Construction of Water Purifying Device

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Abstract

The consumption of non-purified water in almost all rural and parts of urban settlement have been an issue to human health and in some cases result to death among the infants and adults. Water is essential to human life but naturally not pure for human consumption due to the concentration of particulate matters including suspended particles, parasites, bacteria, algae, viruses, fungi and a range of dissolved materials derived from the surface that the water may have made contact with. Artificial means have been adopted by man to eliminate the influence of this foreign body from water to make it safe for consumption. However, the intake of chemical has an advance influence on a man. For example chlorine has a bleaching action. In an effort to seek for means of substituting for the use of artificial means for purifying water, the abundant solar energy was exploited. This paper therefore focused at construction of a simple water-purifying device by using solar energy. In constructing these devices local materials were used and were powered by natural sources of energy (solar energy).The constructed device was used and tested with room temperature of about 305^{0}k then after exposing it to the solar energy the temperature roused to about 360^{0}k after some hours. The research work ended by making suggestions for more research work on the project.

Keywords: *water, purification, solar energy, heat and temperature*

1. Introduction

As the adage goes “necessity is the mother of invention” so it is with the current needs of Nigerians to develop technological goods that would improve on the economics needs of the nation and make the youth industrious .The national policy on education (2009) revised edition seeks the educational system to revitalize the study of science from its non-functional status to functional status where results could be translated into goods and services so as to improve on the existing technologies. To this end it is inherent that Nigeria needs orientation on how to use the available recourses both artificial and natural to reduce the excessive dependences on importation of finished goods. At recent, the consumption of non-purified water in almost all rural and part of urban areas is an issue of concern causing danger to the human life. The country in-spite of it being in tropical region of the world had be backward in developing technological goods that would sustain its economy and the youth through exploitation of the available natural recourses like the radiant sun energy for use. The country has been depending on imported machineries and equipments, these massive importations of foreign technologies have left the citizens to be practicing repairs and non fabrications of goods. It is therefore of importance to re-emphasize on the negative consequences

on the country and the youth on importation of these finished goods and seek indulgence that the university system provide some form of functional education to bring out potentialities of individual through using available materials and the natural solar energy for constructing functional easy-reached goods. This paper therefore wishes to present a constructed water purifying device constructed from simple available materials and the principal energy source being the sun.

2. Literaterature

"We no longer suffer from stomach illness that's because the water is clean and safe" like many other people in rural African with no access to safe drinking water she used to sterilize her water by boiling it. But she says the smoke from the firewood to heat the water use to irritate her eyes. She is also glad she no longer has to go to fetch wood from the bush. Mrs Longwa 2006 says, "I fill the plastic bottles, put them on black painted roof where they stay for a whole day". The sun heats the water, helped by the black roof, which help to absorb the heat. Solar radiation means a combination of ultra-violet rays and heat destroys the bacteria which cause common water-borne diseases like cholera, typhoid, dysentery and diarrhea. After eight hours in the sun, it is ready for drinking. According to World Health Organization 2007 1.1 billion people lack access to an improve drinking water supply, 88 percent of the 4 billion annual cases of diarrheal disease are attributed to unsafe water and inadequate sanitation and hygiene, and 1.8 million people die from diarrheal diseases each year. The WHO estimates that 94 percent of these diarrheal cases are preventable through modifications to the environment, including access to safe water. Simple techniques for treating water at home, such as chlorination, filtration, filters, and solar disinfection, and storing it in safe containers could save a huge number of lives each year.

According to wilderness medical society, water temperatures above 160^0F (70^0C) kill all pathogens within 30 minutes and above 185^0F (85^0C) within a few minutes. So in the time it takes for the water to reach the boiling point 212^0F or (100^0C) from 160^0F (70^0C) all pathogens will be killed even at high altitude. According to professor G Kang 2005 solar disinfection of water is an inexpensive, effective and acceptable method of increasing water safety in a resource limited environment, and can significantly decrease diarrhoeal morbidity in children. The second law of thermodynamics explains as indicated by gibbs (2007) that in "all heat engines energy is taken in as high grade energy and only some of it is converted to useful work, the remaining being emitted as low grade energy at a lower temperature". This explanation was supported as a world-wide view as explained that heat effect is observed by increase or decrease in temperature and by this work the constructed item would be expected to have a change in temperature from T_1 as the initial temperature of the water to T_2, as the final temperature when it has been exposed to sun light for some time.

According to Jerry A. Nethanson 2003 water has a remarkable tendency to dissolve other substances. Because of this, it is rarely found in nature in a pure condition. Temperature plays a more important role in wastewater treatment and water pollution control. Biological wastewater treatment systems are more efficient at higher temperature. He also said one problem with chlorination of water supplies is that the chlorine can react with organics in the water, forming toxic compounds. The toxic compounds are cancer causing substances. Prof R. C Sachdeva 2007, convection boiling may occur when a liquid is forced through a channel or over a surface which is maintained at a temperature higher than the saturation temperature of the liquid. The mechanism and hydronamics of flow boiling are much more complex than in pool boiling because the bubble growth and separation are strongly affected by the flow velocity. The flow boiling is a two-phase mixture of the liquid and its vapor.

3. Method of Constructing a Water Purifing Device

The materials needed for the construction of the device includes; a metal box, wooden box, two

rubber reservoir tanks, cupper pipes, metal sheet, pane of glass, black paint and converging lens. One hole was drilled at the top of the metal box which is the inlet and one near the bottom which is the outlet. The reservoir supplying water to the purifying device and the metal box were painted black to enhance the absorption and retention of heat. The cupper pipe was run from the inlet to the outlet. The collector plate was painted black and placed flat on the copper pipe. The whole set up was placed inside a wooden box to prevent loss of heat to the surrounding. A pane of glass was placed on the top to focus sun rays on the heater and trap all the infrared radiation. A converging lens was placed on its holder attached to the box to converge the sun rays on the constructed device. The lens was adjusted regularly due to the changes in the direction of the sun rays. Water from the supplying reservoir whose temperature was determined as initial was allowed to flow through the inlet and hot water was received at the outlet. The experiment was repeated for three days and the average values of the initial temperature, the final temperature of the water and its time of exposure to the solar energy were recorded.

4. Summary of Readings Taken with the Constructed Device

Initial Temperature T_1 (^{0}K)	Final Temperature T_2 (^{0}K)	Time (GMT)
305	307	9
305	313	10
305	333	11
305	353	12
305	360	13
305	358	14
305	356	15
305	343	16

5. Discussion

The solar device was designed in such a way that it would trap the solar energy from the sun so that it could be used to purify the water. The experiment was repeated for three days. The average temperatures and time were recorded. It was found that the temperature of water at the constructed device increased with time to a maximum of 360^0K at 13GMT and decreased to 343^0K at 16GMT. From such readings it was confirmed that really heat could cause the temperature of substances to rise as described by Fullick (2002). Graph of temperature verses time was plotted. From the graph it was observed that the temperature of the heater increased as time increased but declined towards the evening. The solar panel absorbs the infrared rays from the sun which is converted to heat which the water at room temperature absorbed to produce hot water. It was also observed that this process can work only in the presence of sufficient sunshine. This experiment was performed April/May 2013 when the sun intensity was very high in Potiskum, Yobe State.

6. Conclusion

A water purifying device was successfully designed from local materials and a reasonable hot water that was capable of destroying micro organism that would have been infiltrated into the body of the water was produced.

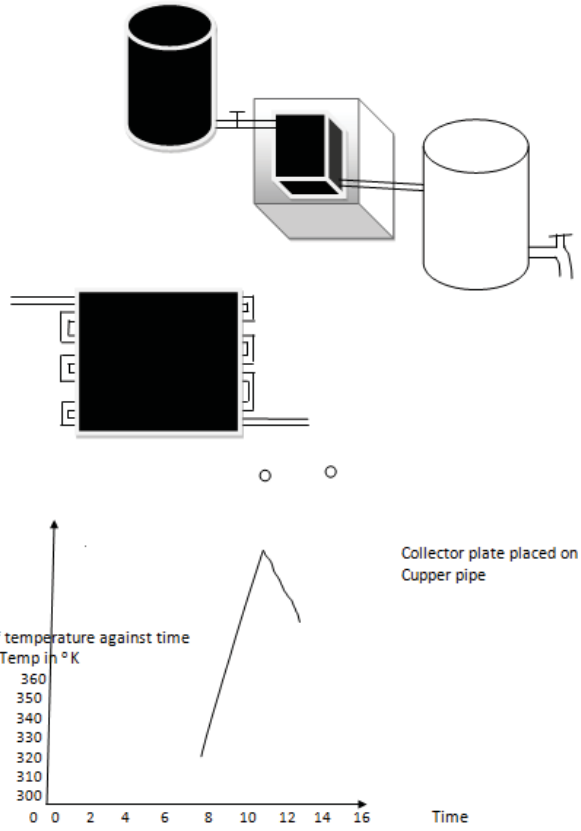
7. Recommendations

The following recommendations should be ad held to, to make the research work more perfect.

- Method of storing heat for days when the sun intensity is low or when there is no sun should be research on.
- Effort should be made to make the water to rotate between the supplying reservoir and the heating device before channeled to the consumption reservoir to improve the

temperature of the water.

- Every effort should be made to improve the water temperature more than 360^0K.
- The number of running copper pipes should be increase to improve the temperature of water going into the consumption reservoir
- This constructed device could be used to replace the water reservoir mounted by the borehole sinkers in the urban and rural area of the country Nigeria.



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