# 5. MAKING PLASTIC FROM POTATO STARCH

**1-2 HOURS**

This activity is similar to cooking, and therefore requires similar high levels of adult supervision. It is an ideal activity for transition to secondary school - this making use of secondary school staff and facilities; or for working alongside a STEM ambassador.

Children will experience how materials can be changed to make useful new materials and products. They will witness how mixing ingredients together and applying heat leads to an irreversible change to the potato starch that they extracted in the previous activity.

## TYPE OF ENQUIRY

Observing changes over time.

## OBJECTIVES

Explore changes that are difficult to reverse, for example, burning, rusting and other reactions.

## TO BE ABLE TO

Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible.

## SCIENCE VOCABULARY

| | | | |
|---|---|---|---|
| solid | liquid | mixture | translucent |
| mix | heat | change | measure |
| irreversible | viscous | opaque | |

## RESOURCES

For a class of children, working in 8 groups. Adapt quantities for smaller or larger classes, if necessary.

- 25-50g potato starch
- 20-30 ml white vinegar
- 8 x Petri dish, saucer or plate
- 2-3 bottles of different colours of food colouring (2-3 ml per group is required)
- 30-40 ml glycerine
- Safety glasses for all participants
- 8 x 50ml measuring cylinders
- 16 x pipettes
- 8 x glass or plastic beakers (see safety guidance below)
- 8 x lolly sticks for stirring
- Activity sheet 10 (1 per group). This can also be shared with families either on the school website or by sending copies home
- Activity sheet 11 (1 per pair)
- Activity sheet 8 (optional)

### For teachers/ambassadors

- Hot plate and magnetic stirrer or small saucepan, spoon and access to a hob
- If children have been given plastic beakers to do the mixing and a hot plate is being used a glass beaker will be needed for each group
- Some examples of bio-plastic made earlier. (It is strongly recommended that the adult has already carried out this activity before introducing it to the class so should have some samples at this stage)
- Digital weighing scales which can weigh to +/- 0.5g (if these are not available ingredients can be measured using teaspoons and pipettes)

## PRIOR KNOWLEDGE/EXPERIENCE

Children should have had opportunities to follow step by step instructions in the correct chronological order.

## PRIOR DISCUSSION

Before starting the main activity remind children that many everyday materials are made up of various ingredients. Show them the potato starch and ask them to spend two minutes in their pairs, reviewing how they extracted it from potato peel. Listen in to one or two conversations and check that they have realised that the starch was always present in the potato.

Ask each group in turn to offer a step in the process, perhaps recording each on the whiteboard or flipchart paper. Hopefully they will state something similar to the following:

- Breaking down the potato peel and mixing it with water
- Filtering the rest of the potato solids from the water and starch
- Leaving the starch to fall to the bottom of the container
- Pouring the water away from the starch.

## ACTIVITY NOTES

Working in groups of four and following the instructions (Activity sheet 10) children measure and mix together 3g of potato starch, 30ml water, 2ml of glycerine and 2ml of white vinegar. 3g potato starch is about 1 teaspoon and this will be accurate enough if no digital scales are available. A drop or two of food colouring can be added at this stage.

At this point, explain that the exact quantities of each ingredient are not critical for this recipe. However, ambassadors can give one or two examples of process that they have carried out where precise measurement has been vital. Children particularly enjoy hearing about mishaps – so please share any stories where imprecise measurements have caused mayhem!

The mixture now needs to be heated to change it into plastic. An adult will need to carry out this stage for each group. Make sure that everyone is wearing safety goggles during the heating process. If not using a magnetic stirrer, keep stirring all the time. Attention should be drawn to the way that the mixture gradually changes consistency and becomes more 'viscous'. It will be necessary to explain to children that viscosity is a way of talking about the thickness or runniness of a liquid.

The adult should highlight that the mixture becomes translucent (an opportunity to ask children what this means). They should also be told that, even though it is made from food ingredients, the potato plastic will not be edible as a completely new material has been made! Once the mixture is bubbling and completely translucent it can be taken from the heat.

The liquid should now be poured into a petri dish, saucer or other shallow container, and spread into a thin layer. It can then be left somewhere warm to harden. This may take two to three days. You may wish to experiment at this stage as spreading the mixture at different thicknesses will have different results. It can, for example, be spread very thinly, over a sheet of cling-film.

Pairs of children can be given Activity sheet 11 and asked to number them in the right order. Then they should use them to recount how they extracted starch from a potato and made it into plastic. One or two children can be selected to recount the stages to the rest of the class, and supported in the use of the correct scientific vocabulary.

Since the heating stage is fairly quick, children may be interested to watch each other's mixture being heated when they are not sorting the *'Stages of making bio-plastic cards'*.

If they have not already been shown samples of bio-plastic the children can be shown some examples that have already hardened.

A copy of the instruction sheet could be sent home with children or it could be shared on the school website as an optional activity to share with families. As well as reinforcing the learning this has the potential to raise the science capital of the whole family.

## QUESTIONS FOR THINKING

- What does the mixture look like before you heat it?
- How does it change when you heat it?
- How does it change when you leave it for a couple of days?
- Do you think that you could get the potato starch back out of the bio-plastic?
- Explain why you think that.

## HEALTH AND SAFETY GUIDANCE

Please use the following health and safety information to produce your own risk assessment for this activity.

- The mixture will be very hot during the heating stage. Only an adult should carry out this part of the activity.
- Safety goggles should be worn throughout the procedure.
- Children should be warned that although it is made of food ingredients, bio-plastic is not edible.
- Glass beakers will need to be used if the mixture is being heated using a hot plate. Most children of this age, if given clear guidelines, should be able to use glass beakers appropriately for the mixing stage. However, if there are any concerns children can be given a plastic beaker and the contents transferred into a glass beaker. Alternatively, a saucepan might be used for this stage.