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Solar Disinfection: A Holistic Approach to Pure Drinking Water in Rural Areas

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ABSTRACT

Solar Water Disinfection (SODIS) is used in the developing world as a low cost method to reduce biological contamination in drinking water. It involves exposing a bottle of water to sunlight for a specified time, while the UV rays from the sun kill and/or inactivate the water-borne microorganisms. SODIS is ideal to disinfect small quantities of water of low turbidity. Contaminated water is filled into transparent plastic bottles and exposed to full sunlight for six to eight hours. During the exposure to the sun the pathogens are destroyed. If cloudiness is greater than 50%, the plastic bottles need to be exposed for 2 consecutive days in order to produce water safe for consumption. However, if water temperatures exceed 50°C, one hour of exposure is sufficient to obtain safe drinking water. The treatment efficiency can be improved if the plastic bottles are exposed on sunlight reflecting surfaces such as aluminium or corrugated iron sheets.

Keywords: *Solar disinfection, turbidity, PET, UV and heat energy, diarrhoea.*

I.INTRODUCTION

There are 3.575 million deaths each year from water-related disease, and 98% of these occur in developing countries (WHO, 2008). Eighty-four percent are children (WHO, 2008). In an effort to fight the water-borne diseases that kill so many, solar disinfection, or SODIS (**Sol**ar **Dis**infection) has been developed. SODIS is a very simple method of water treatment that consists of exposing a bottle of biologically contaminated water to direct sunlight, allowing the UV component of the light to energize reactions in the water that kill or inactivate microorganisms. This renders the water biologically safe for drinking. Water in sufficient quantity and good quality is essential for live. However, at the beginning of the year 2000 one sixth of the world's population, 1.1 billion people, is without access to improved water supply and many more lacking access to safe water. The following technologies are regarded as 'improved water supply': household connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection. The water quality in improved water supply systems often is affected from unreliable operation and lack of maintenance, or the water is subject to secondary contamination during collection, transport and storage.

Furthermore, a new idea is presented which addresses one of the technology's weaknesses: namely, that the SODIS process gives the user no feedback to indicate when the water is safe to drink. In practice the water is usually presumed potable after an exposure of 1 day if it is sunny or 2 days if it is overcast, but there is no

practical way to confirm this in the field or to determine whether the water is ready for drinking before the recommended exposure time is reached. In this document a very simple SODIS indicator is presented and tested, and general guidelines for its use are established.

SoDIS is an extremely simple method of treating biologically contaminated water that is appropriate in regions where finances, resources, and education are in short supply. The user simply fills a PET water bottle with water from whatever source is available- typically some sort of surface water source and places the bottle on a SoDIS table (a table of corrugated sheet steel) in direct sunlight. SoDIS users are taught to leave the bottle for one day if it is sunny and two days if it is cloudy. During this time UV light from the sun passes through the bottle and into the water, where it kills or inactivates microorganisms through several mechanisms. When the prescribed exposure time is reached the water is ready for consumption.

Need for SoDIS

The SoDIS method is ideal for treating water drinking in developing countries. All it requires is sunlight and PET bottles. People can use the SoDIS method to treat their drinking water themselves. The method is very simple and its application is safe. It is particularly suitable for treating relatively small quantities of drinking water.

SODIS has been promoted as an effective method to purify household water since 1999, and about 2 million people now use the approach. However, although SoDIS works well under laboratory conditions, very few studies have investigated its ability to reduce the number of cases of water borne diseases occurring in a population over a specific time period in the real world. Before any more resources are used to promote SoDIS—its effective implementation requires intensive and on-going education—it is important to be sure that SoDIS really does reduce the burden of water borne diseases in communities in the developing world.

Scope of SoDIS in rural areas

SODIS is an effective method for treating water where fuel or cookers are unavailable or prohibitively expensive. Even where fuel is available, SODIS is a more economical and environmentally friendly option. The application of SODIS is limited if enough bottles are not available, or if the water is highly turbid. In fact, if the water is highly turbid, SODIS cannot be used alone; additional filtering is then necessary. The SODIS method (and other methods of household water treatment) can very effectively remove pathogenic contamination from the water. However, infectious diseases are also transmitted through other pathways, i.e. due to a general lack of sanitation and hygiene. Studies on the reduction of diarrhoea among SODIS users show reduction values of 30–80%.

SoDIS improve the microbiological quality of drinking water. It improve the family health. SoDIS can serve as an entry point for health and hygiene education. SoDIS is easy to understand. It reduces the need for traditional energy sources such as firewood and kerosene. Women and children often spend much of their time and energy in collecting woods .SODIS reduces the workload. Public water supply system in developing countries often fail to provide water safe for consumption. SoDIS provides individual users a simple method that can be applied to

household level. Only required is transparent plastic bottles. SoDIS requires sufficient solar radiation. Therefore it depends on the weather and climatic condition. It requires clear water. It does not change the chemical water quality and it is not useful to treat large volume of water.

Recent applications

Solar Water Disinfection is being used as a water treatment method at household level in Kenya, Bolivia and Zimbabwe. Billions of People worldwide do not have access to safe drinking water and therefore are exposed to a high risk for diarrhoeal diseases. Solar water disinfection (SoDIS) is a new water treatment to be applied at household level with a great potential to reduce diarrhoea incidence of users. Demand for safe water, as well as access to adequate and affordable products for drinking water treatment, is key for household water treatment (HWT) in low-income countries like Nicaragua. Promoting solar water disinfection in schools: Experiences and lessons learnt in Latin America.

II.CONCLUSION

SoDIS process has the potential to be an affordable and accessiable method for water disinfection. The SoDIS method is especially useful in developing countries like Haiti that do not have easy access to potable and clean water. This method can also be useful after a natural disaster when it is common for aqueducts to stop functioning for undetermined time. The PET (Polyethylene terephthalate) bottles with 1to 2 litres of water having turbidity less than 30 NTU are exposed to sunlight for 42 hours can easily eliminate 80% bacterial colony. The treatment efficiency can be improved if the plastic bottles are placed on the reflecting surface such aluminium or corrugated iron sheets.

Today SODIS method is one of the recommended household level water treatment technology recommended by WHO (world health organisation).But SODIS is not useful during the rainy season and sterilizing of water.

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