INVESTIGATING PLASTIC: DESIGN AND MAKE 'PLASTIC' CHRISTMAS DECORATIONS

Equipment:

1. Variety of plastic objects, e.g. plastic bags, toys, butter cartons, mineral bottles, ...

2. Vinegar (*1 tablespoon*), Milk (*1 average mug/ approximately 300 mls*), small sieve (*a piece of muslin or cheese-cloth could be used instead*), 2 bowls, spoon, kitchen paper, source of heat to heat milk, thermometer.

Optional: mould for shaping, food colouring.

Suggested Class Level:

All

Preparation:

ALLOW TIME FOR THIS ACTIVITY, e.g. 1 HOUR

Warm the milk to 40 - 50°C (*Microwave or other method*)
CARE. Do not boil. (*Things can be touched safely by hand up to 55-60°C*).
OR Warm milk could be brought in a flask.

Background information:

Fresh milk is very nourishing. It contains many of the essential nutrients needed for health. These include various proteins, fat, carbohydrate, calcium, and vitamins A, D and E. Two of the proteins are called **casein** and whey. Casein forms the basis of cheese and also certain plastics.

Modern plastic is a man-made product which does not occur naturally on its own. Most plastics are made from oil (*the petroleum type*), but some of the earliest plastics were made from casein, especially for making buttons.

When vinegar is added to warm milk, a chemical reaction takes place: the acid in the vinegar reacts with the protein in the milk, causing the milk to curdle and to separate out into blobs ***(the curds)*** and a liquid ***(whey)***. The curds can be moulded and they become hard when dry. They are fairly similar chemically to plastic.

A very similar process takes place in **cheese-making;** rennet is usually used instead of vinegar to curdle the milk, and salt and herbs and other flavours may be added.

Bag with the cheese curds in cheesecloth.

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Trigger questions:

Can you give some reasons why milk is good for you? (*Protein for energy, calcium for strong bones and teeth...*)

What does milk look like when it goes sour?

What does milk smell like when it goes sour?

Can you name some things that are made from plastic?

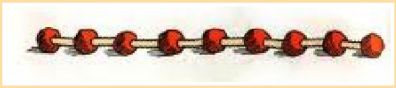
Where do you think the plastic which we use today comes from?
Do you think it is natural or man-made?
(*Man-made, usually made now from petroleum/oil*)

Can you think of any reasons why plastic is so popular?
(*Waterproof, lightweight, easy to mould into shapes, can be dyed different colours, strong ... Plastic bags are strong, light and cheap.*)

Would you like to wear plastic socks?! Why not?

Can you think of any disadvantages of plastic? (*It is not usually biodegradable, i.e. it does not naturally decompose, so it creates a lot of waste, and damages the environment*).

Can you name any different kinds of plastic? (*Many of them begin with 'poly' because 'poly' means 'many' and plastics are made up of very many molecules joined up in long chains like a long string of beads): (polythene, polyester, polystyrene, PVC...*)



What do you think might happen when you add vinegar to milk? Let's investigate!

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Content:

SCIENCE: Materials: properties and characteristics, materials and change, separation
Energy and Forces: Heat, temperature
Living things: human life
Environmental Awareness and Care

MATHS: Number: operations, fractions, decimals and %
Shape and Space: 2-D shapes, 3-D shapes, lines and angles
Measures: capacity, ratios
Lines and Angles (rectangles of material)
Data: represent data

Skills:

Predicting, experimenting, observing, designing and making

Cross-curricular Links:

History: the difference that plastic has made to the world – (*e.g. houses less damp because of 'damp courses'- see DPSM activity 'Keep the Damp Out'; throwaway food and drink containers made from polystyrene which keeps food warm; also the extent to which plastic has contributed to the world's mounting waste problem*).

Activities

Older children:

1. Using a variety of plastic objects, discuss and test the properties of the different types of plastic, e.g. flexibility, strength, hard/soft, transparent/opaque, everyday use, etc.

2. If the children are warming the milk by putting the container with the milk in a bowl of hot water, can they think of a way of speeding up the warming process by wrapping up the bowl in a woolly cloth or polystyrene or any other insulating material?
(*See DPSM activity 'Keeping Warm'*).

Put about 300 mls of warm (*40-50°C*) milk into a bowl.

Add 1 tablespoon of vinegar to the warm milk.

Stir. What do you see?

Strain the mixture, keeping the solid blobs or curds. (*Note: This may take some time to strain*).

Can they describe the curds? (*White opaque, rubbery...*); and whey (*greenish translucent liquid*).

Knead the curds and press them together. What do they feel like?.

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Dry them on kitchen paper and mould them into shapes.

Can the children make Christmas decorations; say a Christmas star, with the 'plastic'?

What can you do to them so that they can hang up? (*Put a hole in the shapes before they dry*).

If left to dry in a warm place they become solid and hard in a few days. (*They are fairly fragile and need to be handled with care*).

The shapes could be painted.

A graph can then be drawn, and the children asked if there is any pattern.

An alternative method could be to use a bigger container and add water, say 50 mls. at a time, and measure the length of material each time. As before the results should be recorded, and a graph drawn and analysed.

2-D and 3-D shapes made at DPSM training day in Port Laoise.

Review: What do you think might happen if the shapes are made quite thin? (*They might snap*).

Younger children:

1. Can they think of different ways to group the plastic objects: e.g. by colour, bendiness, transparent/opaque, etc.

2. Activity 2 above for the older children might be suitable for younger children, perhaps as a demonstration.

They could then feel and squeeze the curds and try to describe them (*rubbery, a bit like cottage cheese,...*).

They could then try to mould them into some basic 2-D and 3-D shapes, e.g. square, circle, sphere, cube, and describe the shapes that they have made.

The nursery rhyme "Little Miss Muffet ... **eating her curds and whey**" could be a good introduction to this activity for younger children.

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MATHS:

1. A good ratio for making this kind of plastic is 15:1 milk: vinegar. If I have a 100 ml bottle of vinegar, how much milk will I need to use all the vinegar to make this kind of plastic? How many litres is this? (*1500 mls, 1.5 Litres*).

2. Teacher wants a class of 20 children to make plastic, working in pairs. 20 mls of vinegar and 300 mls of milk are to be given to each pair, to make a Christmas decoration. How much vinegar and milk will teacher need to bring?

How much will teacher have to spend if milk costs €1.20 per litre, and vinegar costs €1 for a 200 ml bottle?

3. A school decided to analyse the quantities of plastic and paper which it was recycling. It collected 110 kg. of plastic and 500 kg. of paper/cardboard.

How much waste was collected?

Approximately what fraction of this was plastic?

What percentage of it was plastic?

Can you make a pie chart of the waste (*manually or using ICT*)?

Safety:

Care with warming the milk.

Children should wash their hands after handling the curds.

Follow-up Activities:

Food colouring could be added, to make different coloured shapes.

Try out some of the following:

- Will you get the same results with low-fat milk? Investigate the fat content on the cartons of different milks, and compare and record the results.
- Try using soya milk.
- Will other acids like lemon juice or orange juice do the same as the vinegar?