DESIGN OF SOLAR STILLS ON WATER DISTILLATION

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ABSTRACT

Distillation is a process of separating the component substances from a brackish water by separate evaporation and condensation. There is almost no water left on earth that is safe to drink without purification after 20-25 years every day. Only less than 1% water is available for the society for direct use, out of which the maximum fraction has been polluted due to non-manageable industrial development. In this project we have decided uses in non-conventional energy source for the distillation of water. A solar still is a device which can solve the problem of portable water without using the high grade energy. The process of energy get from the sun. Because of this, purpose the solar still is built up with convert the impure water into pure water using the renewable solar energy. The incoming solar radiation from the sun is heating the water

Keyword: *Water distillation, Solar stills*

1.INTRODUCTION

Solar distillation is a tried an true technology. There is an important need for clean, pure drinking water in many developing countries. Often some few years water sources are brackish or contain harmful bacteria and therefore cannot used for drinking. In my project energy input, as heat, solar radiation can be the source of energy. Only 1% of earth's water is in a fresh, liquid state and remaining water are polluted. This bottom surface used blackened material to improve absorption of sunrays. The water initially to heat up and the moisture the glass cover increases. The condensed water can get from using trickles down the inclined glass cover to an interior collection to a storage bottle.

2. NEEDS SERVEDBY SOLAR STILL

Solar distillation is a cost-effective means of providing clean water fir direct andindirect human consumption [four basic human needs (i.e. drinking, cooking,washing, and bathing), industrial uses and green house cultivation).
1. It will improve health standards by removing impurities from water supplies.
2. It shall help complement the existing fresh water in locations where thequality/quality of supply is deteriorating.
3. Where sea water is available, it can reduce the dependence on rain fall.
4. Solar stills, operating on sea or brackish water, shall ensure supplies of water during atime of drought

3. ABOUT SOLAR ENERGY

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. The energy radiated by the sun on a bright sunny day is 4 to 7 KWh per m.

4. SOLAR STILL OPERATION

Water to be cleaned is poured into the still to partially fill the basin. The glass cover allows the solar radiation to pass into the still, which is mostly absorbed by the blackened base. This interior surface uses a blackened material to improve absorption of the sunrays. The water begins to heat up and the moisture content of the air trapped between the water surface and the glass cover increases. The heated water vapor evaporates from the basin and condenses on the inside of the glass cover. In this process, the salts and microbes that were in the original water are left behind. Condensed water trickles down the inclined glass cover to an interior collection trough and out to a storage bottle. Feed water should be added each day that roughly exceeds the distillate production to provide proper flushing of the basin water and to clean out excess salts left behind during the evaporation process. If the still produced 3 litres of water, 9 litres of make-up water should be added, of which 6 litres leaves the still as excess to flush the basin.

5.TYPES OF SOLAR STILLS

1.Single Effect Basin Solar Still

2.Tilted Tray Solar Still

3.Multi basin Stepped Solar Still

4.Regeneration Inclined Step Solar Still

5.Wick Type Solar Still

6.Multiple Effect Diffusion Solar Still

7.Chimney Type Solar Still

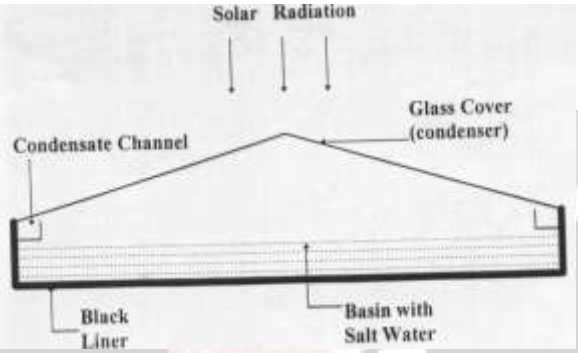
8.Multi-Tray Multiple Effect Solar Still

9.Double Basin Solar Still

10.Humidification Dehumidification Distiller

11.Multistage Flash Distiller

12.Solar – Assisted wiped film Multistage Flash Distiller



6. METHODOLOGY

The design methodology of the project involves designing an asymmetrical solar still as per the output requirements. An asymmetrical design is chosen as it has higher output efficiency . The solar still is designed for an estimated output of around 3 to 5 liters, which is the average requirement for our application. In addition to it, an external reflector has been fabricated to increase the output efficiency.

7. MATERIAL FOR SOLAR STILLS

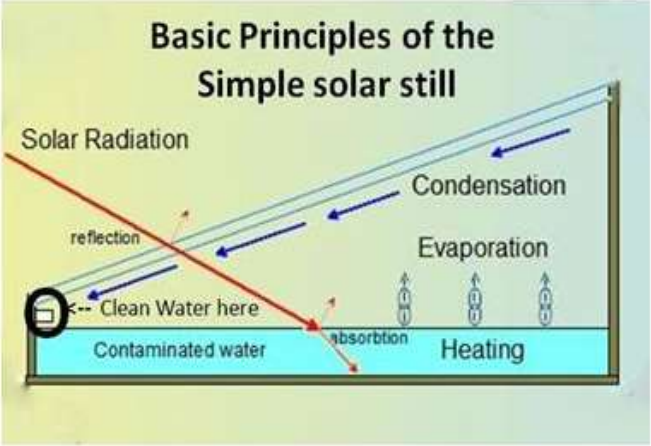
1. GLAZING:- Should have high transmittance for solar radiation, opaque to thermal radiation, resistance to abrasion, long life, low cost, high wet ability for water, lightweight, easy to handle and apply, and universal availability. Materials used are: glass or treated plastic.
2. LINER: - Should absorb more solar radiation, should be durable, should be water tight, easily cleanable, low cost, and should be able to withstand temperature around 100^{0}C. Materials used are: asphalt matt, black butyl rubber, black polyethylene etc.
3. SEALANT: - Should remain resilient at very low temperatures, low cost, durable and easily applicable. Materials used are: putty, tars, tapes silicon, and sealant.
4. BASIN TRAY:-Should have long life, high resistance to corrosion and low-cost. Materials used are: wood, galvanized iron, steel, aluminum, asbestos cement, masonry bricks, concrete, etc.
5. CONDENSATE CHANNEL:-Materials used are: aluminum, galvanized iron, Concrete, plastic material, etc.

8.BASIC REQUIREMENTS OF A GOOD SOLAR STILLS

1. Be easily assembled in the field.
2. Be constructed with locally available materials.
3. Be light weight for ease of handing and transportation.

4. Have an effective life of 10 to 20 years.
5. No requirement of any external power source.
6. Can also serve as a rainfall catchment surface.

9. OPERATION TECHNIQUE



explains about the basic operation of the single basin solar still. Water to be cleaned is poured into the still to fill at certain amount of the basin. The glass cover allows the solar radiation to passes through and it reaches the bottom of the still which is mostly absorbed by the base because the surface is coated with black colour material to increase the sun heat absorption. The water begins to heat up and the moisture content of the air trapped between the water surface and the glass cover. Due to heating water gets evaporated from the basin and condenses on the inside of the cover of the glass. In this process, the impurities that present in the initial water are settled in the base itself and only Condensed water trickles in the inclined glass cover towards downward direction to collection trough and it is stored in the bottle. Every day the basin of the solar still must be cleaned to remove the settled salt contents and impurities. By removing these only we can absorb more amount of heat energy without wastage.

10.Conclusion

Distillation of water using solar still basin is the most economical method to get portable drinking water. Salt, bacteria and other impurities are contaminated which are to be removed completely in the distillation process. The solar stills are best technology for living beings and environment because they do not need electricity for processing, no running water is required, lifetime is more and easy to maintain. In the experiment it has found that the black coated solar still is more effective when compared with the white coated solar still

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