2.6 Easy ice cream

The Wow

Anything involving food, especially food that children can actually eat after the activity, is always going to be exciting! This activity allows children to make edible ice cream in the space of 10-20 minutes using some easy-to-find ingredients and equipment.

To make one serving of ice cream, you will need:

Ingredients:

- 250 ml single cream or milk (full fat works best)
- 1 tbsp caster sugar
- 1/2 tsp vanilla extract (other flavourings can be used for a different taste)
- Lots of ice
- 75g salt

Equipment:

- Small resealable plastic bag
- Large resealable plastic bag
- Measuring equipment (measuring jugs/cylinders, scales, etc.)
- Oven gloves or a towel.

Instructions

First, add your milk, sugar and chosen flavouring to the small resealable bag. Squeeze out as much excess air as possible and seal the bag tightly.

Add the ice and salt to the large resealable bag and give it a shake to combine both substances. Put your sealed-up smaller bag into the large bag and seal the top tightly.

The only thing you need to do now to make ice cream is to shake and shuffle the bag vigorously for around 10 minutes (more or less time may be needed depending on the specific ingredients you use). The outer bag will get **very** cold while you're doing this, so make sure that you have a towel or some oven gloves to hand to protect your skin from the freezing temperatures.

After a few minutes have passed, you can open up the bags and check to see how your milk mixture is changing. When it is ready, all you need to do is to open up the bags and empty your ice cream into a bowl to be eaten, adding some tasty toppings if you want!

What's going on?

In very simple terms, the milk mixture begins to freeze (or solidify) because of the cold ice, and changes state to become a solid. There is a lot more going on in this process though, much of which may be too complicated for primary-age scientists, so careful thought will need to be given to how you present this activity to children and how the background knowledge is explained.

First, we need to know a bit about states of matter. Materials are made up of tiny pieces that we can't see, called ***particles***. In solids, these particles are very close together, arranged in a regular way and are held together by forces of attraction between the particles. In liquids, the particles are still quite close together, but they are arranged randomly. Particles in liquids have enough energy to move around and break free from the forces holding them together, which is why liquids can be poured and take on the shape of the container that they are in. It is important to remember that children following the National Curriculum for England are not required to learn about how particles behave or are arranged in solids, liquids and gases, so careful thought will need to be given to whether it is appropriate or not to talk about this concept with children.

We also need to know about changes of state to explain what is going on here; when liquids cool down enough, they freeze and become a solid. This is because the particles slow down as they cool and so become less able to move around each other. They are pulled into a regular pattern and become solids. This happens to different liquids at different temperatures, with the temperature at which they solidify being called their freezing point.

The ***freezing point*** of pure water is 0°C. However, when salt is added, the freezing point drops a few degrees. This means that the ice and salt in the outer bag is above its freezing point and begins to melt. The heat energy for this is drawn from the milk mixture in the inner

bag, meaning that this mixture cools and the water contained within the milk begins to solidify, forming ice crystals and creating what we know as ice cream.

As you can see, this is complicated science requiring knowledge that is beyond the content of most primary curricula; if you decide to carry out this activity, make sure that you have thought about how it will be explained to children so as not to confuse them, introduce misconceptions or make it difficult from them to learn the foundations of changes of state, which will need to be solid for them to build on in future years.

The Why

This activity is tricky to link with most primary curricula because, as mentioned above, the science involved is beyond the typical expectations for children of this age. While there is an element of changing states, the reasons behind why salt is needed to make the process work are quite complex and can confuse children, particularly if they are new to the concept of changing state and are just becoming secure in their initial understanding. You may wish to keep it simple and use this as a demonstration of a liquid becoming a solid, just explaining that the ice mixture is cold enough to freeze the liquid milk mixture in the inner bag, turning it into a solid.

Children tend to have observed far more examples of melting than they have of solidifying in their own lives (butter melting on toast, chocolate melting in their hands, ice lollies melting on a hot day), so there is some value in this activity as a chance to observe something freezing first-hand.

Children could investigate the differences between liquids with different fat content, including non-dairy products like almond milk, comparing how easily they become ice cream and how tasty the finished product is. There are some great potential links to maths and design technology here, as children could be asked to weigh up the different aspects of what makes the 'best' milk product to use; cream may make a tastier ice cream, but it is more expensive and unhealthier than milk, and less environmentally friendly than oat milk. Keeping to a healthy eating theme, children could also investigate how low the sugar content can get before the ice cream becomes less tasty, or whether sugar can be substituted for flavourings. With these investigations, there are opportunities for children to practise their skills of taking accurate measurements, planning an investigation, recording and presenting results and coming to conclusions based on the evidence that they have gathered. There is also potential for children to explore the difference between carrying out the process with and without salt, but this will require more complex scientific understanding to get to grips with than is necessary, so should only be used with caution.

In the Real World

Providing they live in a climate cold enough for freezing temperatures at least some of the time, children will be most familiar with the phenomenon of ice behaving differently when mixed with salt in wintertime when salt is added to roads and pavements to make them less slippery. The salt lowers the freezing point of the ice, meaning the temperatures in the surrounding environment are no longer cold enough to keep it frozen and it melts. This is helpful because there is more friction on wet surfaces than there is on icy ones, making it safer for people and vehicles to move around. Making this comparison will require some explanation of the complex science discussed above, though, and so will need to be done carefully.

Alternatively, children could find out about the processes used to make ice cream in the real world. Ice cream-making machines used in homes work on a similar principle to what is done here; the ingredients are added to a central container, around which there is a much colder one, then churned in a similar way to the shaking of the bag that is done here. On a larger scale, children could learn about the work of food scientists and food technologists who develop different flavours and textures of ice cream, and the manufacturing processes that go into creating large amounts of it. They could compare their simple list of ingredients to those on the packaging of their favourite brands and reflect on why (or if) so many different ingredients are needed in the ice creams that they buy in the supermarket.

Health and Safety Notes

- As with any food preparation, ensure that children wash their hands with soap and water first
- Check for any allergies, intolerances or dietary restrictions before allowing children to eat their ice cream
- This activity can get very messy – make sure that any spills are cleaned up promptly to avoid any slips, trips or falls