

WATER EQUALS HEALTH; PASTEURIZATION WITH SOLAR COOKING

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ABSTRACT

This paper documents recent efforts by Solar Cookers International in identifying, and eliminating water borne pathogens by pasteurization. Inexpensive point source water testing demonstrates to indigenous people the pathogen problem. The CooKit, Solar Cookers International's low cost reflector oven, combined with the low cost Water Pasteurization Indicator (WAPI) demonstrate how at low temperatures, contaminated water can be pasteurized. Water testing after pasteurization shows potable drinking water.

Reducing the need for wood to cook meals, with its associated expense, CooKit's also provide more food for families, as well as reduce respiratory illness. A specific case study is illustrated.

Worldwide water borne pathogens statistics, and the simple experience on the installation of a sink to reduce disease are presented.

1. THE PROBLEM

Acute respiratory infection is the most common cause of death in children worldwide; about 2 million children die each year. Diarrheal diseases are the second-leading specific cause of mortality in children worldwide and claim approximately 1.6 to 2.5 million children each year, nearly all in developing countries (1). Poor sanitation, hygiene, and water quality account for the deaths of approximately 1.5 million children each year, mostly through diarrhea. The World Health Organization (WHO) estimates 1.1 billion children and adults drink unsafe water (2). "...for those in high-mortality developing regions, indoor smoke exposure is the fourth leading risk factor for disease (following underweight, unsafe sex, and unsafe water / sanitation) (3). These statistics show the importance of reducing both respiratory infection and water borne diseases.

2. THE SOLUTION

It has been known since the late 1880s, when Louis Pasteur conducted groundbreaking research on bacteria, that heat can kill pathogenic (disease-causing) microbes. Most people know that contaminated water can be made safe by boiling. What is not well known is that contaminated water can be pasteurized at temperatures well below boiling, as can milk, which is commonly pasteurized at 71°C (160°F) for 15 seconds (4). This low pasteurization temperature, as well as solar cooker temperatures is shown in Figure 1. The WAPI is currently being manufactured and sold in Nepal for less than \$0.70 US. It can be used repeatedly to indicate if water has reached and maintained pasteurization temperature.

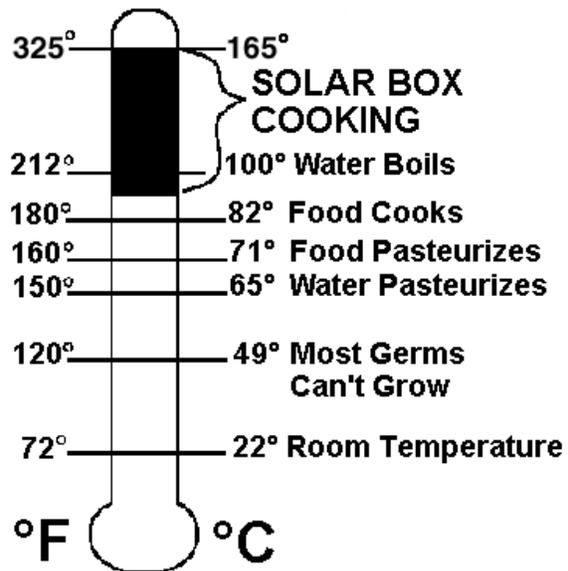


Fig. 1: Temperatures for pasteurization and solar cooking.

Solar Cookers International (SCI) has evolved a low cost, easily manufacturability solar oven called the CooKit. It is made from cardboard with a reflective surface; combined with a transparent oven bag, a black pot can cook most any

dish without smoke. These materials are available world wide, at minimal cost. The Cookit is shown in Figure 2.

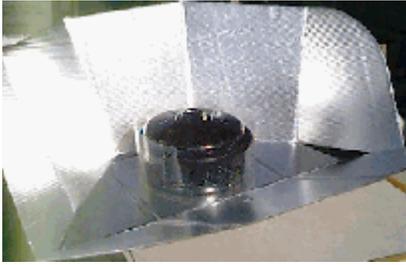


Fig. 2: The Cookit

Combined with the WAPI, the Cookit has the potential to reduce both respiratory infection and water borne diseases.

Solar Cooker's International's Bob Metcalf is a professional microbiologist who has been using simple water testing procedures to show African communities the problems of micro organisms in their drinking water supply. These microorganisms cause diarrheal diseases. After solar cooking and WAPI usage, the water is again tested and shown to be safe for drinking as shown in Figure 3. Simple awareness and step-by-step procedures are helping to spread the use of solar cookers for pasteurization.

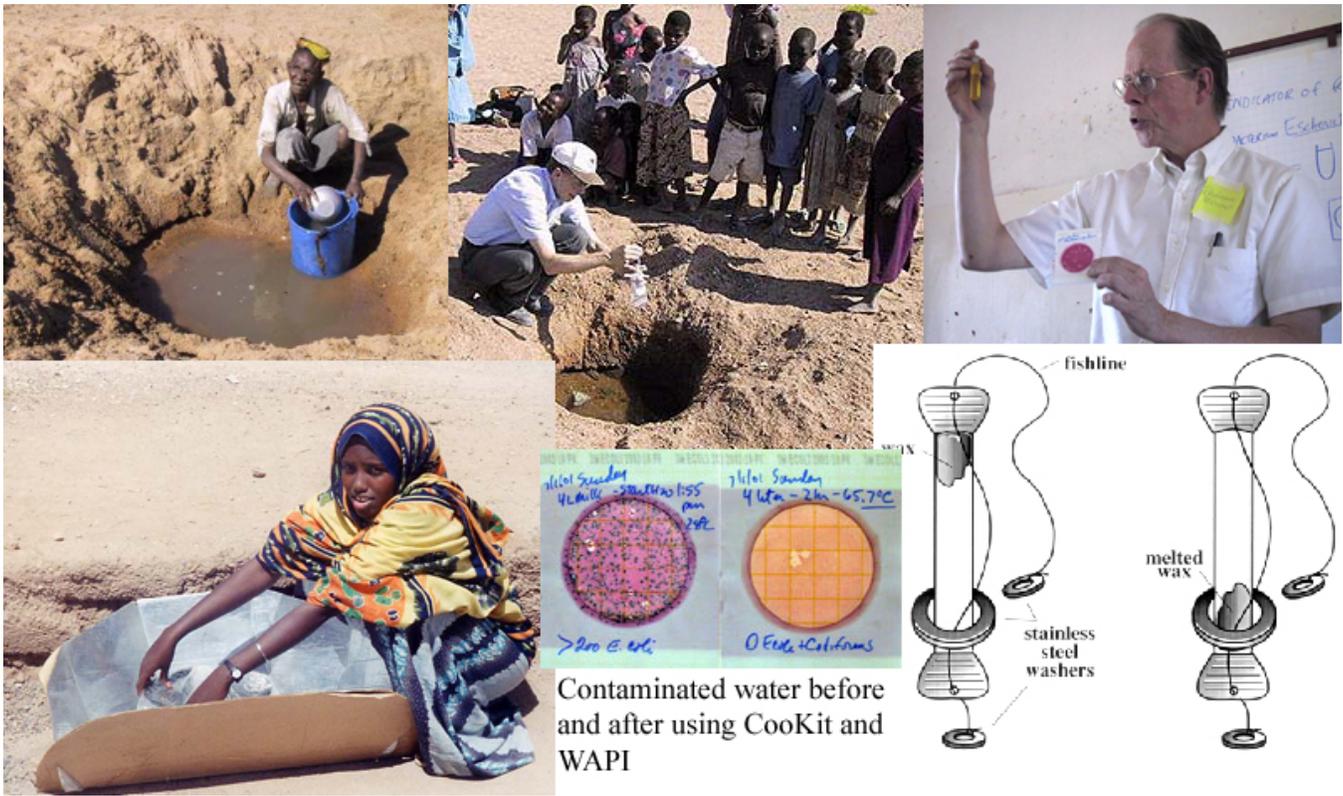


Fig. 3: Drinking water from well is tested and shown to be contaminated, the woman solar cooking pasteurizes the water, indicated by orange sample; WAPI diagram shows melted wax.

3. FUEL AND FOOD COSTS

Wood costs 10 shillings per wood bundle, 75 shillings per dollar, about \$19/month for an average family. Typically it is thin green wood, which does not cook well or last long. Charcoal is 30 shillings ~40 cents US. The amount of food equal to the cost of charcoal is a kilo of rice, or a cabbage and two onions, or 5 eggs, or five bananas, or a kilo of potatoes, or a loaf of bread and greens, or three ears of corn, or a kilo of maize to make ugali as shown in Figure 5.



Figure 5. Food equals charcoal, each portion costs the same as center charcoal.

A solar cooker has the ability to be used repeatedly, reducing the need for traditional fuels. Charcoal is made from wood. Whether it is charcoal, or wood, it is smoky and all turns to ashes after use. The collection of wood takes a lot of time, increasingly difficult because of scarcities, it is heavy, typically the responsibility of the woman in households.

4. HISTORY OF SOLAR COOKERS INTERNATIONAL

Barbara Kerr and Sherry Cole had solar cooking ideas in Arizona back in the early 1970s. In 1987 Bev Blum and friend Anne Funkhouser conceived the idea of Solar Cookers International. With the help of a dozen others, they began Solar Cookers International. The first headquarters was part of a room in an office house in Sacramento, the hub of the region in northern California where hundreds of people regularly cooked with cardboard solar box cookers developed by Barbara Kerr and Sherry Cole a decade earlier. Since then, SCI has been transforming people's lives by showing great cooked meals, steaming out of solar cookers, and sharing the technology worldwide.

More recently, SCI has established an office in Nairobi Kenya where Margaret Owino and local refugees train how to use solar cookers. CookKits can do serious cooking while helping to solve the fuel shortage problem in refugee camps.

SCI continues to spread the knowledge base of solar cooking throughout the world.



Figure 4. SCI artwork

5. SIMPLE SINKS

Yale University sponsors a program for United States physicians to work in a third world country for 2-6 weeks. Pediatricians Charles Erickson and Ty Dickerson were assigned to work at Livingstone General Hospital in Livingstone, Zambia. The hospital was built over 49 years ago for the British for their citizens, whereas a nearby hospital, Batoka was built for the native population. Since independence these government-sponsored hospitals have not been maintained. This is because resources are scarce in this country where the annual income per capita is around \$350 per year. The Bindi (children's) ward was recently refurbished, however there were neither screens on the windows nor sinks in the ward. Although there were 2 sinks nearby in the nursing station and treatment room, these were not convenient enough for parents and nurses to access them readily. Contagious gastrointestinal and other diseases are one of the commonest reasons for admission. Cross contamination is a common cause infection when hands are not washed between patient contacts.

Prior to leaving the US, \$500 was given to the pediatricians by a Rotarian Club to spend on a "humanitarian project". The project became the purchase and placement of sinks in the ward and in the kitchen where food was prepared and dishes washed. The hospital maintenance staff was able to install the sinks after purchasing them at a local supply store. The hospital staff was very grateful for this installation. Hopefully, if the caretakers utilize the sinks, the incidence of disease (nosocomial) will be reduced.

6. CONCLUSIONS

Using solar cookers to pasteurize drinking water can reduce water borne diseases and respiratory infection.

Solar CookKits can help families provide more food, instead of purchasing fuel for cooking. This reduces the burden of collection of wood, smoke from the burning and other dangers associated with fuel collection and use.

Whether it is the installation of a sink in hospital settings, or pasteurization of water at low temperatures, clean water equals health.

7. ACKNOWLEDGMENTS

Figures are courtesy of Solar Cookers International and Bob Metcalf.

8. REFERENCES

- (1) Kosek M, Bern C, Guerrant RL. The global burden of diarrheal disease, as estimated from studies published between 1992 and 2000. *Bull World Health Organ.* 2003;81(3):197-204
- (2) Meeting the MDG drinking water and sanitation target; a mid-term assessment of progress. WHO and UNICEF, 2004. Available at http://www.unicef.org/publications/who_unicef_watsan_midterm_rev.pdf Accessed November 12, 2004
- (3) *Pediatric annals*, October 2004, page 651, [Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJ; Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. *Lancet.* 2002;360(9343):1347-1360]
- (4) <http://solarcooking.org/newsletters/scrnov02.htm>