7. How does polystyrene expand?

2-3 hours activity

Children observe how a physical process can be modelled to help explain the changes that have taken place from polystyrene beads to moulded polystyrene spheres.

OBJECTIVES

- Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible
- Pupils should make their own decisions about what observations to make

RESOURCES

(per class)

- Activity sheet A7
- Sample A Polystyrene beads in a transparent, sealed container.
- Sample B 1 cubic centimetre of polystyrene beads (the amount needed to make one sphere) Expanded polystyrene spheres
- Flour (about 750g)
- Dried yeast (1 sachet)
- Mixing bowl
- Weighing scales
- 2-3 baking trays (used for fairy cakes, jam tarts, etc.)
- Tea-towel
- Oven and hob
- Unblown popcorn (optional)
- Glass pan with lid (optional

Safety note

Do not allow the children to hold the loose polystyrene beads as they are small and light enough to be inhaled.

CARRYING OUT THE ACTIVITY

Show the children Sample A of polystyrene beads.

Show the children some expanded polystyrene spheres and ask them to look for similarities and differences between the two examples. Explain to the children that the beads are used to make the spheres. Let the children observe the spheres through hand lenses and ask what they can see (e.g. the misshapen outline of the original beads)

Show them Sample B of beads and tell them that this is the amount needed to make one sphere. Ask the children to think of ideas about how the spheres might be made from the beads.

To extend these ideas, the following activity of bread-making provides a simple analogy of the process. Dough is made by following any recipe for bread. Before the dough is left to rise, divide it equally between all the children. Each child then rolls small 'beads' of dough (about the size of marbles) and piles them in one compartment of the baking tray. When each child has done this they record (pictorially and/or in writing) on Sheet A7 what the dough looks like. Tea-towels are placed over the baking trays and the dough left in a warm place to rise for 45-60 minutes. The children observe the dough again. They can record what it looks like and comment on changes that have taken place. The buns can be cooked and eaten! A discussion of the changes that have taken place is linked to the changes in the polystyrene spheres.

ALTERNATIVE ACTIVITY

Unblown popcorn could be expanded in a glass pan (or popcorn for the microwave could be used) for the children to observe this expansion. In this example the corn expands but does not stick together.

BACKGROUND INFORMATION

Expanding polystyrene. The process involves expanding the polystyrene beads in a pan of boiling water.[1] The expanded beads are cooled and placed in a spherical mould and the mould is added to a pan of boiling water to complete the expansion and compress the beads together. To obtain packaging for televisions, etc. the mould is in the appropriate shape for the consumer item. The beads used in this process have a chemical inside them to enable air to be drawn into their structure. As the air is heated in the boiling water it pushes the polystyrene structure outwards causing expansion.

Expanding dough. When dough is left to rise in a warm place the yeast ferments and this releases carbon dioxide gas. The gas is 'trapped' in the dough in small bubbles and this causes the volume of the dough to increase. In this activity, as the dough rises and expands, thebeads stick together. The appearance of the resulting 'bun' is lumpy, as the misshapen beads can still be seen. Unlike the polystyrene beads, the dough beads are not forced to sticktogether under pressure but by the consistency of the mixture.

1 The beads available from craft shops have been through this stage of expansion. Prior to this the beads are much harder and smaller.