

# Solar Water Disinfection (SODIS)

Martin Wafler, seecon international gmbh



## Copyright & Disclaimer

### Copy it, adapt it, use it - but acknowledge the source!

#### Copyright

Included in the SSWM Toolbox are materials from various organisations and sources. **Those materials are open source**. Following the open-source concept for capacity building and non-profit use, copying and adapting is allowed provided proper acknowledgement of the source is made (see below). The publication of these materials in the SSWM Toolbox does not alter any existing copyrights. Material published in the SSWM Toolbox for the first time follows the same open-source concept, with all rights remaining with the original authors or producing organisations.

To view an official copy of the Creative Commons Attribution Works 3.0 Unported License we build upon, visit <a href="http://creativecommons.org/licenses/by/3.0">http://creativecommons.org/licenses/by/3.0</a>. This agreement officially states that:

#### You are free to:

- Share to copy, distribute and transmit this document
- Remix to adapt this document. We would appreciate receiving a copy of any changes that you have made to improve this document.

#### Under the following conditions:

• Attribution: You must always give the original authors or publishing agencies credit for the document or picture you are using.

#### **Disclaimer**

The contents of the SSWM Toolbox reflect the opinions of the respective authors and not necessarily the official opinion of the funding or supporting partner organisations.

Depending on the initial situations and respective local circumstances, there is no guarantee that single measures described in the toolbox will make the local water and sanitation system more sustainable. The main aim of the SSWM Toolbox is to be a reference tool to provide ideas for improving the local water and sanitation situation in a sustainable manner. Results depend largely on the respective situation and the implementation and combination of the measures described. An in-depth analysis of respective advantages and disadvantages and the suitability of the measure is necessary in every single case. We do not assume any responsibility for and make no warranty with respect to the results that may be obtained from the use of the information provided.



#### **Contents**

- 1. Concept
- 2. How it can optimize SSWM
- 3. Treatment efficiency
- 4. Operation and maintenance
- 5. Applicability
- 6. Advantages and disadvantages
- 7. References



### 1. Concept

#### **Background**

- simple low-cost, household-level drinking water treatment technology
- uses solar radiation to improves microbiological quality of drinking water
- one of the recommended HWTS by World Health Organisation (WHO).









Store water in the SODIS bottles



SODIS user's instruction

Source: Samuel Luzi (Fundacion SODIS), Regula Meierhofer, (EAWAG/SANDEC)



### 1. Concept

#### Working principal

- PET (Polyethylene terephthalat) bottles or bags (1 to 2 litres) filled with low turbidity water and exposed to sun light
- optical inactivation (UV-A radiation):
  - o only slightly attenuated by clouds
  - turbidity reduces amount of UV radiation that penetrates water (→ containers should not exceed depths of 10 cm)
- thermal inactivation (infrared light):
  - o increased water temperatures reduces required exposure time
- Exposure time:
  - o 6 hours (bright to 50% cloudy sky) to 2 days (100% cloudy sky)

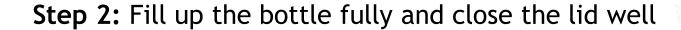


### 1. Concept

#### The 4 SODIS steps (adapted from http://www.sodis.ch/)

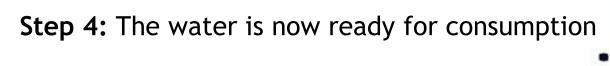


Step 1: Wash the bottle well the first time you use it





**Step 3:** Expose the bottle to the sun from morning until evening for at least six hours





# sustainable sanitation and water management

# 1. Concept

# **Examples**



Indonesian SODIS users

Source: SODIS EAWAG

# SSWM sustainable sanitation and water management

# 1. Concept

# **Examples**



Prototype of SODIS bag for use in humanitarian missions

Source: http://www.sodis.ch/



# 2. How it can optimize SSWM

- simple and extremely low cost method to improve microbial quality of drinking water at household levels
- be used in both rural areas and urban settings



# 3. Treatment efficiency

Microbiological studies demonstrate effectiveness of SODIS against a range of germs

#### **Bacteria**

	Disease	Reduction with SODIS method (6h, 40°C)
Escherichia coli	Indicator for water quality & enteritis	99.999%
Vibrio cholera	Cholera	99.999%
Salmonella species	Typhus	99.999%
Shigella flexneri	Dysentery	99.999%
Campylobacter jejuni	Dysentery	99.999%
Yersinia enterocolitica	Diarrhoea	99.999%

#### Virus

	Disease	Reduction with SODIS method (6h, 40°C)
Rotavirus	Diarrhoea, dysentery	99.9 - 99.99%
Polio virus	Polio	99.9 - 99.99%
Hepatitis virus	Hepatitis	Reports from users

#### **Parasites**

	Disease	Reduction with SODIS method (6h, 40°C)
Giardia species	Giardiasis	Cysts rendered inactive
Cryptosporidium species	sCryptosporidiasis	Cysts rendered inactive after > 10h exposure
Amoeba species	Amibiasis	Not rendered inactive.  Water temperature must be above 50 °C for at least 1h to render inactive!

Overview on most important research results

Source: SODIS EAWAG

10



### 4. Operation and maintenance

#### Check on water turbidity

Turbidity of raw water must be less than 30 NTU.

Water turbidity can easily be determined:

- •place full bottle on a newspaper headline (letters should have size of about 1.5 cm) and look through bottle from top to bottom
- water turbidity is less than 30 NTU if letters are readable
- •if not, water must be filtered first

#### Replacement of bottles

Old bottles and bottles that are no longer transparent (about 6 to 12 months of daily use)



# 5. Applicability

- no replacement to access to safe drinking water
- simple and extremely low cost method to improve the microbial quality of drinking water at household levels (small volumes)
- used in rural areas and urban slums; PET bottles generally more available in urban regions
- cannot treat chemically polluted water (e.g. arsenic, fluoride or industrial and agricultural organic contaminants)
- secondary treatment of water coming from an improved source (e.g. well water), which does not meet the microbial quality standards



# 6. Advantages and disadvantages

#### Advantages:

- •improves microbiological quality of drinking water
- extremely low-cost
- •easy to understand and simple to use
- relies on locally available resources, plastic bottles and sunlight

#### Disadvantages:

- does not treat chemical pollution
- •is strongly climate and weather dependent
- treatment of small volumes
- •requires PET bottles (or plastic bags)
- •large efforts in terms of promotion and information to have an impact



## 7. References

MEIERHOFER, R. WEGELIN, M. (2002): Solar Water Disinfection. A Guide for the Use of SODIS. (=SANDEC Report, No 06/02). Duebendorf: Water and Sanitation in Developing Countries (SANDEC) at the Swiss Federal Institute of Aquatic Science and Technology (EAWAG)

EAWAG/SANDEC (2006): Training Material for SODIS Promotion. Duebendorf: Water and Sanitation in Developing Countries (SANDEC) at the Swiss Federal Institute of Aquatic Science and Technology (EAWAG)

OATES, P., SHANAHAN, P., POLZ, M. (2003): Solar disinfection (SODIS): Simulation of solar radiation for global assessment and application for point-of-use water treatment in Haiti. In: Water Research 37(1), 47-54. SODIS (2009). Microbiology. URL: http://www.sodis.ch [Accessed 19.04.2010]



### "Linking up Sustainable Sanitation, Water Management & Agriculture"

SSWM is an initiative supported by:



Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederazion svizza

Federal Department of Foreign Affairs FDFA Swiss Agency for Development and Cooperation SDC





sustainable sanitation alliance































Compiled by:

