

C3 How does human digestion break down fats? – Saponification of edible oil

1 We emulsify oil

1.1 Apparatus and materials

- Cooking oil (“vegetable oil”), bottle
- Dishwashing detergent
- 1 plant clip (as test tube holder)
- Tap water
- Test tube, glass, 13 cm
- 1 test tube stopper

Attention: After you have completed the experiment, return the materials or dispose of them properly as instructed by your teacher.

1.2 Safety information

The materials may be used only as instructed by your teacher or as described in the experimentation instructions.

For this experiment, be aware of the following risks:

- Remove all water-sensitive materials from your workspace.
- Do not get detergent in your eye. If this should happen, immediately rinse your eye thoroughly with clear water

1.3 Conducting the experiment

- Fill the test tube with approx. 3 cm of water and add 1 cm of oil on top.
- Close the test tube with a stopper and shake it thoroughly.
- Put it down and observe the mixture of the liquid for a while.
- Now add two drops of dishwashing detergent to the test tube and shake again. Put the test tube down and observe.
- Repeat this after you have added four more drops of detergent.



Fig. 1: The test tube with oil and water before shaking. The plant clip acts as a test tube holder.

1.4 Observation

Write down a summary of your observations.

1.5 Analysis

- a) What additives can you use to stably mix oil and water?
- b) Explain the effect of these additives.

1.6 Questions

- a) What is the name of the group of substances that includes the cooking oil you've used in this experiment?
- b) What chemical composition do oils have?
- c) What other representatives of this group of substances can you name?
- d) This experiment shows you an important principle, namely how two substances can be mixed together. Where do you find this principle applied in the human body?

2 Saponification of edible oil

2.1 Apparatus and materials

- 1 boiling chip
- 1 bowl, aluminum
- Cooking oil (“vegetable oil”)
- 1 lighter or matches
- 1 pair of safety goggles for each student
- 1 pH test strip
- 1 plant clip (as test tube holder)
- Table salt
- 1 tea light
- 1 teaspoon
- 1 test tube, glass, 13 cm
- 1 test tube stopper
- Washing soda (sodium carbonate, Na_2CO_3)

Attention: After you have completed the experiment, return the materials or dispose of them properly as instructed by your teacher.

2.2 Safety information

The materials may be used only as instructed by your teacher or as described in the experimentation instructions.

For this experiment, be aware of the following risks:

- Take care when working with a flame that you don't burn yourself or start a fire.
- Wear safety goggles during the entire experiment. If sodium carbonate splashes in your eye or on your skin, immediately rinse your eye or skin thoroughly with clear water.
- Use the aluminum bowl as a fireproof base.

2.3 Conducting the experiment

- Fill the test tube with approx. 3 cm of water and add a small amount of soda (Na_2CO_3 , about as much as fits on the tip of the teaspoon handle three times).
- Close the test tube with the stopper and shake until a clear liquid is formed.
- Remove the stopper and measure the pH value of the solution.
- Add a boiling chip.
- Then add a few drops of cooking oil, shake slightly, and heat for about 20 minutes, always just below boiling point (you will recognize this from the fact that water condenses in the neck of the test tube).
- Observe the changes in the test tube.
- Finally add a small amount of table salt (about as much as fits on the tip of the teaspoon handle two times) to the solution and observe again.
- Measure the pH value in the solution again.



Fig. 2: The aqueous soda solution is heated after the oil is added.

2.4 Observation

Describe the changes that occur in the test tube while heating the oil with the soda solution and again after adding table salt.

2.5 Analysis

- a) Explain your observations.
- b) Formulate reaction equations for the steps carried out above.
- c) Explain the action of the table salt.

2.6 Questions

- a) Find out about soap production in the past and today.
- b) What chemical reactions form the basis for soap production?
- c) What significance does the basic reaction have for human metabolism?