

EFFECTIVENESS OF POLY-MART SUNSHIELD® COLORED TANKS RELATIVE TO WATER TEMPERATURE AND LIGHT INFILTRATION

With the growing popularity and use of rainwater harvesting systems, more people are installing tanks, cisterns, and rain barrels as a means to store water for use in their home landscapes and for drinking water supplies. Rainwater is only as clean as the methods used to capture and convey it into your catchment system. Quality of the water being stored is of the utmost importance, especially when it comes to utilizing captured rainwater for potables uses. Rainwater harvesting systems put the users in charge of their supply, so they are also responsible for water quality.

The goal of this study was to determine the effect that water storage container color and the added benefits of black colored tank layers have on light penetration and water temperature. Various colored tanks are available for commercial water storage containers but little is known on the effects color has on water temperature and light penetration or if black lined tanks have a benefit.

MATERIALS AND METHODS

To achieve the goal of this study, water temperature and light penetration within the containers were measured to show its variability given color of container.

Storage Tanks

The rainwater harvesting storage tanks used for this research were Poly-Mart 100 gallon high density polyethylene plastic containers in white, green, light brown and black. In addition, a replication of the same 4 colored tanks, these with an interior layer of black molded plastic were used to test its effectiveness for controlling temperature and light penetration.

Experimental Design

The tanks were randomized and placed in full sun conditions to allow for the most light penetration possible and were spaced three feet apart to prevent shading effects from neighboring tanks. The tanks were filled with rainwater collected from a composite roof and filtered through a traditional micron basket filter..

Instrumentation and Data Collection

To measure the water temperature and light penetration inside the storage tanks, HOBO Pendant Light/Temp data loggers were used. The devices were tied to the lid of the storage container utilizing plastic wrapped wire and submerged to a depth of 24 inches into the tank. This depth was chosen for a better representation of total water volume temperature and not variation, due to the potential for higher temperatures at the surface of the tanks. Once installed, the lids were screwed closed.

Data Collection

The HOBO data loggers record data every minute. The experiment lasted from June 2, 2014 to September 1, 2014, the hottest months of the year. Data was transferred from the data loggers to the computer every two weeks to make sure the equipment was working properly and for data storage space. Data was transferred and compiled using XYZ. Weather data from the same time period was collected via an onsite weather station operated by the AgriLife Dallas Center.

RESULTS AND DISCUSSION

The experiment was set up to test the effectiveness of Poly-Mart SunShield® Rainwater Harvesting Tanks versus their conventional colored alternatives. The experiment was designed to collect water temperatures as well as light infiltration into the Rainwater Harvesting Tanks at full sunlight conditions.

Effect of Container Color on Water Temperature

As may be expected, the darker the outside color of the Rainwater Harvesting Tank, the higher the internal water temperature. Overall, the greatest difference was between the green tank without a black liner and the white barrel with the black liner. Their mean difference was 7.1 °F. The white lined with black and only white tanks had the overall lowest temperatures, whereas the green and black tanks without liners had the overall highest temperatures.

Table 1. Mean, Max and Min temperatures in 100 gallon tanks

	Black-w/o liner	Brown-w/o liner	Green-w/o liner	White-w/o liner	Brown-w/liner	Green-w/liner	White-w/liner
mean	93.89	92.75	97.04	92.17	94.21	92.74	89.94
max	113.36	110.05	118.92	108.96	113.81	111.14	104.54
min	70.65	68.59	70.14	70.31	71.00	70.31	70.48

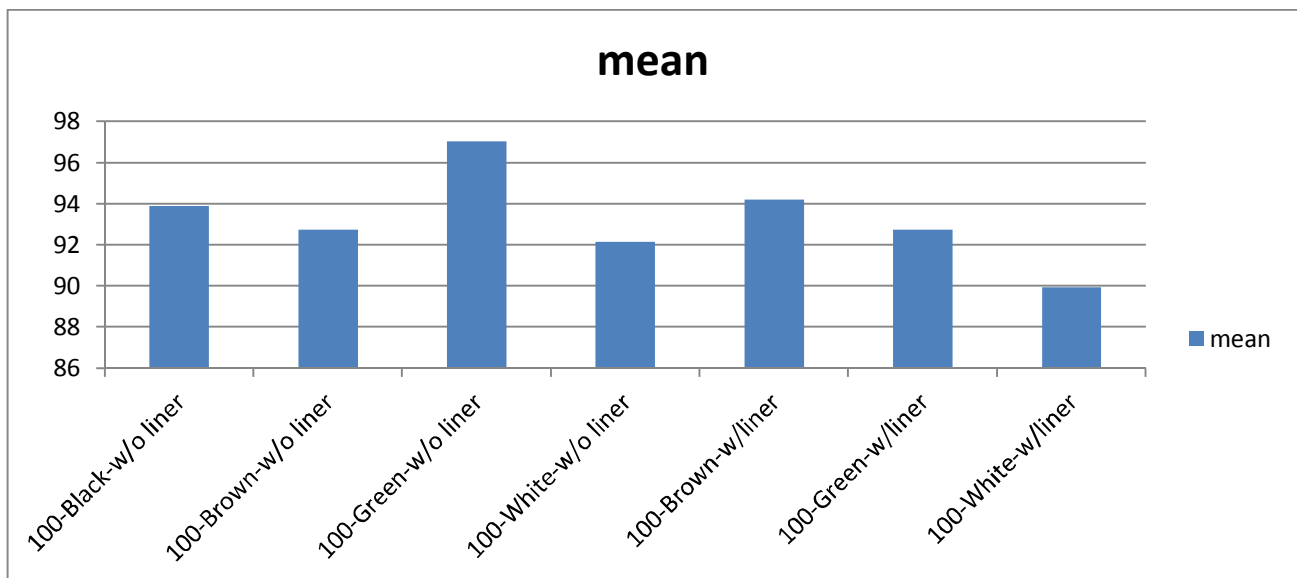


Figure 1. Mean water temperature in 100 gallon tanks

To show the differences visually, the daily high temperatures of each treatment were calculated from the data collected and graphed over the 12 week study. This is shown in figure 2 below. As you can see, water temperature in the tank followed daily temperatures fairly well in relation to a common trend line.

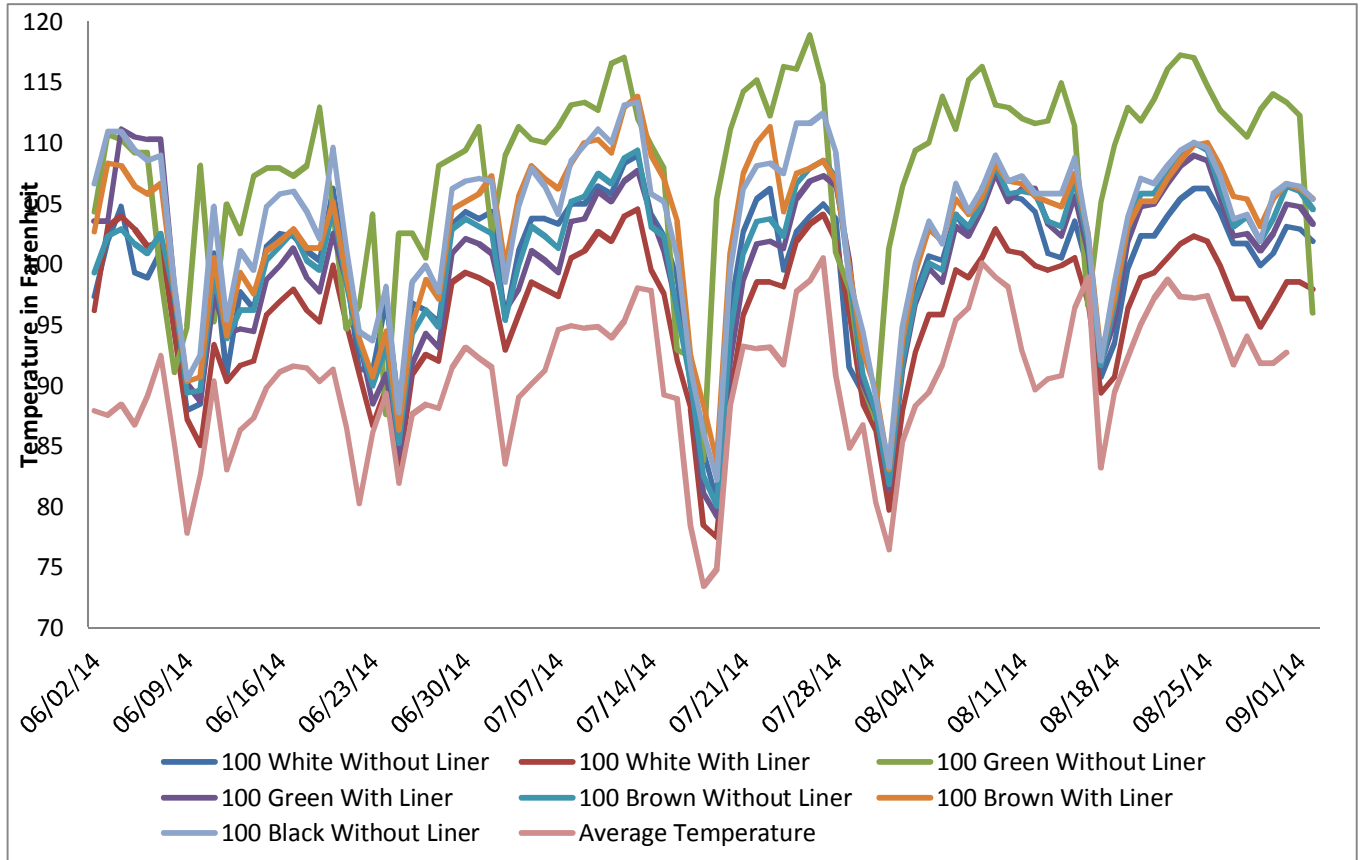


Figure 2. Daily high temperatures of 100 gallon tanks.

Effect of Container Color on Water Temperature

As you may expect, there is an opposite relationship with color of tank and light penetration. The lighter the tanks color, the higher the penetration of light. The white unlined tank had the greatest amount of light penetration, followed by the brown unlined tank and then the green unlined tanks. The black tank and all of the colored tanks with black liners had zero light penetration.

Table 2. Mean, Max and Min Light penetration in 100 gallon tanks

	Black-w/o liner	Brown-w/liner	Brown-w/o liner	Green-w/liner	Green-w/o liner	White-w/liner	White-w/o liner
Mean	0.00	0.00	17.39	0.00	9.59	0.00	341.61
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max	0.00	0.00	121.00	0.00	82.00	0.00	2560.00

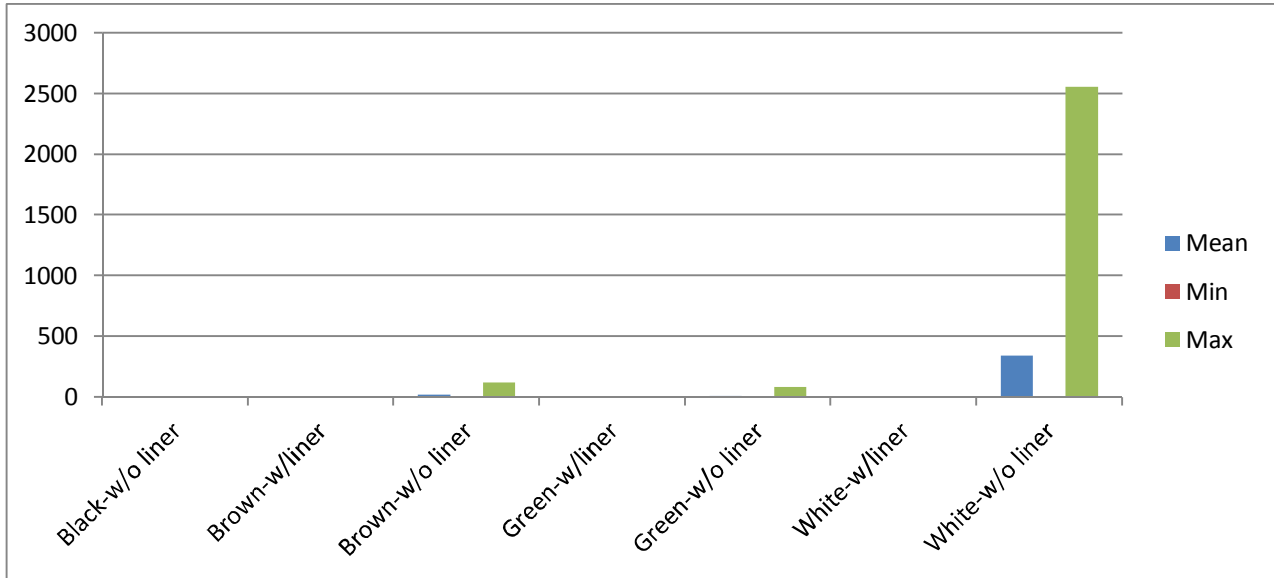


Figure 3. Mean light penetration in 100 gallon tanks

To show the differences visually, the daily high light penetration amounts of each treatment were calculated from the data collected and graphed over the 12 week study. This is shown in figure 2 below.

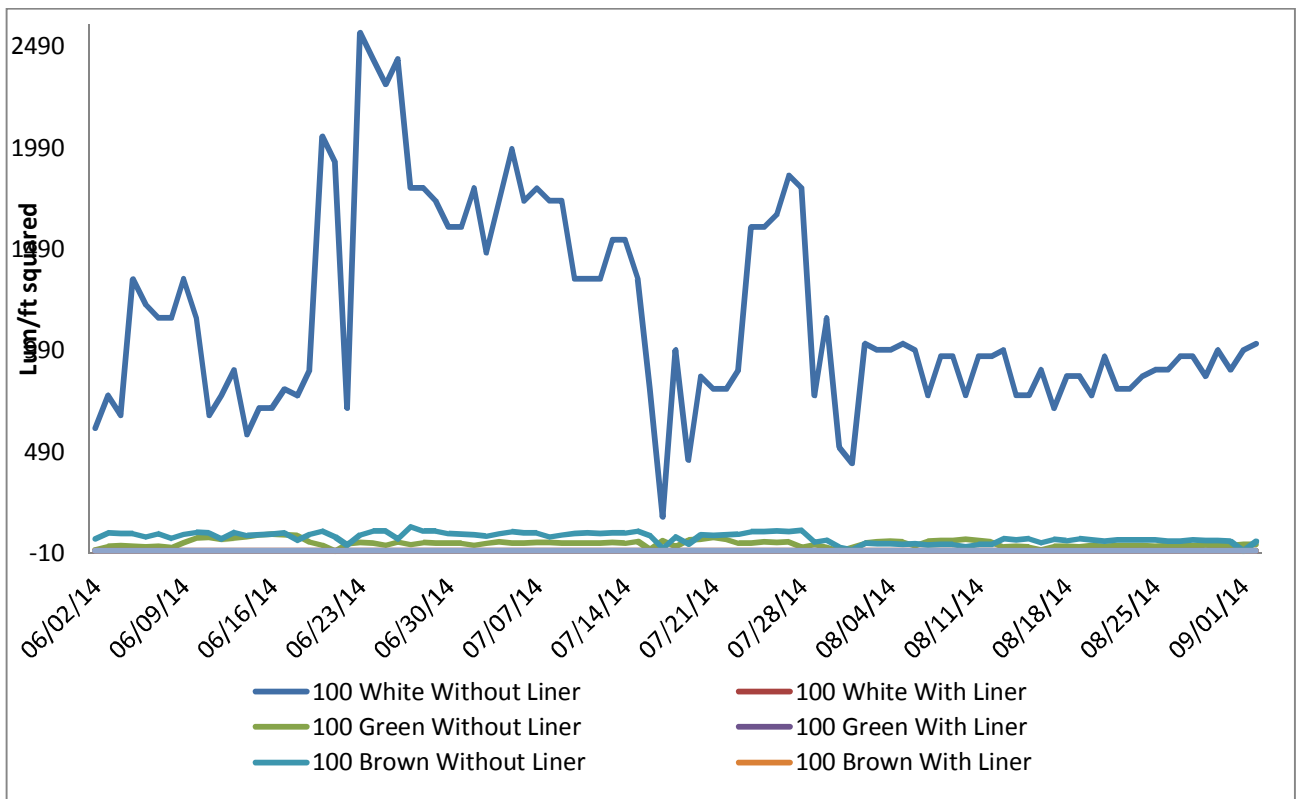


Figure 4. Daily high light penetration in 100 gallon tanks

CONCLUSION

Poly-Mart black lined colored tanks are 100% effective in reducing light penetration into rainwater harvesting cisterns. Black lined tanks coupled with light outside colors keep water within the tank cooler than dark colored tanks alone.

This study was conducted by the Urban Water Team located at the
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in cooperating with Poly-Mart, Inc.

Urban Water Team - Dallas

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