Experimental Use of Recycled Materials to Construct a Solar Water Heater

An investigation into custom made solar water heater collectors was conducted to compare a current design and to determine if there are possible improvements to the system. The second aim of this research is to examine designs for solar water heaters that are both cost effective, use recycled materials and fictional, thus reducing the cost and making solar power available to most residential home owners. In examining available drawings many differing designs of solar water heater construction are addressed. The selection of a system designed in Brazil by Mr. Alano (2014) that incorporates the above criteria was selected for comparisons to variations of the system in an attempt to improve the efficiency of the original design. The systems incorporate household recyclable materials that are redirected in an alternative manner to form a solar hot water heater.

In Mr. Alano’s design utilizes tetra pack cartons (common milk cartons) which contain a limited amount of aluminum (5%) and the other 95% is polyethylene and cellulose material is incorporated to absorb heat for transfer to the water running through CPVC pipe (Alano 2014) (see Figures 1 and 2). Current literature indicates that Mr. Alano’s system heats the water to 52 degrees Celsius (125.5 degrees Fahrenheit) (Alano 2014). In the experiments conducted for this article, PET bottles and aluminum cans are used; as glazing and absorber plate, respectively, termed a “Solar Tube” (see Figure 3). Two test collectors were constructed for the implicit purpose of comparing their ability to transfer heat and to determine if the variations improved the efficiency, compared to each other and the original design. Data was collected at the top of the hour every hour throughout the day. The results indicate that the variations of the original design significantly improved the efficiency level.

Two differing support backgrounds were tested (there is no support structure for the original design). The first consisted of a plywood frame painted white, while the second test collector background was covered in aluminum to attempt to increase the reflection to capture heat on the reverse side of the collector tubes. For each of the two backgrounds one solar tube was constructed using only a 1/2” CPVC pipe painted a matte black and a second tube that includes aluminum cans for the collector plate, also painted matte black (see Figure 4). The selected piping material of CPVC pipe was shown to be as effective as other possible selections at a low cost and ease of use (Patterson & Miern, 2009). The placing of the absorber system on different backgrounds is to take advantage of the reflecting energy, creating a 360 collection system. The expected results will show that the temperatures are increased, while keeping the cost of the collector at an affordable price and ecologically friendly. Descriptive statistics are used to examine the differences between the varying systems.

References


Figure 1: Current Installed System (Alano 2014)
Figure 2: Close up of PET bottles and tetra packaging collection plate (Alano 2014)

Figure 3: Close-up of Unpainted Solar Tube
Figure 4: Experimental Frame and Set-up