

SODIS – Solar Water Disinfection: Water Quality Improvement at Household Level with Solar energy.

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Introduction

The lack of clean drinking water for some 1.1 billion people in this world has dramatic consequences: approximately 4 billion cases of diarrhoea are reported annually, of which 2.5 million end in death. Every day around 6000 children die due to the lack of safe drinking water. Criteria for improving water supplies only consider water availability and its accessibility. However, since the drinking water quality is not taken into account, the situation is far worse as more than 1.1 billion people are exposed to unsafe drinking water.

In order to make water safe to drink, further treatment is necessary. The most recognized and established treatment is to boil the water to kill the micro-organisms, such as bacteria and viruses, in the water. In developing countries most people in the urban and peri-urban areas use kerosene or gas for cooking and boiling water, while in the rural areas people commonly use wood or other biomass as fuel. As fuel is getting scarcer or too costly, the water often is no longer boiled leading to an increase in infections

SODIS

SODIS, which stands for Solar Water disinfection, is a simple method that utilizes the synergy of the UV-A (radiation effect) and infrared light (thermal effect) to kill the bacteria and viruses in the water (Figure 1 & 2). The system

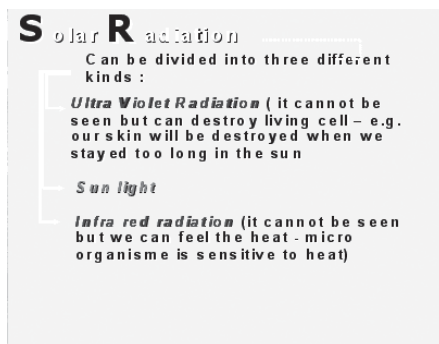


Figure 1 The three types of solar radiation (diagram: Yayasan Dian Desa, Yogyakarta, Indonesia)

uses PET (Polyethylene) transparent plastic bottles that are exposed to the sunshine for several hours (Figure 3). These are ordinary plastic drink bottles of the kind used for soft drinks and bottles water- they do need to be clear and transparent. The plastic bottles have proven to be an adequate and safe container for the treatment.

SODIS was first initiated through experiments performed by Prof. Aftim Acra at the American University of Beirut. It was further researched with extensive laboratory and field tests carried out by EAWAG-SANDEC, a Swiss Research Center for Water and Sanitation for Developing Countries, based in Switzerland. The field tests of SODIS, completed in several developing countries, have shown it to be an efficient and effective drinking water treatment method, as well as a simple and low cost technology.

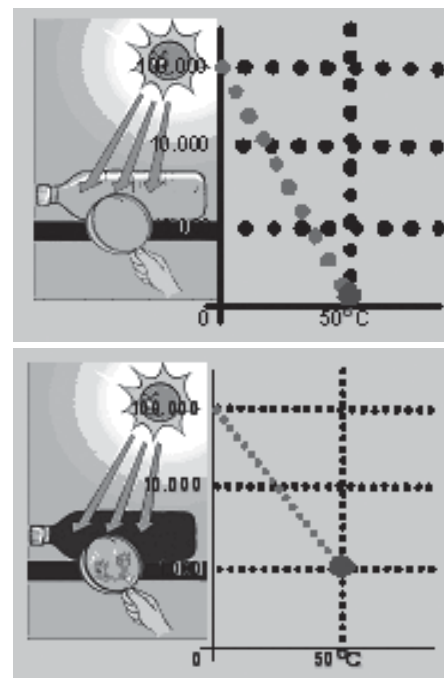


Figure 2 All faecal bacteria in the transparent bottles where there is synergy between the UV-A radiation and heat is inactivated when the temperatures reaches 50°C, top picture, but not in the dark bottle that only gets the heat from the sunshine, bottom picture (diagram: Yayasan Dian Desa, Yogyakarta, Indonesia)

SODIS in Indonesia

Indonesia is a developing country that still faces problems with the availability and accessibility of safe drinking water, especially for those living in rural areas. In many areas people still drink untreated water, to save fuel or because of a taste preference, and neglect the possible negative health consequences.

SODIS was first field tested in Indo-



Figure 3 How is SODIS used? Clean bottles are filled with water and placed on the roof. The bottles must be exposed to the sun from the morning until the evening, at least six hours, before they are ready for consumption (photos: Yayasan Dian Desa, Yogyakarta, Indonesia)

nesia in 1997 by Yayasan Dian Desa, an Indonesian NGO based in Yogyakarta, Indonesia, and more recently there has also been collaborative work with EAWAG-SANDEC, who also provide technical back up. Support has been provided by UNICEF, SIMAVI and from some private sector companies such as the Coca Cola Company and Georg Fischer.

The two main areas of SODIS dissemination in Indonesia are in two islands, East Lombok District in Lombok Island and Sikka District in Flores Island. Between these two islands there are more than 150,000 beneficiaries in more than 40 villages (Figure 4 & 5). The benefits of adopting and applying SODIS, as reported by the communities, are a saving on fuel and an improvement in health, especially reduction of stomach problem or diarrhea. The local health department has also recognized the positive health impacts of SODIS application by a community (Figure 6). The following graph shows the reduction of diarrhoea incidence in the villages on Lombok Island, Indonesia, where SODIS is used by the community (Figure 7).

Conclusion



Figure 4 The water bottles can also be placed on a corrugated iron sheet (photo: Yayasan Dian Desa, Yogyakarta, Indonesia)



Figure 5 Some 130,000 people in East Lombok use SODIS (photo: Yayasan Dian Desa, Yogyakarta, Indonesia)

Impact of SODIS on Diarrhoea Incidence

Cases of Diarrhoea in the Years '02, '03, '04 (until May '04)				
	Av. Cases Diarrhoea '02 (before SODIS)	Av. Cases Diarrhoea '03	Av. Cases Diarrhoea '04	Reduction in '04 compared to Av. of '02 and '03
Paneda Gandor Vill.	15	16	1	90 %
Ketangga Vill.	12	12	1	87 %
Sel. Ketangga Vill.	41	41	31	23 %
Pringgabaya Vill.	30	38	15	57 %
Jerowaru Vill.	60	28	14	68 %
Pengadangan Vill.	19	6	2	86 %
Gelanggang Vill.	48	28	0	100 %
Sukamulia Vill.	10	9	2	84 %
Jenggik Vill.	11	14	3	78 %
Tebasan Vill.	12	8	4	54 %
Average Reduction of Diarrhoea				73 %

Figure 6 Number of cases of diarrhoea in ten villages in East Lombok from 2002 until May 2004 and the percentage reduction in diarrhoea incidence after SODIS was introduced.

The case study in Indonesia has shown that SODIS is a simple and cost-effective alternative in providing access to safe water. All that is required is a 1.5 litre or smaller PET plastic bottle and sunshine. Plastic bottles are low in cost, approximately USD 0.15 to 0.20 (Rp. 1,000 – Rp. 1,500), and can last for three to four months if used on a daily basis.

Limitations

However, there are several limitations to the further application of SODIS technology:

- SODIS is unable to be used with larger containers. The best size of PET plastic bottles to be used for SODIS is 1.5 litres and maximum size is 2 litres.
- SODIS application is dependent on the climate.
- SODIS cannot be applied to muddy water. Therefore, if the water is muddy, the water must be pre-treated in order to clarify it.

References

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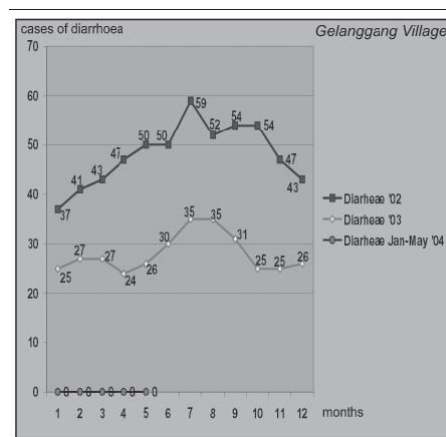


Figure 7 The incidence of diarrhoea in Gelanggang village was impressively reduced after the introduction of SODIS

Profile of the author

Christina Aristanti has been involved with Yayasan Dian Desa, an Indonesian NGO working on appropriate technology for community development, since 1980. She is primarily interested in the issues associated with household water treatment and sanitation and previously worked as an assistant to the Director of Yayasan Dian Desa. She became more greatly involved in household energy, and specifically improved cookstoves, in 1989 when Yayasan Dian Desa was a focal point of Foundation for Woodstove Dissemination and to an even greater extent when the Asia Regional Cookstove Program (ARECOP) started in 1990. She has been the manager of ARECOP from 1992 to present. More information on the work and future activities of ARECOP can be found at www.arecop.org.