitive skin, wear gloves every time you make and play with slime. Always wash your hands after making or playing with slime.