

2.6 Lesson 6: Water quality test

Teacher's information – Lesson 6: Water quality test

The lesson starts by informing why and how a water quality test should be conducted. Subsequently, three water quality tests are carried out in this lesson, one with raw water, one with SODIS water and one with chlorinated water. The results of the water quality tests can be interpreted on the next day.

Objectives – Knowledge

- Know what the used water quality test measures
- Understand why E. coli is used as indicator

Objectives – Attitude

- Consider a water quality test as a useful tool

Time

- 30 minutes (Day 1)
- 30 minutes (Day 2)

Materials – School

- 1 ml of SODIS water
- 1 ml of chlorinated water
- 1 ml of contaminated raw water from a source used for drinking
- 1 waterproof pen
- 1 vessel with hot (> 70°C) water
- 1 vessel for discharge
- Drawing material

Materials – Toolkit

- 3 water quality tests
- 3 syringes
- Images: Lesson 6

Key messages of the lesson

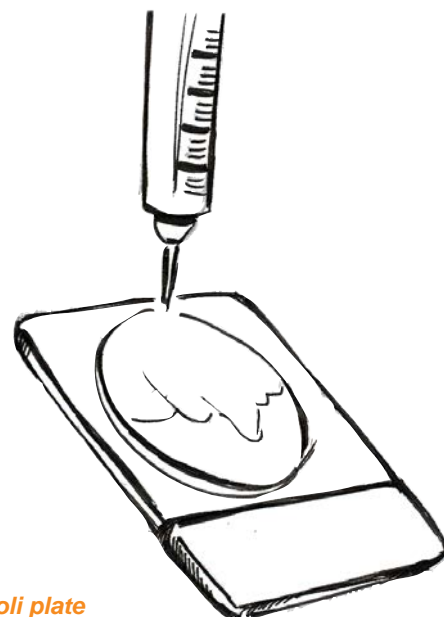
- **A water quality test can detect small organisms invisible to the human eye.**
- **The presence of *E. coli* bacteria indicates recent faecal contamination.**

Water quality test

Image: A look into water

Materials: 3 water quality tests, 3 syringes, 1 ml raw water, 1 ml SODIS water, 1 ml chlorinated water, 1 waterproofed pen

1. Explain why you carry out a water quality test. Show the school children again the image “A look into water”.
 - The water contains very small organisms like bacteria and viruses that are invisible to the human eye.
 - Some of the microorganisms pose a severe threat to human health as they cause different diseases with the following symptoms: vomiting, stomach pain or diarrhoea.
 - Because they are so small and invisible, we will conduct a water quality test to determine if the water contains dangerous small organisms.
2. Explain how the test works and why it measures *E. coli* as indicator.
 - *E. coli* is almost exclusively of faecal origin.
 - *E. coli* is easy to measure.
3. Carry out the first three steps of the water quality test with the children.
 - Preparation of the test
 - Inoculation of the *E. coli* plates
 - Incubation of the *E. coli* plates



*Inoculation of an *E. coli* plate*

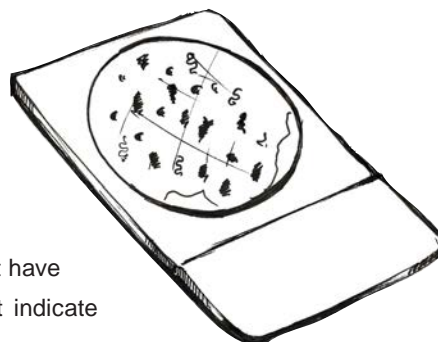
Results of the water quality test

Materials: 3 water quality tests, drawing material

1. Take the plates stored for 24 hours and carry out the last steps of the water quality test.

2. Count the E. coli with the children.

- Count the number of blue spots (E. coli) and record the E. coli concentration for 100 ml of water by multiplying the count of 1-ml sample by 100.
- The red spots are coliform colonies. They do not have to be counted in this test because they do not indicate faecal contamination and are harmless.



E. coli and coliform colonies

3. Interpret the test results together with the children and motivate the children to disinfect their water in school and at home.

- Safe water does not show a single blue spot (E. coli colony).
- Is there faecal contamination in the raw water?
- Is there faecal contamination in the chlorinated water?
- Is there faecal contamination in the SODIS water?

4. Dispose the used test.

What did we learn today?

- What is the purpose of a water quality test?
- Is water disinfection with the SODIS method efficient?
- Is water disinfection with chlorine efficient?

Home-bringing message

- Tell your family about the quality of the raw water, chlorinated water and SODIS water.
- Explain to your family how you measured the water quality.

2.6.1 Background information – Water quality test

There are several types of water quality tests, which measure different indicators of water contamination, such as microorganisms, heavy metals or pesticides.

The water quality test “Compact Dry EC” measures bacteria present in the environment and in the faeces of human and warm-blooded animals, such as cows or dogs. The test detects two groups of bacteria:

- **Total coliform bacteria**

They are generally harmless and found in the natural environment (e.g. vegetation, soil). If only total coliforms are detected in drinking water, a faecal contamination is unlikely.

- **Escherichia coli (E. coli)**

E. coli bacteria are present in great quantities in the intestines of humans. Most E. coli are harmless, but some strains can cause illness. The presence of E. coli in the water sample indicates recent faecal contamination.

Water quality tests require a well-equipped laboratory and trained staff. However, since such conditions are often unavailable, an adapted test method is described hereafter. It works with the following materials:

- 1 water sample
- 1 E. coli plate
- 1 syringe
- 1 vessel with hot water ($> 70^{\circ}\text{C}$)
- 1 vessel for discharge
- 1 labeling material, such as a waterproof pen, paper or stickers

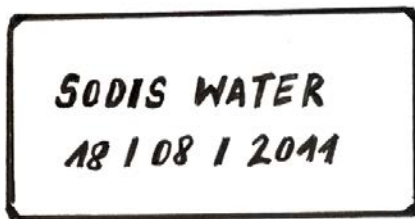
Water quality test – step-by-step

- **Step 1: Preparation**

Prepare the required materials. It is essential for the test to be carried out under the highest possible hygienic conditions. This includes personal hygiene (washing hands with soap), environmental hygiene (clean room) and materials that are disinfected with hot water (>70 °C).

- **Step 2: Inoculation of the E. coli plate**

- Use a 1-ml sterile syringe and fill it with the water to be analysed.
- Remove the lid of the E. coli plate and place it face up on a clean surface. Do not touch the inside of the lid. Distribute the 1-ml water sample over the E. coli plate.
- Close the lid.
- Label the lid with the water type used (raw water, chlorinated water, SODIS water) and the date.



Example of a label

- **Step 3: Incubation of the E. coli plates**

- Place the E. coli plates in a dry and dark place at a temperature of 25 – 35 °C for 24 hours.
- Clean the other equipment and store it in a dry and clean place.

- **Step 4: E. coli counts**

- Blue spots are E. coli colonies. Red spots are total coliform colonies.
- Count the number of blue spots and record the E. coli concentration for 100 ml of water by multiplying the count of the 1-ml sample by 100.

- **Step 5: Interpretation of the test results**

It is important to focus on interpreting the E. coli colonies (blue spots) as they indicate faecal contamination. Safe water should not have a single blue spot.

Test result	Interpretation	Water safety
No spots	Neither a faecal nor an environmental contamination is detected.	The test indicates safe water.
Only red spots	No faecal contamination is detected. The detected environmental contamination is harmless.	The test indicates safe water.
Only blue spots	A recent faecal contamination is detected. Drinking this water can cause illness.	The test indicates unsafe water.
Red and blue spots	A recent faecal and environmental contamination is detected. Drinking this water can cause illness.	The test indicates unsafe water.

- **Step 6: Action**

- If the test with raw water indicates unsafe water, disinfect the water.
- If the test with raw water indicates safe water, carry out another test at a later date or with another water source.
- If the SODIS-treated water or chlorinated water indicates unsafe water, repeat the test. Make sure that the water has been disinfected properly and the water quality test conducted correctly.

- **Step 7: Disposal of the used test**

The test should be safely disposed of to avoid contamination. Burn the test or disinfect it with hot water (> 70 °C) or with chlorine. Do not let the children play with the test.