deSTEMber
SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH
PRESENTED BY: girlstart

Edible Slime

Ooey gooey polymers! Observe the physical properties of matter while stirring together a tasty, non-Newtonian fluid.

TEKS:

SCI 3/4/5.6: Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used.
SCI 3.6.B: The student is expected to describe and classify samples of matter as solids, liquids, and gases and demonstrate that solids have a definite shape and that liquids and gases take the shape of their container.
SCI 3.6.C: The student is expected to predict, observe, and record changes in the state of matter caused by heating or cooling in a variety of substances such as ice becoming liquid water, condensation forming on the outside of a glass, or liquid water being heated to the point of becoming water vapor (gas).
SCI 4.6.A: The student is expected to classify and describe matter using observable physical properties, including temperature, mass, magnetism, relative density (the ability to sink or float in water), and physical state (solid, liquid, gas).
SCI 4.6.B: The student is expected to investigate and compare a variety of mixtures, including solutions that are composed of liquids in liquids and solids in liquids.
SCI 5.6.A: The student is expected to compare and contrast matter based on measurable, testable, or observable physical properties, including mass, magnetism, relative density (sinking and floating using water as a reference point), physical state (solid, liquid, gas), volume, solubility in water, and the ability to conduct or insulate thermal energy and electric energy.
SCI 5.6.C: The student is expected to compare the properties of substances before and after they are combined into a solution and demonstrate that matter is conserved in solutions.

Materials:

- 14 oz can of sweetened condensed milk
- Flavoring extract (optional - vanilla, chocolate, etc)
- Food coloring
- Saucepan
- 1 tablespoon cornstarch

How To:

1. In a saucepan over low heat, stir together the cornstarch and condensed milk in a saucepan. Safety: an adult should assist when using the stove.
2. Stir until the mixture thickens. Be careful, the mixture burns easily!
3. Remove from heat.
4. Add 3-5 drops of food coloring and 1-2 drops of flavoring extract.
5. Allow the slime to cool.
6. The slime can be stored in a plastic bag in the fridge for a day or two.

STEM Explanation:

Cornstarch is a polysaccharide–many sugars–made of glucose units linked together to form long chains, called polymers. When cornstarch is heated with condensed milk, the molecules loosen and allow the milk to be absorbed into the chain. This means that the milk goes inside the molecule chain. During this process, moisture is adsorbed to the surface of the molecule chain. This means that the milk sticks to the surface of the cornstarch. All of the milk on and around the molecule chain makes the solution very thick and slimy!

Do you think the slime you created is a solid, liquid, or gas? That's a tricky question to answer! Everything on Earth is made up of matter, and this matter is made up of tiny particles called atoms. Matter takes on different shapes and forms depending on how these atoms are arranged. The three most common forms of matter are solids, liquids, and gases. Solids have atoms that are packed tightly together, and solid materials have a definite size and shape. Liquids have a definite size, but no definite shape. Atoms in a liquid are more loosely packed and can flow past one another. In gases, the atoms are far apart from one another, and gases spread out to fill whatever "container" they are in. Gases have no definite size *or* shape.

So, to answer the question about the state of matter of the slime, it is pretty easy to rule out gas. The molecules of slime do not expand to fill the room you are in! Slime does behave like both a liquid and a solid, though. When you move slime around in your hands, you can make it into different shapes! But when you put slime into a container, it slowly takes the shape of that container. How is this possible?

Because slime has properties that make it fit into both the solid and liquid categories of matter, scientists put it into a different category: non-Newtonian fluids. Non-Newtonian fluids can act like both solids and liquids. Instead of flowing at a constant rate, non-Newtonian fluids flow at different rates, depending on the pressure that is applied to them. Slime flows very slowly and behaves like a solid when you apply pressure to it because the polymers become more tangled. However, when you remove this pressure, the polymers become less tangled and slime flows more quickly, like a liquid. Quicksand and ketchup are both examples of other non-Newtonian fluids… can you think of any more?

Career:

Chemists study the properties of matter. They must understand the structure, properties, and compositions of various substances. Chemists study the dynamics of systems and processes at a molecular level.

Resources:

http://chemistry.about.com/od/slimerecipes/a/edible-slime-recipe.htm
https://www.scientificamerican.com/article/slime-is-it-a-solid-liquid-or-both/

