

Potable water for all: promotion of solar water disinfection

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The SODIS water treatment process is used at household level to treat small quantities of water for drinking purposes. The treatment basically consists in filling transparent plastic bottles with water and expose them to full sunlight for approximately five hours. However, efficient application of SODIS requires relatively clear water, the turbidity should be less than 30 NTU. Therefore, pre-treatment of turbid water by sedimentation is often necessary prior to SODIS application. The water treatment process is illustrated in Fig. 1.

Extensive laboratory and field tests revealed that SODIS is best applied using the UV-A radiation of sunlight to irradiate and the infrared light of the solar energy to heat up the water. Synergy's will occur at a threshold water temperature of 50 °C. A 3-log reduction (99.9 per cent) of faecal coliforms and of *Vibrio cholerae* can be achieved by an exposure of plastic bottles or bags to sunlight during 5 hours (Wegelin, 1994; Sommer, 1997).

Acceptance of SODIS

A field study programme carried out with the help of demonstration projects located in seven different developing countries (Colombia, Bolivia, Burkina Faso, Togo, Indonesia, Thailand and, China) revealed good socio-cultural acceptance and affordability of SODIS by the target population. At the beginning of this programme, a total of approximately 550 household participated in the SODIS demonstration projects. One year later, 10260 households used SODIS. The final evaluation revealed that 84 % of the households will certainly continue to use SODIS after the formal end of the projects. Hence, SODIS is accepted at village level in the demonstration projects, however, for a large dissemination of this water treatment

alternative general awareness and acceptance has to be achieved at national and international level (Wegelin, 1998).

Socio-cultural aspects, scientific evidence and control possibilities for adequate application might hinder large-scale dissemination and efficient use of SODIS. The water treatment method may, therefore, face the following limitations:

- Although SODIS is a very simple water treatment method, it is often difficult to inform people about the effects of UV-A radiation, temperature, and turbidity on the inactivation of harmful micro-organisms. Such information is generally beyond the understanding of most communities.
- The need to boil the water before it is consumed has been passed on for years to teachers, health workers and medical personnel, students and housewives. All of a sudden, boiling is no longer necessary. Exposing the water to sunlight and getting it heated to 50 °C is said to be sufficient to kill the harmful micro-organisms. This message is difficult to accept not only by the target population, but more especially by the officers responsible for public health.
- Common plastic bottles normally do not attract public interest. Water treatment is generally declared as an important factor in maintaining a healthy life. As such, it is expected to require special care and equipment. SODIS application is not spectacular and may, therefore, not be appealing as some excitingly new and sophisticated technologies.

Information need

Since SODIS is a modest technology, it may not attract the required public interest. This may lead to an information problem. Most of the promising new approaches are currently being applied on a relatively small scale, often by NGOs. They are usually not regarded as serious engineering options by professional and scientific circles. Many new approaches have already been pioneered but they have not yet widely been applied and are not comprehensively enough to produce a significant breakthrough leading to more effective and sustainable solutions. While SODIS has been accepted by the beneficiaries at village level where demonstration projects were conducted, acceptance at national and international level is needed to enhance dissemination in areas suitable for its application. SODIS violates the general recommendation to boil unsafe water which has been propagated by public health officials for

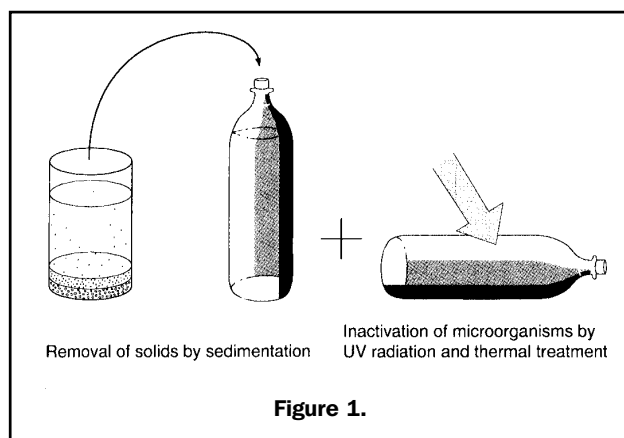


Figure 1.

many years. These people are often unaware of the real thermo-sensitivity of micro-organisms and tend to attribute too much importance to water quality. The behavioural changes, expected from the communities, cannot be sustained if policy makers and administrators do not support them. A clear understanding of the potential and limitations of SODIS is, therefore, essential.

SANDEC (Water Supply and Sanitation in Developing Countries), a department of EAWAG (Swiss Federal Institute of Environmental Science and Technology) organised an international e-mail conference in order to create awareness among national and international agencies. Comprehensive information material (a background paper, technical notes and a video on SODIS) were sent to the workshop participants who reviewed and discussed this alternative water treatment option. The findings and recommendations of this conference are summarised in a synthesis paper which has been published on the homepage <http://www.sodis.ch>.

Furthermore, SANDEC in co-operation with SDC (Swiss Agency for Co-operation and Development) is supporting the development of national SODIS networks in Indonesia, Togo and Bolivia. SANDEC's co-operation partners in these countries are acting as leading agencies and are preparing SODIS information material, initiating new projects and establishing networks to enhance information exchange. Independent, demonstration projects are carried out in other countries such as Bangladesh, South Africa or Ecuador in order to study efficiency and socio-cultural acceptance of the SODIS process.

New approaches and strategies have to be applied for an effective promotion of SODIS. The development of national SODIS networks and the involvement of the private sector in dissemination activities are such unconventional new possibilities for the marketing of SODIS.

SODIS promotion in Ethiopia

Promoting the dissemination of SODIS in Ethiopia has been taken up by Enda-Ethiopia, the Ethiopian branch of the Third World Association Environmental Development Action, based in Dakar, Senegal. One of ENDA's objectives is to promote front-line technologies, i.e. technologies which meet basic needs of the local people, do not require capital input and are easy to replicate. SODIS is such a technology.

Key facts on access to potable water in Ethiopia

- *7 per cent of the population in Ethiopia's rural areas have access to potable water.*
- *51.4 per cent of the households consume water from springs or unprotected wells and 37.6 per cent consume river water.*
- *46 per cent of childhood death are due to*

Approach

The SODIS technology has been tested at both laboratory and field level. Given sufficient precautions are taken to ensure it is properly used, the technology can be disseminated on a wider scale. From the beginning, Enda-Ethiopia did not mean to restrict the dissemination of SODIS to its own interventions but rather make the technology known to a large public in Ethiopia. Instead of focusing on one target only (the consumers), the different stakeholders have all immediately been involved, so that dissemination of the technology can proceed in a collaborative way, with each interested stakeholder contributing according to his/her specific expertise, role or type of intervention.

Promoting the dissemination of SODIS follows a three-stage approach:

- Introducing SODIS to a varied public, composed of many different stakeholders.
- Pilot projects and testing.
- Dissemination of information on SODIS experiences in Ethiopia.

The first two stages are expected to result in a better understanding of the applicability and acceptance of SODIS in Ethiopia. By the end of the second stage, specific data should be available on how best to apply SODIS in the Ethiopian context, which bottles to use, where to find them, how to use them, how to approach households and communities as well as local authorities, and points requiring special attention. All this information will be used to produce the information and training materials required for the third stage, during which the technology will be disseminated to a broad public via the mass media, environmental clubs in schools and at district level, and possibly the private sector. It is understood that no wide dissemination will be attempted without approval of the technology by the Ministry of Health.

Introduction of SODIS to a varied public

To introduce SODIS to as varied a public as possible, the technology was first presented at a general meeting organised by the Forum for Environment, a platform for communication between people concerned with the environment in Ethiopia, irrespective of their profession or nationality. Special care was taken to invite a very diverse public, including representatives from different government departments, NGOs, several university departments, the Ethiopian Science and Technology Commission, the private sector, bilateral donors and the mass media.

The business sector has been among the first involved in dissemination efforts, as it is expected that this sector will provide the necessary drive for distributing plastic bottles. The manufacturer of plastic bottles in Ethiopia immediately saw the advantage for his business of the SODIS technology. He sponsored the first meeting on SODIS and invited several bottling factories to attend.

The Forum for Environment meeting on SODIS was held at the end of January 1999 and resulted in:

- The establishment of a SODIS interest group.
- The pledge by a number of organisations and agencies to test the acceptance and applicability of the technology in their areas of work.
- Interest of the bottling factories to be associated to the movement.

The plastic bottles

Production of plastic bottles has just started in Ethiopia. Bottles of different sizes (0.5, 0.75, 1.00, 1.5 and 2 litres) are produced by Thermoplastic. All these bottles are made of PET. Pieces of plastic taken from the bottles were analyzed by EAWAG, which confirmed the excellent UV-A transmittance. The plastic bottles manufactured in Ethiopia are now used or about to be used by two bottling companies, one company using them for bottling flat water and the other for bottling soft drinks.

The 1.5 litre plastic bottles are sold at the price of 1.5 birr. Assuming a family of 7 with a requirement of 2 litres of clean drinking water per person per day, some 9 bottles of 1.5 litre are needed to cover the family's drinking water requirements. If the bottles have to be purchased, as is likely to be the case as long as waste plastic bottles will not be widely available, the expense to buy the material that will protect one family of 7 against water-borne diseases will amount to about 15 birr. This expense will have to be renewed every 4, 6 or 12 months, according to the life span of the bottles.

The life span of the PET bottles is being investigated. It has been observed that the plastic bottles get quickly scratched and blemished as a result of poor handling and storage. This is very likely to occur in most households, especially if waste bottles are used. The microbiological quality of SODIS-treated water using blemished plastic bottles is now being examined in two government laboratories, to see how much results are affected by using worn-out bottles.

Glass bottles

On the Ethiopian market, the most widely available bottles are still the glass bottles. They are very commonly used throughout the country as containers for local drinks such as *katikala* and *arake, tedj* (honey mead) and *talla* (local beer). Buying used bottles is a familiar practice in Ethiopia. Old whisky (Johnny Walker) bottles are commonly used for serving drinks at wedding and other parties. Given this wide use and overall availability, the effectiveness of glass bottles for SODIS use is also being tested. More especially, water treated in (imported) Johnny Walker and (locally produced) Ouzo glass bottles is being analyzed.

Pilot projects and testing

The SODIS interest group

A SODIS interest group was formed after the first presentation at the Forum for Environment. The group includes representatives from different NGOs, the East

African Bottling Factory (both Addis and Dire Dawa plants), the Curriculum Department of the Ministry of Education, the Ministry of Water Resources, the Addis Ababa University, a secondary school in Addis Ababa, the Addis Ababa Environmental Protection Bureau and the mass media. Although the group does not include a representative of the Ministry of Health, the Water Sanitation Team of the Environmental Health Department has indicated its interest and asked to receive for all information on further developments.

Tasks of the interest group

- The major tasks participants in the interest group will perform include.
- Arrange for further analysis to be made of water samples treated according to the SODIS method using different types of bottles (glass, plastic, worn out).
- Test the impact and acceptance of SODIS in some of working areas.
- Prepare simple training material in Amharic.
- Exchange information on progress made by each.

Moreover, each participating member will introduce the SODIS technology whenever attending a meeting on a related topic. This is how another interest group came to be established, in Dire Dawa, after presentation of the SODIS technology at a seminar on saving fuelwood.

Demonstration projects

Two NGOs are making the necessary arrangements to introduce SODIS as part of their water development programmes in some of their working areas. This will include both urban and rural areas. One NGO will focus more on acceptance by the local population, while the other is more especially interested in the epidemiological aspects.

In addition to this, a graduate student preparing her master paper will introduce SODIS in two villages in the Wabe Shebelle (Somali) area, in collaboration with a local NGO. Rather than introducing the technology to villagers, the target group will be the extension workers and teachers in the area. All of them drink river water and it is expected that once they are convinced, they will further disseminate the technology to the local households in the area.

Conclusion

All in all, SODIS has raised much interest in Ethiopia. Major reservations expressed relate to the limited quantity of water that can be treated at once, which makes the technology unusable in clinics and schools. On the other hand, several scientists and development officers have pledged to contribute in one or another way to test the technology in Ethiopia. This was done in a positive spirit, so as to clear the way for dissemination of SODIS in the country. Prospects for more Ethiopian people to drink potable water is therefore promising.

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