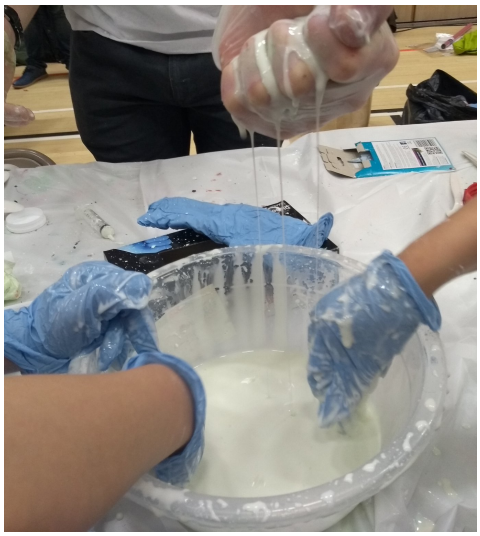
really small science At Home



Activity: Sludgy stuff

Ages: 6 and up – Adult supervision required.

In this activity, you will discover the properties of non-Newtonian fluids using cornflour and water.

You will test different concentrations of cornflour and water to determine the point at which the mixture will exhibit different behaviours. Mixtures of cornflour and water exhibit Newtonian behaviour (they behave like water) and above a certain concentration they behave differently – non-Newtonian behaviour.

You will need:

- Cornflour
- Water
- Food colouring (optional)
- A kitchen scale
- A large mixing bowl
- A spoon

This experiment can get a little messy so make sure you are doing this somewhere you can wipe clean afterwards!

Make up different cornflour/water mixtures and observe their behaviour when you try to mix with a wooden spoon or apply a force to the liquid. Does the mixture behave- a Newtonian liquid or a non-Newtonian liquid?

What to do:

1. Weigh out 50 g water and place into large mixing bowl. If you are using food colouring, you can add a few drops of food colouring to the water to make your sludge a nice colour!
2. Weigh out 50 g cornflour and add to the bowl or water.
3. Mix it up until there are no lumps. What does your mixture look like? Is it runny or thick?
4. Add another 10 g of cornflour and stir. Is the mixture still runny?

5. Continue to add 10 g of cornflour until the mixture is no longer a runny liquid. You will know when you have made your non-Newtonian sludge because the mixture will feel hard when you apply pressure (like squeezing it with your hands!) but will go runny again afterwards!

Once you have made your sludge explore your creation's non-Newtonian behaviours. Hold it in your hand and let it drip through your fingers. Hit the surface gently with a spoon. Try to roll it into a ball!

How much cornflour did you use in total?

50 g + ? g = _____

The Science:

We understand how liquid behaves and we understand how solids behave, but when you mix solids and liquids together it's much harder to understand.

When we mix the cornflour the particles of cornflour are spread through the water and when this mixture is runny – it is less concentrated and the mixture behaves just like water this is **Newtonian**. When we add more cornflour, the mixture becomes thicker until it becomes **non-Newtonian** fluid,

A non-Newtonian fluid means that applying stress changes its **viscosity** (how easily it flows). If you apply force to the mixture, it solidifies and feels solid, but if you apply gentle pressure – like running your fingers through it, it behaves like a liquid.

This is because cornflour particles are so tiny – smaller than a human hair. When they are mixed in water, cornflour particles repel each other, which helps them to flow. However, when the particles are squeezed together a fore between the two surfaces *friction* slows them down and they behave like a solid.

Non-Newtonian fluids are good at absorbing shock and engineers think they could be used as armour!

ReallySmallScience:

ReallySmallScience is a group of researchers from the Department of Chemical and Process Engineering at the University of Strathclyde. Our aim is to bring chemical engineering research to people of all ages through fun, hands-on science activities.

At Strathclyde, researchers in Chemical and Process Engineering study the science of sludge through material science and rheology (which is the study of how materials flow). Our

researchers are very interested in non-Newtonian liquids and their applications as shock absorbing materials.

You can find out more about us at our website:
https://bionanostrath.wixsite.com/reallysmallscience

Twitter @RSmallScience
Facebook @RSmallScience
Instagram @ReallySmallScience