

A TECHNIQUE TO PURIFY WASTE WATER USING SOLAR ENERGY: SOLAR WATER DISTILLATION

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Abstract: *There is almost no water left on the earth that is safe to drink without purification in future. Water from various sources is often brackish (i.e. contain dissolved salt) and/or contain harmful bacteria and therefore cannot be used for drinking purpose. Our aim is to get pure water from the impure or brackish water available. Everyone wants to find out the solution of water problem with the available source of energy in order to achieve pure water. Keeping these things in mind, we have devised a technique which will converts the impure water in to pure/portable water using the renewable source of energy (i.e. solar energy).*

Key words: solar, distillation, water, sunlight.

I. INTRODUCTION

Water is the basic necessity for human along with food and air. There is almost no water left on earth that is safe to drink without purification. Only 1% of earth's water is in fresh, liquid state, and nearly all of this is polluted by both diseases and toxic chemicals. For this reason, purification of water supplies is extremely important. [1] Drinking water is one of the reasons of major health hazards responsible for almost 90% of health problem in rural areas. Women and children's are mostly affected because they are quite vulnerable to water borne disease. [2] There is an important need for clean, pure drinking water. Often water sources are brackish (i.e. contain dissolved salt) and/or contain harmful bacteria and therefore cannot be used for drinking. In addition, there are many coastal locations where seawater is abundant potable water is not available. Pure water is also useful for batteries and in hospitals and schools. [3]

II. DISTILLATION

Distillation is one of many processes available for water purification, and sunlight is one of several forms of heat energy that can be used to power that process. Sunlight has the advantage of zero fuel cost but it requires more space (for its collection) and generally more costly equipment. To dispel a common belief, it is not necessary to boil water to distill it. Simply elevating its temperature, short of boiling, will adequately increase the evaporation rate. In fact, although vigorous boiling hastens the distillation process it also can force unwanted residue into the distillate, defeating purification. Furthermore, to boil water with sunlight requires more costly apparatus than is needed to distill it a little more slowly without boiling many levels of purification can be

achieved with this process, depending upon the intended application. Sterilized water for medical uses requires a different process than that used to make drinking water. Purification of water heavy in dissolved salts differs from purification of water that has been dirtied by other chemicals or suspended solids.

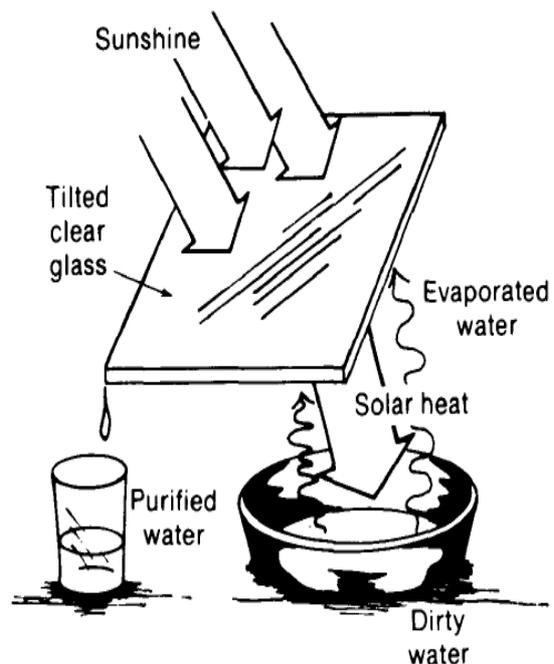


Fig.1 Basic concept of solar distillation [4]

For people concerned about the quality of their municipally-supplied drinking water and unhappy with other methods of additional purification available to them, solar distillation of tap water or brackish groundwater can be a pleasant, energy-efficient option. [5]

III. 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. [6] 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.[1]

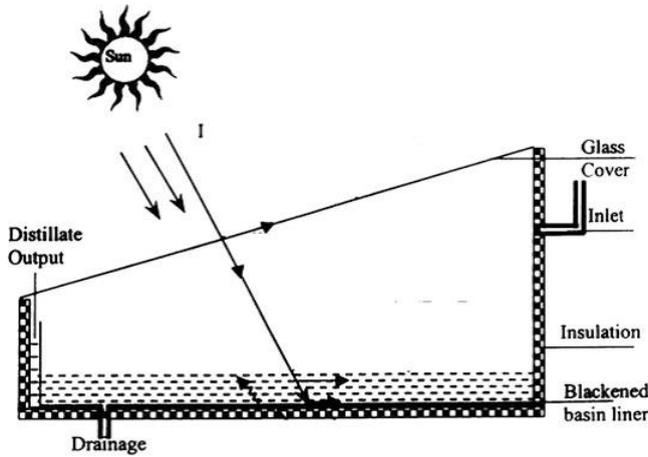


Fig. 2 Solar Energy System

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. 3.8×10^{24} 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 m². [7]

IV. SOLAR STILL (DISTILLATION)

A solar still is a simple way of distilling water, using the heat of the sun to drive evaporation from humid soil and ambient air to cool a condenser film, two basic type of solar still are box and pit still. In solar still impure water is contained, outside the collector, where it is evaporated by sun light shining through clear plastic. The pure water vapor condensed on the cool inside plastic surface and drips down from the weighted low point, where it is collected and removed. The box type is more sophisticated.

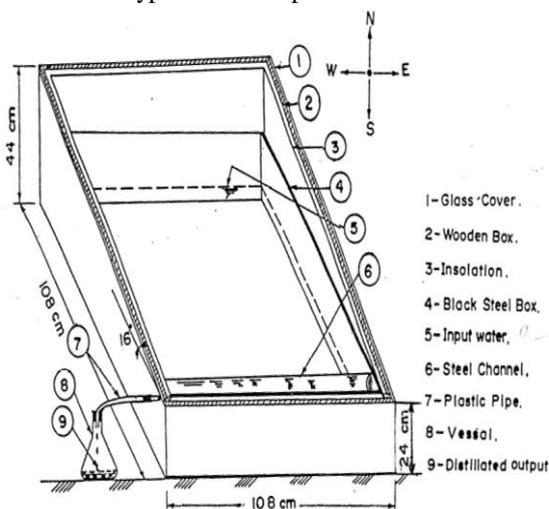


Fig.3 Schematic diagram of solar still [8]

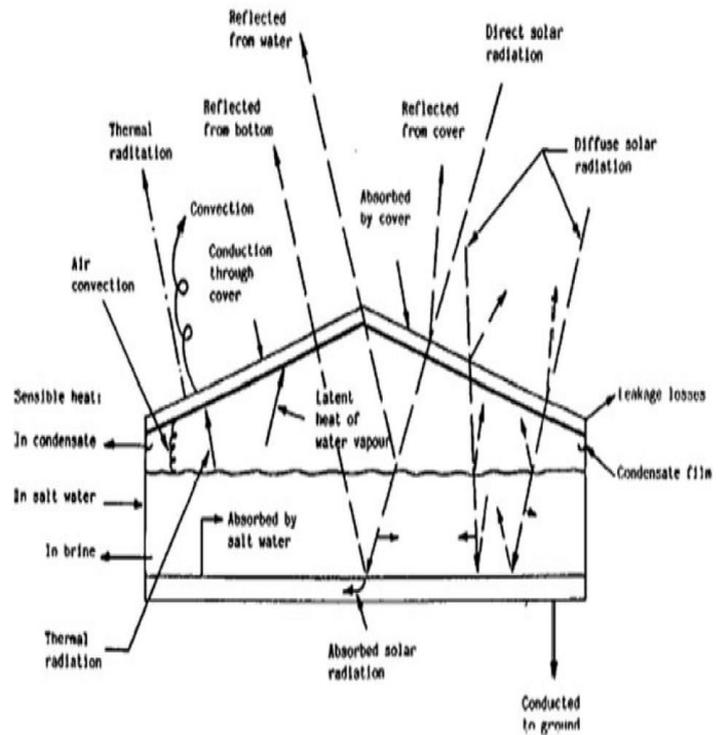


Fig.4 Energy flow diagram [2]

The basic principle of solar water distillation is simple, yet effective, as distillation replicates the way nature makes rain. Condensing on the glass surface for collection. This process removes impurities, such as salt and heavy metals and eliminates microbiological organisms. The end result is water cleaner than the purest rain water. [9]

V. DESIGN OBJECTIVES FOR AN EFFICIENT SOLAR STILL

For high efficiency the solar still should maintained:

- A high feed (undistilled) water temperature
- A large temperature difference between feed water and condensing surface
- Low vapour leakage

A high feed water temperature can be achieved if:

1. A high portion of incoming radiation is absorbed by the feed water as heat. Hence low absorption glazing and a good radiation absorbing surface are required
2. Heat losses from the floor and walls are kept low
3. The water is shallow so there is not so much to heat.

A large temperature difference can be achieved if:

- The condensing surface absorbs little or none of the incoming radiation
- Condensing water dissipates heat which must be removed rapidly from the condensing surface by, for example, a second flow of water or air, or by condensing at night [3]

VI. CLASSIFICATION OF SOLAR DISTILLATION SYSTEM

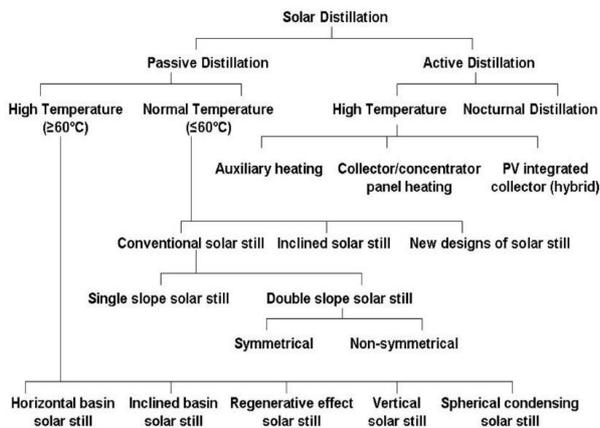


Fig.5 Classification chart of solar distillation [10]

VII. ADVANTAGES OF SOLAR DISTILLATION:

- This technique produces drinking water from impure water.
- This is very simple technique & does not pollute the environments.
- Its control the water pollution.
- Water is saved for future.

VIII. CONCLUSION

It is necessary to save water for future to use as drinking water. In whole world only a few percentage of water is fresh or pure to use as drinking water. In this paper it is concluded that, water distillation is a very good technique to purify the waste water and this pure water is used for drinking purpose. In this technique heat from the sun is used to drive this and sun light plays a major role in this technique. By this technique we can save water for future as well as it is possible to treat the polluted water and recycle the waste water into drinking water.

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