DEPARTMENT OF CHEMISTRY

UNIVERSITY OF OXFORD

Plastic Fantastic

MAKING PLASTICS

1) With Milk and Vinegar

Method

•Warm about half a pint of whole milk.

•Add about 1 tablespoon of white vinegar to it. The milk immediately curdles.

•Sieve the curds and whey then squeeze and dry with kitchen roll.

•The plastic can then be moulded into a shape and will dry firm overnight. It can then be painted and varnished.

Apparatus

A measuring jug

A tablespoon

A pan

A sieve

A Mould

Kitchen Roll

Half a pint of Whole Milk

1 Tablespoon of White Vinegar

What is happening?

•Milk is a mixture of protein (caesin) and fat in water.

•The protein is repelled by water which is why it forms particles, the outside of particles is negatively charged so they repel each other and don't stick together.

•Vinegar is an acid which means it contains lots of positively charged H+ ions which will neutralise the negative charges. This allows the protein particles to come together and form a big sticky network.

•This tends to catch the fat particles and form the white lump you saw in the experiment which are called curds. The watery stuff left over is called whey. This process is called curdling.

PRECAUTIONS

TAKE CARE WHEN HANDLING HOT MILK. THIS STEP MAY REQUIRE AN ADULT.

DO NOT EAT OR DRINK ANY OF THE INGREDIENTS.

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2) With PVA glue and Borax

Method

- Make up a small quantity of saturated (when no more solid will dissolve in the water) borax solution. (food colouring can be added to colour your plastic)
- Add a teaspoon at a time of this solution to a tablespoon of PVA glue.
- Keep adding and mixing as the PVA changes to a solid that is 'bouncy'.
- Left to dry for a few days the solid will become hard and can be decorated.

Apparatus

PVA glue

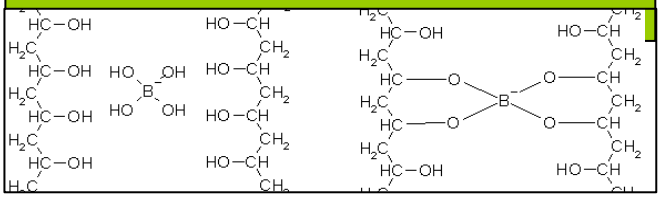
Borax (available cheaply from a chemist)

2 Jars

Teaspoon

Tablespoon

Food colouring (optional)



What is happening?

•PVA is a polymer – polyvinyl alcohol, and contains long chains of molecules.
•When borax is added to PVA it causes a reaction where the PVA chains cross-link, or join together in places.
•This makes the PVA less runny as the PVA chains can not easily slide past each other any more.
•If more borax is added, more PVA chains join together until finally the slime is formed and the PVA looks more like a solid.
•The slime has very different properties depending on what you do to it – it is viscoelastic. It can be squishy (viscous behaviour) or bouncy (elastic behaviour).
•If you make a ball from the slime and drop it on the table, it will bounce. The energy from bouncing spreads through out all the chains which are joined together and can not spread out in the time it takes to bounce.
•If you place the slime on the table, it has time to slowly spread out, similar to a liquid.

PRECAUTIONS

DO NOT EAT OR DRINK ANYTHING USED IN THIS EXPERIMENT.