Weekly Highlight

Solar Water Pasteurization System

Water treatment in the developing world is a massive, complex problem. Staff investigated solar water pasteurization in the FY98 time frame as a potential niche market for solar products (Burch and Thomas, NREL/TP-550-23110; and Solar Energy Journal, Vol. 64, p. 87). The study concluded that the most viable solar pasteurization market was on the smallest scale: individual home or small home groups requiring under ~50 gal/day. The study compared pasteurization to alternative home-scale technologies, and hypothesized that required system costs might be acheivable with low-cost polymer collectors. The program conclusion was that suitable polymer materials and collectors should be developed and tested for durability first, before applying low-cost polymer technology to a niche market like water pasteurization. One of the consumers of the study was the development team at Solar Solutions, Inc. (SSI), in San Diego, CA. SSI has cited the NREL study as providing the technical motivation for their development. The SSI development work has been funded privately.

The SSI product is shown in Figure 1 below. It is basically a 1.4 ft^2 "batch" system, using solar to heat about 1.3 gallons of water up to pasteurization temperatures, indicated by melting of a 70 ^oC wax. The outer layers are constructed of UV-protected polymer films. Impulse heat sealing- a low-cost, low-tech technique- is used to seal the various layers. A convection gap is maintained by "bubble pack" material. A cylinder containing wax melting at 70C indicates when the process is completed and another cycle may begin. Up to 4 pasteurization cycles per day can be done. The system currently sells in the US for under $20, and SSI states the system could be manufactured abroad under $1 per unit. Assuming a de-rated daily production of three gallons (to account for cloudiness) and a product lifetime of 5 years (probably conservative), the cost/m^3 of treated water is displayed in Figure 2 as function of product initial cost. Discount rate was set to zero for this short lifetime. When compared to "batch chlorine" (basically adding bleach to water) on strictly cost basis, the unit should cost under ~$2. Similarly, compared to a home UV-PV-filter system, the unit should cost under $13. It should be remembered that other considerations are crucial for 3rd world application; a major advantage of solar pasteurization is its simplicity: no chemicals to run out, no lights to burn out, and no electronics to fail. NREL will place the product's glazing and absorber materials under accelerated testing, increasing the program's database of glazing and absorber materials for later products designed for U.S. use. SSI is planning to proceed through NGOs and other paths to develop manufacturing facilities in the 3rd world.

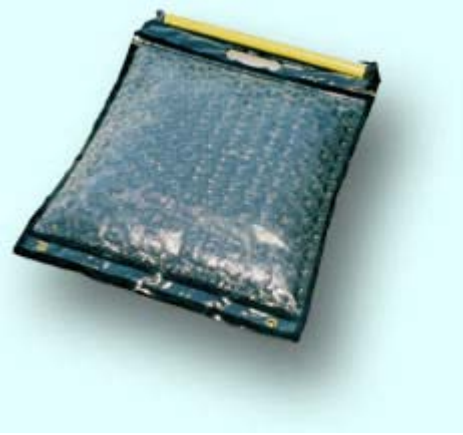

Figure 1. Solar Solutions, Inc. AquaPak solar water pasteurization system. The system aperture is ~14 in. square. The bubble-pack insulation on the top surface is discernible.

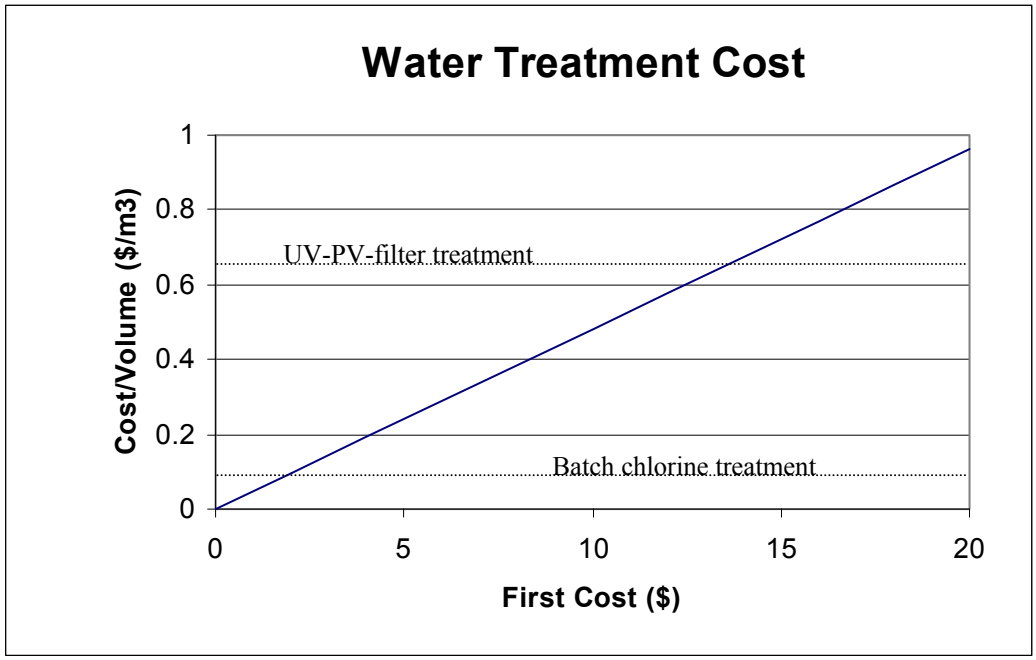

Figure 2. Water treatment cost ($/m^3) is shown as a function of the SSI AquaPak first cost. For economic comparison, batch chlorine cost and UV-PV-filter cost are shown as labeled, dashed lines.