Solar Water Disinfection

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1 in 4 people worldwide lack access to improved drinking water sources…

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Women and children spend hours of their day transporting water.

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2.4 Billion people lack access to basic sanitation.

Waterborne Illness: A Major Cause of Death

- Typhoid (bacteria)
- Cholera (bacteria)
- E. coli (bacteria)
- Amoebic Dysentery (protozoa)
- Giardia and Cryptosporidium (protozoa)
- Intestinal Worms (helminths)
- Polio (virus)
- Hepatitis A (virus)
- Calicivirus (virus)

2.2 million deaths each year…

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…9 out of 10 of them children

(World Health Report 2002, WHO)

Problem Statement

Current solar water disinfection devices are either too expensive for households in developing countries or inefficient in terms of transportability and disinfection time. Our goal is to design an **inexpensive** solar disinfection device that is **easily transported** in **bulk** to distribution sites, **quick** to **disinfect** water, and **easy to use** and **maintain** in the areas of need.

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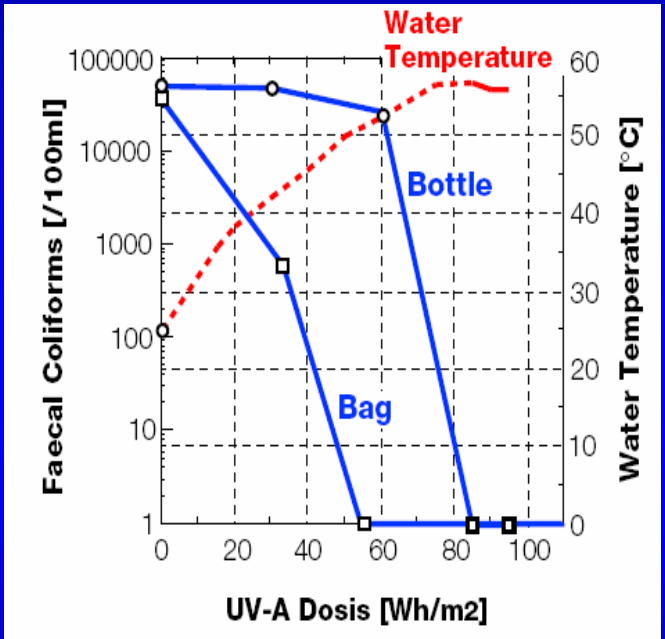
Why Solar?

*"Because of its **simplicity**, **low cost**, and the need for only beverage bottles and sunlight, solar disinfection is an **appropriate technology** for disinfection of household water in the developing world."*

-World Health Organization

Why bags?

- Thinner material for faster disinfection
- Water can expand over a larger area to catch more sun
- Collapsible for transportation in bulk
- Built-in black background to heat the water for full disinfection



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Higher treatment efficiencies can be achieved with plastic bags due to their larger area exposed to sunlight and smaller water depth.

-SODIS

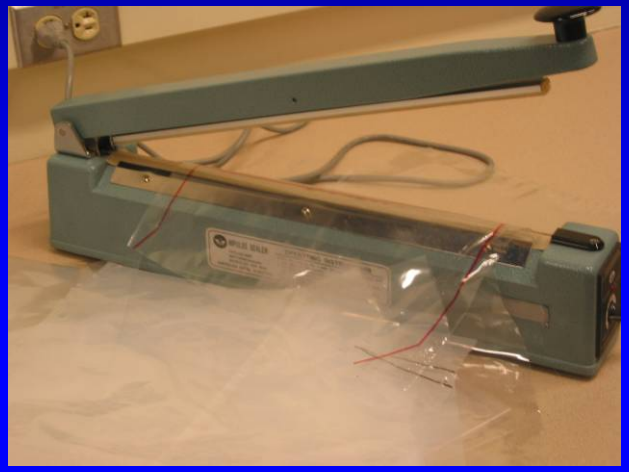
Design Specifications

- **Inexpensive for the user:** $1.2/family/year
- **Low Lifetime Cost:** 0.016 cents/ L disinfected
- **Quick to disinfect water**: ideally 20L/day
- **Easy to use:** 1 min/fill, 10 kg max weight (full), 0.5m max length when carrying
- **Optimal Thickness**: UV transmission v. durability
- **Easy to maintain:** No loose parts
- **Environmentally friendly:** Long-lasting (1-year), other uses

Simple Solutions

Work to date

- Material and design selection
- Water Quality Testing with various materials



- Two competing prototypes awaiting field testing
  - Screw Cap Design
  - Sewn Cloth Design

Screw Cap Design

Pro's

- Intuitive Spout
- Design mimics conventional water container
- Durability
- Simplicity of manufacture
- Locally available materials
- Adaptable Design

Con's

- More parts
- Additional cost

Cloth Bag Design

Pro's

- Bladder made from 1 solid section of polyethylene tubing
- Uses most of the plastic (minimal waste)
- No loose parts
- Protective cloth enclosure increases lifetime
- Cloth can be untied for washing/mending
- Cloth provides a dark background for efficiency

Con's

- More difficult to manufacture
- Requires some instruction to operate

Bladders (bags) made in a city or township where electricity is available.

Manufacture requires only…
- *polyethylene tubing*
- *heat sealer or grill*
- *scissors to cut out valves*
- *labor, packaging, etc.*

Bladders are shipped to a village

- *Hundreds of bags fit into 1 mailing envelope!*

Local entrepreneur sews cloth enclosures

- *fabric scraps traded for completed bags*
- *repairs and replacement bladders available locally*
- *enclosures can be custom-made*
  - Built for carrying depending on distance from home to water source
  - Culturally appropriate appearance
  - Multiple bladders for larger families

Looking to the Future…

- **Field Testing**
  - Senegal
  - Mexico
  - Zambia
- **Co-Creation in Zambia**
  - Feature high school student project
- **Reassess and Modify Prototype**
- **Look for Large-scale manufacture**

Timeline

- Summer 2005
  - Field testing in various sites
  - Co-creation in Zambia
- Fall 2005
  - Continued work on prototypes with feedback
- IAP 2006
  - D Lab trips
- Spring 2006
  - D Lab Spring Continuation
- Summer 2006
  - Anniversary of initial implementation
  - Search for manufacturers

A Better Life

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