

E2. The function of emulsifiers and stabilisers

Pupils are asked why the food industry uses **emulsifiers** and **stabilisers**.

Pupils may suggest the following reasons for the food industry using stabilisers:

- the quantities produced are very much larger than for foods produced at home
- there needs to be greater consistency between batches produced for consumers
- foods are likely to be transported over large distances and stored for long periods of time before use
- some additives allow the production of food which it is not possible to produce at home
- there is a trend for more of this sort of product to be purchased ready made because:
 - there may be a lack of time due to work
 - these products are more convenient to use
 - there may be a lack of the necessary skills
 - ready made products may be cheaper.

Investigating the action of an emulsifier

Pupils carry out a simple practical activity to investigate the stabilising effect of egg yolks.

Following the introduction the pupils conduct a simple investigation which looks at emulsions and emulsifiers.

Pupils should find that before shaking, the liquids form separate layers in the tube with oil floating on top. The egg yolk may sink to the bottom. Immediately after shaking, the contents of the tubes appear to have mixed. However, on leaving to stand, the tube without the egg yolk will quickly revert back to two layers. The tube with the egg yolk should remain mixed.

Egg yolk contains the **phospholipid**, *lecithin*. Lecithins are used as food additives and have the E-number, E322. Lecithin acts an emulsifier because it enables the vinegar and oil to mix. Eventually, most emulsions will separate out into their components. The use of stabilisers prevents this for a considerable period of time.

KS4

project in food technology

Timing - various

Pupil activity sheet E2 accompanies this activity.

Requirements (per group)

- test tubes
- test tube rack
- 5 cm³ tap water
- 5 cm³ cooking oil
- 1 cm³ whisked egg yolk.

Investigating using a stabiliser in a mayonnaise for coleslaw

More able groups/older pupils will be able to make the mayonnaise for this investigation, otherwise you may like to carry out the investigation as a class exercise.

Stabilisers have been developed which are added to mayonnaise to give good viscosity and 'cling' properties in cold conditions. A mayonnaise suitable for the commercial market has to be able to thoroughly coat the pieces of vegetable and not 'run off'. The mayonnaise lubricates the vegetables and helps to prevent decay over the shelf life of the product (typically 16 days under refrigeration). During the shelf life the vegetables release water, which is mopped up by the mayonnaise while still maintaining its clinging properties.

In this investigation, a mayonnaise is produced with the use of an industrial stabiliser. It is compared to the same mayonnaise made without the stabiliser. The mayonnaise without the stabiliser has the consistency of water, separates into an oil layer and a lower aqueous layer and is not suitable as a coating mayonnaise.

The instructions for making the mayonnaise and carrying out the investigation are on the pupil activity sheets E2. You may have to increase the quantities of the ingredients in the mayonnaise to make sure that the horizontal blades are covered during mixing, otherwise a froth will be formed.

More able pupils may be able to calculate the cost of the two dressings (the cost of the stabiliser is negligible). They may also be able to compare the nutritional value of the dressings with respect to any, or all, of the following:

Pupil activity sheet E2, accompanies this activity.

Requirements

- *kitchen blender with horizontal blade attachment*
- *balance or scales*
- *granulated sugar*
- *table salt*
- *white vinegar*
- *water*
- *vegetable oil*
- *fresh egg yolk*
- *chopped white cabbage*
- *grated carrot*
- *various bowls, spoons, etc*
- *'HAMULSION' - a commercial stabiliser* supplied with this resource; store this in a dry place*

** Further samples of the stabiliser are available from the Chemical Industry Education Centre, University of York, Heslington, York, YO10 5DD*

per 100g	energy (kcal/kJ)	fat (g)	carbohydrate (g)	protein (g)
vegetable oil	900/3780	100	0	0
egg yolk	350/1470	30	0	16
sugar	400/1680	0	100	0

Stabilisers and emulsifiers are food additives. They, and other similar additives, are numbered from E331(c) to E495. They are widely used in the food industry in products such as salad dressings, processed cheese, preserves, margarine, yoghurt, instant desserts, ice cream, low fat products and others.

Emulsifiers and stabilisers are used to help to retain the physical qualities of products. Emulsifiers make water and oil mix together evenly. Stabilisers give products good texture and mouthfeel.

When you make food at home, such as some of the items mentioned above, there is often no need to add extra emulsifiers or stabilisers to the recipe. So why does the food industry use emulsifiers and stabilisers so often? To answer this question you should think about the differences between producing food for the home and food for sale in shops and supermarkets.

Home-made foods such as salad dressings, yoghurt and ice cream are excellent and nutritious products. However, nowadays more of these products are bought from shops rather than made at home. Think of as many reasons as you can to explain this trend.

Investigating the action of an emulsifier

What are emulsifiers and emulsions? Carry out the following investigation to help you to answer this question.

Method

1. Pour about 2 cm depth of tap water into a test tube. Carefully add an equal depth of cooking oil to the same tube. Note down what the contents of the tube look like.
2. Pour about 2 cm depth of water into another test tube. Carefully add an equal depth of cooking oil to the same tube. Add 1 cm depth of egg yolk. Note down what the tube looks like.
3. Put a bung in each tube and then shake both of the tubes for 30 seconds.
4. Leave the tubes to stand in a test tube rack.
5. Look carefully at the tubes over the next few minutes and describe what is happening in each tube.

Discuss with your group and with your teacher the explanation for your observations.

Investigating using a stabiliser in a mayonnaise for coleslaw

SAFETY NOTE
YOU MUST NOT EAT ANY OF THE MAYONNAISE
MADE IN THIS INVESTIGATION
HORIZONTAL BLADES ARE EXTREMELY SHARP;
BE VERY CAREFUL WHEN HANDLING AND
WASHING THEM.

Ingredients for mayonnaise:

50 cm ³	vegetable oil
10 cm ³	egg yolk
20 g	sugar
9 g	salt
40 cm ³	white vinegar
70 cm ³	water
2 g	of a commercial stabiliser

Method

1. Secure the horizontal blades in a blender. Put the water, vinegar, sugar and salt into the blender. Mix on slow speed for 30 seconds.
2. Mix the stabiliser in about 5 cm³ of the oil.
3. Add this to the mixture in the blender and blend on slow speed for 3 minutes.
4. Add the egg yolk and blend to mix this in.
5. Very slowly and carefully add the remaining oil.
6. When all the oil has been added continue to blend for at least 3 minutes until the final mayonnaise is white and homogeneous (evenly mixed).
7. Transfer the mixture to a bowl and wash the blender and blades thoroughly.
8. To show what the stabiliser does in the mayonnaise, make up exactly the same recipe but do not add any stabiliser.

What differences are there between the mayonnaise with the stabiliser and the mayonnaise without the stabiliser? Compare the two by looking at:

- the colour
- the consistency or thickness
- the homogeneity or how evenly mixed it is.