Performance Evaluation of Chameleon 60 Atmospheric Water Generator

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Introduction:

Upon request from Drinkable Air Technologies for equipment evaluation, a performance test was conducted at the Southern University campus from June to August 2011. The major goal of the company is to improve our environment through the use of new technologies at affordable prices. Hence, the company designed and developed the Atmospheric water generator (AWG) Chameleon 60 which generates water from the humidity in the air, condensed, processed and purified to become clean drinkable water. This environmental friendly method of water supply has great potential to serve as an alternative method of water supply for humans as well as for animals and plants provided it is cost-effective compared with other sources of water generators.

According to the company engineer, Chameleon 60 has superior air flow design combined with large surface area at the evaporator coil that helps produce more clean water than any other AWG of comparable size. Moreover, the enviroGuard system of the AWG eliminate bacteria and purifies the water with an ozone process which oxygenates the water. The process keeps the water pure, fresh and drinkable at all times (Company report). The potential utilization of the AWG will not be limited to US municipalities, business and residential areas. It will have high international demand particularly in developing countries with scarce water supply and during humanitarian relief situations.

This study is limited to quality and quantity of water production and does not include mechanical and electrical issues that affect the equipment reliability. The objective of the study is to perform equipment performance test on AWG Chameleon 60 with respect to quantity and quality of water produced and electric usage in terms of KWH consumed.

Methodology of testing the atmospheric water generator:

Performance test of Chameleon 60, AWG was carried out in Baton Rouge at the Southern University campus. The unit was delivered by Drinkable Air Technologies (DAT) to Southern University Agricultural Research and Extension Center (SUAREC) on June 6, 2011. According to DAT, the size of the unit is 45x29x32 inches and is powered by electric supply of 208-230V/1Ph/60Hz (Fig. 1).

The equipment was placed on level concrete blocks and was connected to 220 volts electrical box and meter to measure the electric usage (KWH) for water production. Volume of water produced and KWH consumed was measured at different intervals (5 min, one hour, 12 hours and 24 hours). Daily hourly temperature and relative humidity were obtained from the Southern University weather station located approximately 300 ft away from the equipment. Water was collected in a graduated cylinder and 5 gal containers. For water quality analysis
filtered and unfiltered water was collected and is being analyzed in a laboratory. Hence, this report will not include the results of water quality analysis.

Fig. 1. Chameleon 60 Atmospheric water generator that was tested for its water production at the Southern University Baton Rouge campus.

Test Results

As expected it was found that relative humidity and temperature are the critical factors that affect production of atmospheric water. The humidity varied with day and night and the minimum was 53% and maximum 99% for the duration of the test. The temperature range during the test period was 73-96 °F. The average temperature and humidity during the test period was 85 °F and 77%, respectively. A typical temperature and humidity distribution is shown in Fig. 2. Relative humidity increased with decrease of temperature and lowest humidity was recorded in the afternoon at about 4:00 pm. The highest humidity is early in the morning at about 5:00 am. The humidity generally increases after sunset and the unit is more efficient when operated by night than day time. It was not possible to operate the machine at lower humidity than 53% due to the fact that Baton Rouge average humidity in summer is over 50%.
Water production varied from 1.98 to 4.45 gal/hr and the average electric usage per hour was 6 KWH. Clouds and rain significantly influenced the temperature, humidity and water production. Almost instantly the parameters change and water production increases with decrease of temperature and increase of humidity. Under Baton Rouge weather conditions the average water production per day was 77 gal and electric usage was 147 KWH. The water production during 24 hour operation is shown in Fig. 3. Highest water production was obtained at around 5:00 to 6:00 am when temperature was the lowest and relative humidity the highest.
The relationship of temperature, relative humidity and water production is shown in Figs. 4 and 5. Linear prediction equations were developed and the relationship gave high $R^2$, indicating a significant relationship of water production vs. relative humidity as well as production vs. temperature. Correlation between water production and humidity was 0.89, indicating a positive and significant correlation between the two variables. In general, it was found that relative humidity is the critical factor affecting production of atmospheric water. The advantage of this study gives an opportunity to make further research that could integrate the unit with solar panels or wind turbine to harvest water for drinking as well as for watering gardens. We believe that by using solar panels and AWG, plants can be grown with no need of rainfall.

Fig. 4. The relationship between relative humidity and water production by atmospheric water generator.
Summary

This report focuses on the performance evaluation of the Atmospheric Water Generator, Chameleon 60. The machine was rigorously tested and evaluated based on its water production capacity and electrical usage. Several additional improvements were made to the equipment during the course of the test. For the period between June and August, the AWG, Chameleon 60 has the capacity to produce up to 77 gallon of water in 24 hours under Baton Rouge weather conditions. Because of lower temperature and higher humidity at night time, the unit produces more water efficiently at night than day time. It was not possible to test the unit at lower humidity than 53%. Hence, it is recommended that it is tested at lower humidity regions as well. Mathematical models that predict the water production as a function of humidity and temperature were developed. As this way of atmospheric water harvesting has great potential for wide agricultural use, all research efforts will be made to explore other sources of energy besides electrical power to run the machine.