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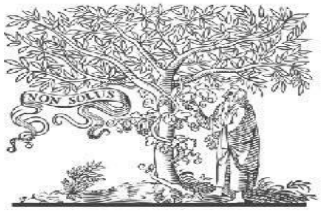

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Design and Fabrication of Solar Still

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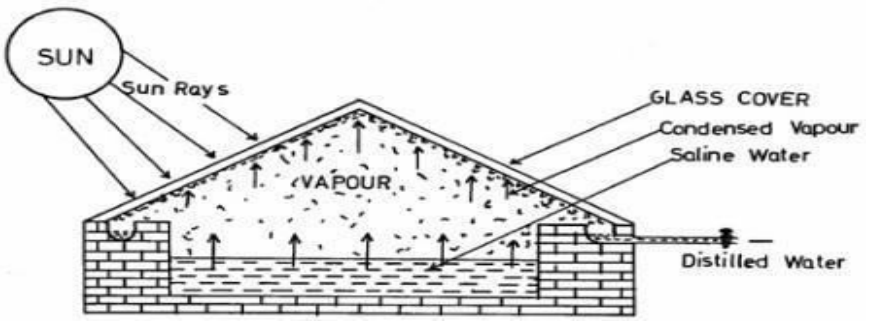
Abstract

In 25 years, just a small portion of the world's freshwater supply will still be fit for human consumption without treatment. It's crucial to keep in mind this truth. Sadly, this is entirely accurate. Our planet's water is mostly polluted, with only 1% of it being fresh and pure. Water supply filtration is crucial for this reason. We have created a tool that cleans contaminated salty water into pure drinkable water using renewable energy sources in an effort to give safe drinking water to everyone in the globe (i.e., solar energy). Radiation, convection, and conduction are the three main methods of transferring heat. The outcome is reached by evaporating the salinized or polluted water and retrieving it as pure, drinking water. The technology transforms the salt water into clean water in six hours.

The use of solar thermal energy for saltwater desalination applications has only been possible so far with small-scale devices in rural areas. High capital intensity and a relatively low productivity rate in the capital cost are the main factors responsible for this. Nevertheless, due to the looming depletion of fossil fuel supplies and the increasing demand for fresh water to fulfil growing irrigation and water demands, more research and development into the desalination and purifying of water using renewable energy has been undertaken.



Keywords: Solar energy, Water salination, Polluted water ,Portable ,Sun ,Renewable energy.

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Introduction

The amount of fresh water on Earth is limited. Almost two-thirds of the earth's surface is covered by water, but more than 97% of the water that is accessible is either salty or polluted. The rest, or around 2.6%, is composed entirely of fresh water. Just 1% of fresh water is available to humans and other creatures. Yet, as the population increases, there is a greater demand for fresh water. Even this little amount is regarded to be adequate to maintain life on Earth. Polluted water shouldn't be taken straight since it contains harmful germs and dissolved debris. Having enough drinking water and fresh water is a problem on a worldwide scale. This problem affects both developed and developing nations. Reverse osmosis, multi-effect distillation, mechanical vapour compression, and other processes are now employed to produce fresh water. The primary disadvantage of these procedures is the high energy cost of purification. The solar thermal desalination process is the most effective for producing clean drinking water at a reasonable price. Solar distillation systems are becoming more and more well-liked because to their ease of operation and incredibly low expenses.

SOLAR ENERGY

Electromagnetic energy is released by the sun and is absorbed by the earth. Solar radiation is a low-cost, non-polluting option. India receives around 5000 trillion kWh more from the sun's energy annually than it consumes..

Solar energy is a viable option for building heating and cooling. air conditioning and refrigeration usage

- Stoves fuelled by the sun
- Water heated by solar energy

innovations for solar-powered water pumps

Solar Collectors are devices that catch solar energy. Solar collectors catch photons and send the energy to any fluid that comes into contact with them. Solar cells are the components that convert solar energy into electrical energy.

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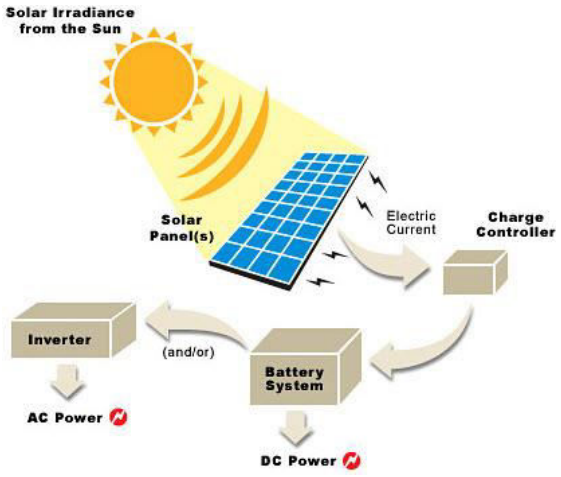


WATER IMPURITIES -

A. Particles that are suspended - Suspended solids are small solid particles that are suspended in water as a colloid or because the water is flowing. Pollutants and pathogens are transported on the surface of particles, hence suspended solids are important. To remove suspended particles from the environment, water filters and/or sedimentation are frequently utilised (usually at a municipal level).

B. Inorganic salts that have been dissolved - Compounds that lack CARBON. As an example, sodium chloride, sodium sulphate, magnesium chloride, magnesium sulphate, calcium chloride, calcium sulphate are all examples of salts.

C. Organic molecules that have been dissolved-CARBON-containing compounds.

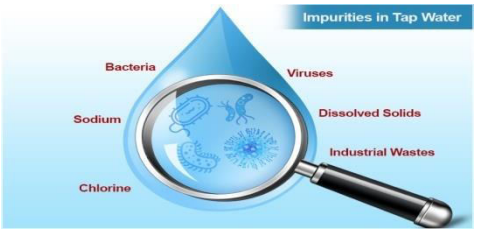
As an example, consider hydrocarbons.

D. Microorganisms are tiny organisms. - Includes Fungi, Algae, Bacteria etc.

E. Pyrogens- Compounds that cause fever.

F. Gases that have dissolved - Eg- Argon, Methane, Ethylene, Carbon Mono-oxide, Carbon dioxide, Hydrogen, Helium, etc

with two parameters.



WATER PURIFICATION –

DISTILLATION:

Thermal energy is applied to evaporate the salty water, and the finished product is the condensation of the steam that results from the process.

VAPOR COMPRESSION:

Water vapour from hot liquid is isothermally compressed and superheated in this condition. After cooling to saturation temperature, the high temperature vapour is condensed under continuous pressure.

REVERSE OSMOSIS:

Water containing salinity is driven under elevated heat through particular filters, allowing only water molecules to get through while leaving any dissolved salts behind.

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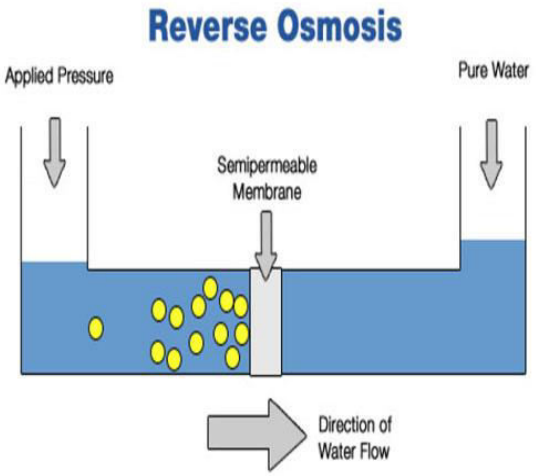


REVERSE OSMOSIS

Methodology

Benefits of Distillation:-

Eventually, we opted to use the distillation process due to the following advantages:

1. It generates high-quality water.
2. The cost of upkeep is basically non-existent..
3. This method may convert any form of water into drinking water.
4. The system will have no movable parts and won't run on power.
5. Water waste will be kept to a bare minimum.

PRINCIPLE OF SOLAR STILL

Solar stills function on the principle of sun distillation. A solar still acts like rainwater in regards of evaporation and condensation. The solar still's basin, which is black in colour, is loaded with salinated water. This is surrounded by a completely airtight surface. The top does have a transparent cover that slopes. Following that, it is exposed to sunlight. Solar light that goes through the cover is absorbed by the black lining. The distillator's architecture successfully captures a considerable part of solar energy. When the internal temperature of the distiller rises, the saline water evaporates, having left the entirety of the concentration of salt as well as any germs, viruses, toxins, and other potentially dangerous things.

WORKING OF SOLAR STILL

Solar stills are referred to as stills because can distil or purify water. The evaporation and condensation processes used by solar energy are still the same as those used by precipitation. Evaporation of ocean water causes cool, condense, and rain, which ends up falling back to earth. As the water has evaporated, all pollutants are gone behind, leaving just pure water. Solar stills use the same process.

The inside surfaces of a solar still is made out of a protective layer with a glass protective surface. This interior surface is comprised of a blackened material to increase absorbing of the sun's rays. Poured into to the still, refilling it basin halfway with cleaning water. Radiation from the sun (quick wave) can reach the still through glass top, although it is mostly absorbed by the blackened surface of the base.

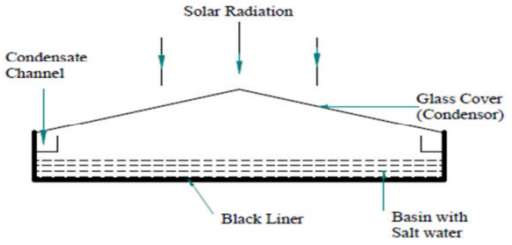
The air trapped in between bottom and the top cover gets more moist as the water

heats. The still's glass cover reflects lengthy infrared radiation back into the still, trapping solar energy within (the "greenhouse" effect). The warmed water vapour condenses inside of the glass cover after evaporation from the basin.
The still's glass cover reflected lengthy infrared rays from of the base back into to the still, trapping solar energy within (the "greenhouse" effect).

The hot water vapour condenses inside of the glass cover following draining from the basin.

The original water's minerals and bacteria are not eliminated throughout this treatment. Via an inclined glass top, condensed water drops from the a storage container flow into an inside collecting trough. Solar still runs on the sun's energy without any moving components.
Whenever the still is filled, generally in the morning or at night, the total volume of water generated that day is gathered. After dark, the still will continue to produce distillate until the liquid temperature decreases. Feed water that almost exceeds distillate production should be delivered each day for proper available water cleaning and to eliminate surplus salt left remaining from the evaporation process.

The most important elements of the design are the sealing of the base with black



WORKING OF SOLAR STILL

Implementation

Solar panels in a variety of designs are still being developed. The manufacture and usage of an one effect solar panel remain simple. Despite this, efforts to improve the Solar's output and efficiency remained.
There are two kinds of solar stills: passive and active.
Passive - Passive approaches include the use of black pebbles and elastomer, float perforated black plate, enhancing the sun absorption rate of liquid with dye or charcoal, adequate insulation, decreasing the depth of the water in the basin to limit thermal capacity, maintaining vapour tightness, and employing reflecting side walls.
Active - Active techniques also use a collector or heat recovery to heat the water in the basin, implementing vacuum inside of the solar still to accelerate the condensation and evaporation procedures, and cooling the transparent cover to raise the temperature gradient between it and the moisture in the basin and thus accelerate the evaporation rate..

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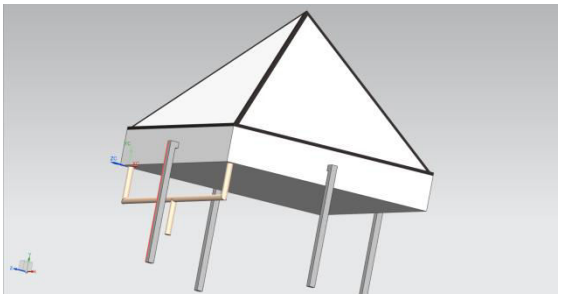
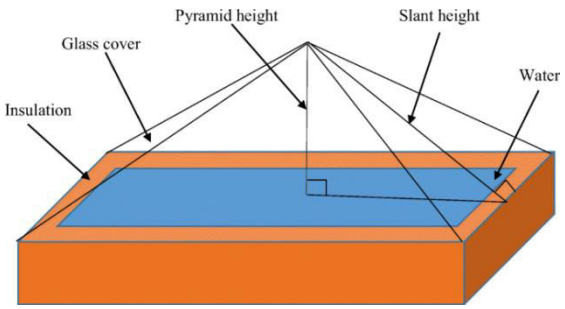


DESIGN OF FOUR SLOPE SOLAR STILL

Literature Survey

Some of the variables that impact the efficiency of the solar still include solar strength, wind velocity, weather conditions, the gap in water crystal temperature changes, the region of the absorber surface, the available surface of the liquid, the temp of the air intake liquid, the crystal angle, and the depth of the water. To improve the efficiency of solar stills, the additional variables surface of water, solar collector area, intake water temperatures, glass angle, and water depth—can be modified. Energy of the sun, wind speed, and ambient temperature, on the other hand, are not controllable due to their metrological characteristics. Several adjustments are being attempted to enhance the efficiency of a solar still by taking into account the numerous elements impacting its output. examined how well a solar still with an integrated heated water heating storage tank performed. The hot water from of the storage reservoir heated the basin water, resulting in a higher yield of distilled water, according to analysis. The tank is fitted in such a manner that a miniature solar distillation apparatus is created.



MODELS OF HEAT TRANSFER

Temperature difference is the transfer of thermal energy across physical systems performed by dispersing heat based on temperature and pressure. Non-isolated systems' entropy can decrease. The majority of goods emit infrared heat radiation at near-room temperature. The three primary modes of heat transport are radiation, convection, and conduction.

The following are the primary ways of heat transfer:

1. CONDUCTION
2. CONVECTION
3. RADIATION

CONDUCTION - The exchange of energy between things in physical contact. Thermal conductivity is a material's ability to transfer heat that is typically measured using Fourier's Equation for heat conduction.

CONVECTION - The energy transfer between an item and its surroundings caused by fluid motion. The average temp

is used to evaluate properties linked to heat transfer via convection.

RADIATION - Energy is transformed to electromagnetic radiation by the motion of energetic particles with in atoms.

Possible issues with solar stills that would affect their efficiency include:

1. Improper fitting and joints enhance cold flow of air from the outside into to the still.
2. Glass cracking, breaking, or scratches that limit sunlight transmission or let air in.
3. Algae growth and accumulation of dirt, bird droppings, etc. To avoid this, cleaning should be done every few days.
4. The darkened absorbent surface has deteriorated over time.
5. Salt buildup here on bottom, which must be cleaned on a regular basis.
6. The still's salty water is either too deep or has dried up. The depth must be kept at roughly 20mm.

THE BENEFITS OF A SOLAR STILL

1. Sunlight is completely free.

2. Since it lacks moving parts, it is dependable and nearly maintenance-free.

3 . Water flavour is said to be improved because the gadget acts as a Solar Hot water Vaporizer and does not boil the water.

DISADVANTAGES OF SOLAR STILL

1. Distillate production per unit of area is low.

2. Productivity declines over time due to a variety of factors.

3. Vapour escape at joints

Conclusions - Toxins are eliminated from water instead of the other way around using the distillation process. Solar energy is one such source. This is due to the fact that solar distillation offers various advantages. Solar distillation employs only free energy from the sun, so there are no operational or energy costs. This solar still's main disadvantage has been its low growth or high capital expenditure every unit of distillate output. There are several ways to make this better, like adding black dye to the saltwater, employing internal and external mirrors, minimising heat conduction through the top cover and basin walls, or recycling the latent heat released by the condensing vapour on the glass cover.

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