SOLAR DESALINATION BY USING PHASE CHANGING MATERIAL

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ABSTRACT

Water is the most important element for sustaining life on earth. There is an important need for clean, pure drinking water in many developing countries. There are many coastal locations where seawater is abundant but portable water is not available. Often Water sources are brackish which contain dissolved salts or contain harmful bacteria. So purification of water is very important. For this purpose, a plant which can convert brackish water into portable water by using solar energy has been proposed and analyzed. A solar still has been developed for purifying water. It is simple and effective method to get purified water in a cost effective manner. Solar still effectively eliminate all water borne pathogens, salts, and heavy metals. This benefits the users by reducing health problems associated with water-borne diseases. The TDS ,pH, Hardness and density of water samples are tested before and after the distillation. Solar desalination by using phase changing material this process utilizes minimum amount of energy to produce potable water and this process is completely ecofriendly it also utilizes minimum area for installation.

Keywords: *Solar Still, Solar Energy, Desalination, Phase Changing Material.*

1. Introduction

Today water demand is increasing continuously because of the industrial development ,intensified agriculture, improvement in standard of life and increase in the world population. Earth's composition consists of 97.5% of water is regarded as the sea water and the 1-2% is available for domestic's usage .According to the World Health Organization(WHO),it is necessary for person to have a minimum water consumption of 15-20 L for the basic needs.

About 70% of the planet is covered in water, yet of all that, only round 2% is fresh water, and of that 2%,about 1.6% is locked up in polar ice caps and glaciers. So of all the earth's water,98% is salt water, 1.6% is polar ice caps and glaciers, and 0.4% is drinkable water from underground wells or rivers and streams.

The scarcity of water occurs in the under developed areas or villages. In order to solve this problem, some new drinking water sources should be discovered and new water desalination techniques be developed. In recent years, desalination of salt water has been one of the effective methods followed in many countries.

1.2 About solar energy

Solar energy is a very large energy, inexhaustible source of energy. The power from the sun intercepted by the earth is approximately 1.8×10^{11} MW, which is many thousand times larger than present all commercial energy consumption rate on the earth. Thus in principle, solar energy could supply all the present and future energy needs of the world on a continuous basis. This makes it one of the most promising of all the unconventional energy sources.

The sun radiates the energy uniformly in all direction in the form of electromagnetic waves. When absorbed by body, it increases its temperature. It is a clean, inexhaustible, abundantly and universally available renewable energy, solar energy has the greatest potential of all the sources of renewable energy and if only a small amount of this form of energy could be used, it will be one of the most important supplies of energy, especially when other sources in the country have depleted.

This solution is solar water distillation. It is not a new process, but it has not received the attention that it deserves. Perhaps this is because it is such a low- tech and flexible solution to water problems. Nearly anyone is capable of building a still and providing themselves with completely pure water from very questionable sources. 3.8x1024 joules of solar radiation is absorbed by earth and atmosphere per year. Solar power where sun hits atmosphere is 1017 watts and the total demand is 1013 watts. Therefore, the sun gives us 1000 times more power than we need. If we can use 5% of this energy, it will be 50 times what the world will require.

1.3 About Phase changing material

Material that are capable of storing latent heat at the time of the phase transition are known as Phase Changing Material (PCM). PCM have much higher thermal energy storage capability than the sensible heat storage medium. These materials are very suitable in heat absorption or release of energy by undergoing a change of phase.

A PCM usually absorbs and release the thermal energy so as to balance a specified temperature. Whenever a PCM is in its solid phase it will absorb heat from the surrounding temperature and the surrounding temperature will decrease. The temperature of the PCM equalizes the external surrounding temperature till it reaches its melting temperature. When such phenomenon occurs the PCM starts to melt i.e. the phase alteration process the PCM absorbs large amount of hotness without any variation in the temperature. The reversible process of the same takes place as the surrounding external temperature cools down. Now, at this phase the PCM remains in its liquified form releases its absorbed heat. In this process the PCM again changes its phase from liquid to solid leaving behind a warm effect.

2. Principle of Desalination

Desalination is one of the most important methods of getting potable water from brackish and sea water by using the free energy supply from the sun. In nature, solar desalination produces rain when solar radiation is absorbed by the sea and causes water to evaporate. The evaporated water rises above the earth's surface and is moved by the wind. Once this vapor cools down to its dew point, condensation occurs, and the fresh water comes down as rain.

3. Materials and Working process

3.1 Materials used:

a. Wood: It is used as insulator which does not allow the heat to pass out. Ply wood of 12mm thick is used for the setup.

b. Phase changing material: It has the ability to absorb the heat in the day time and liberate that heat during night time. The main purpose of using PCM is to increase the yield of fresh water.

c. Aluminum sheet: It is placed above the PCM and water is fed on top of the sheet. It absorbs more amount of heat and transfer it to both water and PCM. Sheet of 2mm thick is used.

d. Glass: The main purpose of using glass is that it condenses the water vapor.This glass is tilted to an angle so that maximum solar radiations can pass through it.

3.2 Working process

The main objective of this method is to purify brackish water and to obtain portable water with the help of solar energy. Outer tray is made of wooden tray, as per the dimensions by cutting and then joining. Initially In this process project we are using direct method of solar desalination , where the salt water is evaporated and condensed to obtain the potable water. The brackish water is passed to the closed system with a constant flow rate of water. We are going to use phase changing material above the aluminum sheet which is placed just above the wood. when the temperature reaches the melting point of phase changing material and it gets heated up. During this time the PCM stores energy and this energy will be lost based on the insulation system. Due to this, the water evaporates and is condensed vapor flow down gradually along with the glass. As the salt solution in the system increases, it has to be taken out of the system. This process repeats from morning to evening. The vapor which is collected from the glass is collected through pipes and are portable.

4. Conclusion

By survey we concluded that the water plays a very important role in everyone's life. As on today on the basis of the review we know that water pollution has reached the critical situation. Due global warming , urbanization, and the growth of population has resulted in water scarcity. The alternate method in order to overcome the crisis is solar desalination by using phase changing material this process utilizes minimum amount of energy to produce potable water and this process is completely ecofriendly it also utilizes minimum area for installation. Brine solution disposal may be a massive drawback in each chemical process business hence correct ways in which to extract minerals from brine and use of brine for cultivation and irrigation must be practiced.

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