Pumpkin Putty

Ingredients & Supplies:

- Borax
- water
- 9 oz. cup
- 3 oz. cup
- measuring spoons
- small bowl
- popsicle stick
- Elmer's glue
- red and yellow food coloring
- Ziploc sandwich bag - must have seal

Instructions:

Today, you will learn how to make Pumpkin Putty! To start, you need one 9oz. cup, one 3oz. cup, 1 popsicle stick, 1 Ziploc bag, and measuring spoons. Fill a small bowl with water. Next measure one cup of borax, and open a bottle of Elmer's glue.

First, measure 4 TBS of water. Pour the water into your 3 oz. cup. Next, measure ¼ tsp. Borax. Be sure to use your finger to level off the Borax to get a perfect ¼ tsp. Too much Borax will make your pumpkin putty too stiff. Put the ¼ tsp. of Borax into your water. Now, use your popsicle stick to stir the borax and water solution. You want the Borax to fully dissolve in the water. Set the solution to the side, and you will use it later.

Next, you will need the Elmer's glue and a tablespoon. Carefully measure 4 TBS of glue. Pour the glue into your 9oz cup. Use your popsicle stick to help get the glue out of the measuring spoon. Now, measure 2 TBS water and pour it into the 9oz cup. Add 2 drops of yellow food coloring and one drop of red food coloring. Use your popsicle stick to mix the glue/water mixture.

Now it's time to mix both of your solutions together. Carefully pour your water/borax solution into the 9oz. cup. Watch as solids begin to form. Use your popsicle stick to stir. You will notice that the mixture starts to solidify. When it becomes too hard to stir, you will use your hands. Take the mixture out of the cup and begin to roll it in your hands. Yes, it is very messy and sticky! But, the more you knead it in your hands, the firmer it will become. Try to take as much of the mixture out of the cup as possible. (You may have liquid left in your cup, and that is fine.)

You have just formed gooey, yet solid, pumpkin putty!

When you are finished playing with your pumpkin putty, place it into the Ziploc bag. Or you can store it in an airtight container. This putty will last a long time, just make sure it is air-sealed!

The Science Behind It:

To understand how pumpkin putty works, you have to take a dive into the concept of fluid chemistry. You probably think of water when you hear the word fluid, but to chemists and physicists, a fluid is any substance that has no fixed shape and yields easily to external pressure.

A key property of fluids is something known as viscosity, which measures how much a fluid resists flow at a certain temperature. The viscosity of a material depends only on temperature. Chemists classify such materials as Newtonian fluids in honor of Isaac Newton, who pictured a fluid as a series of layers sliding past each other and reasoned that viscosity is the result of friction between these layers.

Pumpkin putty is a non-Newtonian fluid; its viscosity depends on both temperature and on the force applied to it. Over long flow times or at high temperatures, pumpkin putty behaves like a highly viscous fluid. But over short flow times or at low temperatures, it behaves like an elastic solid.

Pumpkin putty offers a fun way to demonstrate how polymers or long chains of molecules repeated over and over again work.

Glue contains a polymer called polyvinyl alcohol, or PVA. In the glue-water mixture, these polymer chains slip and slide past each other easily. But when you add the borax solution to the glue, it connects one PVA molecule to another in a process known as cross-linking. As more chains link up, they no longer slip and slide. Instead, they form a large mat that resembles a net or a spider's web. This is what gives the material its putty-like qualities.

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History of the Pumpkin

It's the month of October and pumpkins are everywhere! The pumpkin has become one of the most iconic images of the Fall and especially of Halloween. Let's find out more about this bright orange symbol.

The word "Pumpkin" comes from the Greek word "*pepon"* for "large melon." But, the pumpkin is actually a type of squash that originated in the Americas. Pumpkins from centuries ago, however, were not the round orange jack-o-lantern types we know of today. Over 5,000 years ago, pumpkins were much thinner with crooked neck tops. Over the centuries, the pumpkin was cultivated along with corn and beans. These "Three Sisters" grew exceptionally well alongside each other. Native Americans roasted strips of pumpkin over campfires. These dried strips could be stored and ground into flour. The dried shell could also be used as bowls. The pumpkin helped Native Americans survive during the cold winters.

When Pilgrims came to the Americas, they learned from the Native Americans how to cook and use the pumpkin. The Pilgrims were very fortunate to have the pumpkin because it was a staple food. They also used the shells as a template for haircuts. They placed the shell on top of the head to make sure the haircut was round. This coined the nickname "pumpkinheads"!

Jack-o-lanterns

The carving of "Jack's Lanterns" originated in Ireland centuries ago. Based upon an Irish myth about Stingy Jack, the Irish would carve out turnips and potatoes. They then placed lumps of coal inside the root vegetables and lit them like a candle. "Jack's Lanterns" were placed on windowsills to chase away evil spirits. The name "Jack's Lanterns" eventually turned into "Jack-o-Lantern."

When the Europeans arrived in the Americas and were introduced to the bright, round pumpkin, it was perfect for carving! Jack-o-lanterns are now carved from pumpkins for the October holiday, Halloween.