2.4 Lesson 4: Solar water disinfection

Teacher's information – Lesson 4: Solar water disinfection

This lesson contains two parts. On the first day, the children become familiar with the SODIS method and learn to apply it. On the second day, they can drink their own SODIS water.

Homework for this lesson
- Every child should bring bottles to treat water with the SODIS method.

Objectives – Knowledge
- Know the four steps of the SODIS method

Objectives – Attitude
- Consider SODIS as a useful method for water treatment

Objectives – Skills
- Capable of selecting a suitable bottle to apply the SODIS method
- Capable of recognising when water is too turbid for the SODIS method
- Capable of pretreating turbid water
- Capable of applying the SODIS method independently

Time
- 60 minutes (Day 1)
- 10 minutes (Day 2)

Materials – School
- 0.5 litres of safe water
- 6 litres of water from a commonly used drinking water source
- 1 cup
- 1 soap

Materials – Toolkit
- 12 empty PET bottles
- Images: Lesson 4

Infrastructure
- SODIS station

Key messages of the lesson

- **The SODIS method is an efficient and easy method to disinfect water.**
- **The SODIS method only requires sunlight and PET bottles.**

SODIS bottles

Materials: Bottles brought from home
Images: SODIS method

1. Show the images “SODIS method” and introduce SODIS to the children.
   – The SODIS method is very easy to apply as it requires only sunlight and PET bottles.
   – Step 1: Wash the bottle well with soap the first time you use it.
   – Step 2: Fill the bottle with water and close the lid well.
   – Step 3: Expose the bottles to the sun from morning to evening for at least six hours.
   – Step 4: The water is now ready for consumption

Cleaning PET bottles

Filling bottles with water

Exposing bottles to the sun

Drinking safe water

2. Ask the children to show the bottles they brought from home. Explain why some bottles are suited for the SODIS method and others not.
   – Good bottles: PET (symbol: 1 PET), transparent, unscratched, not bigger than three litres
   – Bad bottles: coloured, scratched, damaged, bigger than three litres

The SODIS method – step-by-step

Materials: 1 PET bottle, 0.5 litres of safe water, 1 cup

1. Explain Step 1: Wash the bottle well with soap the first time you use it.
   - Use appropriate bottles as described in exercise “Bottles for SODIS”.
   - Clean bottle and lid with soap.

2. Explain Step 2: Fill the bottle with water and close the lid tightly.
   - Turbidity test with newspaper or fingers. Turbid water needs to be pretreated.
   - Due to expanding warm water, do not fill the bottle to the top.

3. Explain Step 3: Expose the bottles to the sun for at least six hours.
   - Lay the bottles horizontally on a clean surface in the sun where they will not be shaded. If possible on a reflective surface, like a sheet of corrugated iron.
   - UV-A rays of the sun kill germs such as viruses, bacteria and parasites.
   - Rule of thumb for cloudy weather: if less than half of the sky is clouded over, six hours will be sufficient to disinfect the water completely. If more than half of the sky is covered with clouds, the bottles must be placed in the sun for two consecutive days.
   - The method does not work satisfactorily during days with continuous rainfall.

4. Explain Step 4: The water is ready for consumption.
   - The water can be stored for several days if the bottle is kept unopened after treatment and stored in a cool, dark place.
   - To prevent recontamination, drink the water directly from the bottle or pour it into a clean cup or glass immediately before drinking.

5. Explain the advantages and drawbacks of the SODIS method in the local context.

Man placing bottles on a SODIS table

Good behaviour practice – the SODIS method

Materials: 12 PET bottles, 6 litres of raw water
Infrastructure: SODIS station

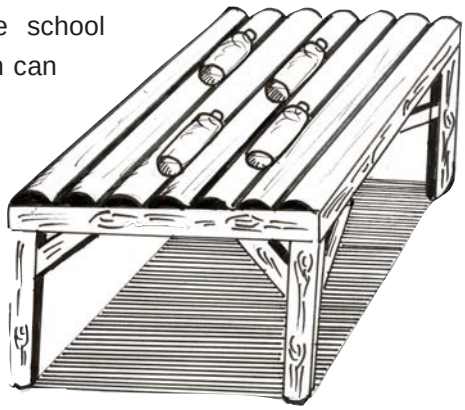
1. Walk through the school area together with the children and look for a good place to practise the SODIS method.

2. Build the SODIS station together with the school children (see page 88). The Safe Water Team can also conduct this task.

3. Apply the SODIS method step-by-step by following the guidelines in the background information section.

4. One day (two days if cloudy) later: drink the safe SODIS water together with the school children.

5. Store one bottle of SODIS water safely for the lesson “Water quality test” (see page 66).



SODIS station

What did we learn today?

- What is the SODIS method good for?
- What are the four steps of the SODIS method?
- Which bottles are suitable for the SODIS method?
- What do you think will happen if the water bottle is too big?
- Can we apply the SODIS method if the water is turbid?
- Why is it important to expose the bottles for at least six hours?
- Does the SODIS method work identically in sunny or cloudy weather?

Home-bringing message

- Explain or demonstrate the SODIS method.
- Where could we place the SODIS bottles at home?
- Where can I find bottles to apply the SODIS method?

Homework

- Every child should bring chlorine products to the next lesson.

2.4.1 Background information – Solar water disinfection

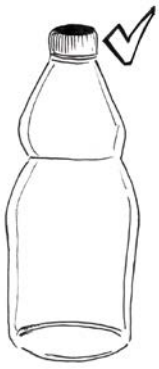
The SODIS method is very easy to apply; all it requires is sunlight and PET bottles. A transparent colourless PET bottle is cleaned with soap. The bottle is then filled with water and placed in full sunlight for at least six hours. The UV-A rays of the sun kill germs such as viruses, bacteria and parasites. After this exposure period, the water is disinfected and can be consumed. More than five million people treat their drinking water with the SODIS method.

Step 1: Wash the bottle well with soap

The bottles used for the SODIS method must be transparent and colourless. PET bottles are ideal because they are light, do not break easily and are readily available in many regions. They are usually labelled with the symbol 

. Scientific studies have confirmed repeatedly that when the SODIS method is applied correctly, the use of PET bottles causes no danger to health. Glass bottles or special SODIS bags can also be used.

Besides the ageing process of the bottle material, scratches on its surface will also reduce penetration of UV-A light. Heavily scratched bottles (after about six months of daily use) should be replaced. As UV radiation is reduced with increasing water depth, the bottles must not hold more than three litres.



Good bottles:
transparent
unscratched
not bigger than three litres

Bad bottles:
heavily scratched
damaged

Bad bottles:
coloured

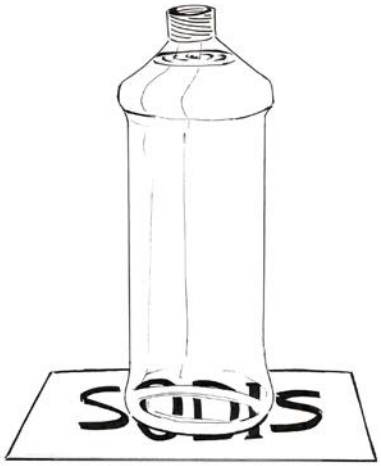
Step 2: Fill the bottle with water and close the lid well

Water that has been polluted with chemicals (poisons, fertilisers, industrial waste) must not be used. The SODIS method only kills germs. The chemical composition of the water remains unchanged.

The SODIS method requires relatively clear water of less than 30 NTU (= Nephelometric Turbidity Units). If the water is very turbid, the effectiveness of the method is reduced. There are two simple tests to find out, if the water is too turbid for the SODIS method.

- **Water turbidity test with newspaper**
  Place the filled bottle upright on top of a newspaper headline. Look down through the bottle opening. If the letters of the headline are readable, the water can be used for the SODIS method. If the letters are not readable, the water must be pretreated.

- **Water turbidity test with fingers**
  Place the filled bottle upright and put your hand behind the bottle. Look through the bottle and count the fingers. If you can count all the fingers behind the bottle, the water can be used for the SODIS method. If you cannot count all the fingers, the water must be pretreated.



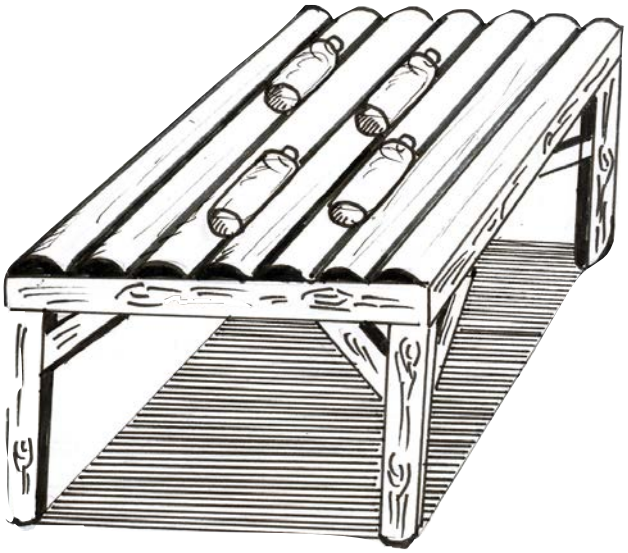
Water turbidity test with newspaper

Water turbidity test with fingers

Step 3: Expose the bottles to the sun for at least six hours

Since warm water expands, do not fill the bottle to the top. Lay the bottles horizontally on a clean and unshaded surface in the sun for the entire treatment time.

If possible, lay the bottles on a reflective surface, like a sheet of corrugated iron. The reflection and higher temperature will speed up the disinfection process. However, this is not essential for its application. The bottles can be placed on any surface, such as wood, concrete or clay brick.



SODIS table with corrugated iron

The method does not work satisfactorily during days with continuous rainfall. Also cloudiness affects the strength of solar radiation and thus also the effectiveness of the SODIS method.

Rule of thumb: If less than half of the sky is clouded over, six hours will be sufficient to completely disinfect the water. If more than half of the sky is covered with clouds, the bottle must be placed in the sun for two consecutive days.

Step 4: The water is now ready for consumption

The water can be stored for several days if it the bottle is kept unopened after treatment and stored in a cool, dark place.

The treated water should be kept in the bottle and drunk directly from the bottle, or poured into a clean cup or glass immediately before it is consumed.

Advantages and drawbacks of the SODIS method

Advantages

- Simple application
- Recontamination is unlikely as water is served directly from bottles in which it is treated
- Proven reduction of bacteria and viruses
- Proven health impact
- No change in water taste
- Use of local resources
- Reduction of energy consumption
- Low cost

Drawbacks

- Requires relatively clear water
- Dependence on climatic conditions
- Long-term treatment (some hours to two days)
- Treatment of limited water volume
- Requires a large supply of intact, clean and adequately sized bottles
- No change in chemical water quality