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SOLAR OPERATED PORTABLE WATER PURIFIER

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Abstract—Probably within the next twenty years the world will face crisis related to the water scarcity. Due to the depletion of the natural resources such as fuels and coals may cause chaos. Desalination process is employed by direct sunlight. Solar still methods are used to provide water for the nearby communities. Solar still is easy to be constructed and can be constructed with any available materials that are available nearby homes and it can provide us with less cost and low maintenance.

Keywords—Distillation, Fossil, Desalination

I. INTRODUCTION

Solar still is one of the methods to generate purified drinking water that can be used for not only cooking purposes but also for drinking purposes. The distillation of water is done by this system. In my project I constructed the solar still for the production of pure water. The solar still with single basin is easy to construct and is employed in killing the disease-causing microbes with the help of sunlight.

0.5 liters per square meter per sun hour is the average water production that is employed in the still. The glass on the top of the solar still allows sunlight to pass through. The main distinct advantage is that the water that enters through the system with the contaminants can only be exported as a purified water molecule where it can be used with no more process purification

The main objective is to enable the solar still to be distinctly more efficient such that the water can be purified with ease without any of the lateral delay that is caused due to heat losses. The solar purification involves purification of water that can be used for almost all the house hold uses including drinking and cooking. Using solar energy, the sunlight can be directly utilized with the solar still basin for the effective purification and moreover no external cause is required to power up the device. Mostly this solar water purification device is used in rural areas where the is adequate water but

no means to purify them without electricity. The most important positive thing is that it does not require any fuel.

It is really the unique feature of the solar water purifier that it does not require any means of fuel such that it sets it far apart than any other means of water purification devices that may help in preserving the fuels and purify water.

Only 1% of the world is filled with fresh water where it resides as lakes rivers ponds underground and in glaciers and as rain. Moreover, over that 1% certain amount of water can only be purified using the generated methods for purification of the safe water. Approximately 1.1 billion people in this world have inadequate access to safe drinking water.

II. OBJECTIVE

The main motivation is due to the unavailability of fresh water that is present for drinking purposes, moreover it is not been able to produce water from other impure sources in terms of remote areas where there is no supply of adequate amount of electricity to purify water, the aim of our project is to harness solar thermal energy for the process of water purification and removal of microbes.

Thus, filtering water without using any non-renewable source. The objectives of our project are: Removing sediments and particulate matter from water. Killing pathogen, viruses and other diseases causing elements from water, thus making it purified.

The purpose of this project is to develop solar water purification stills and in return get effective purified water. The potable water from the impure water can be evaporated and purified with the help of the sun. The goal of this project is to design a still with the highest possible water production per unit cost of the process equipment.

III. METHODOLOGY

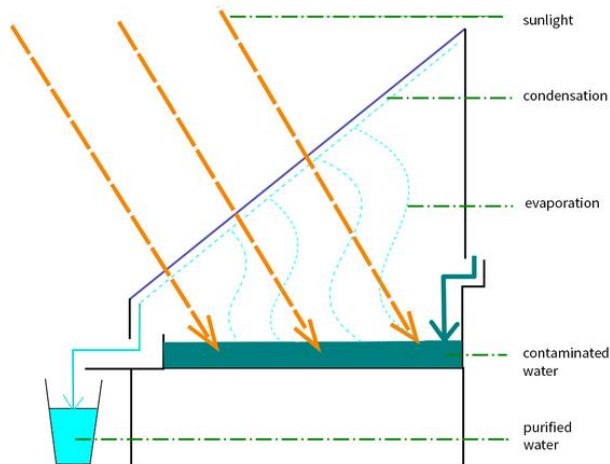


Fig.1

A solar still is a low-tech way of distilling water, powered by the heat of the sun (more precisely, the heat & humidity of the soil, and relative cool of the plastic).. In a solar purifier, impure water is contained outside the collector, where it is evaporated by the sun through clear plastic. The pure water vapor (and any other included volatile solvent) condenses on the cool inside plastic surface and drips down off of the weighted low point, where it is collected and removed.

The box type is more sophisticated. Solar stills are used in cases where rain, piped, or well water is impractical, such as in remote homes or during power outages. Solar stills are occasionally used on a longer term basis in developing world settings. However, depending on environmental conditions, they usually produce a relatively small amount of water, and even less where the source is saline or brackish.



Fig.2

If the source is inadequate, a compromise method is to mix the distilled water with the brackish or saline water purified with other methods - this gives a more adequate quantity and re-introduces the other source contaminants, while still

lowering the salinity, and improving the taste. The Water Pyramid is a larger version, which uses an inflatable dome as the condensing surface and can be used in tropical, rural areas. Knowing how to put together a solar still is often billed as a useful survival skill and could provide an important means of potable water in the event of a wilderness emergency. Nevertheless, under typical conditions makeshift solar stills rarely produce enough water for long-term survival, and the sweat expended in building one can easily exceed its daily output.

Solar stills can extract water from moisture in the ground but to increase the amount of moisture available to a solar still, water (fresh or saline) can be added inside or along the edges of the still. Where no water sources are readily available, shredded vegetation, wet soil/sand, urine or covered feces can be used inside the pit. If only the natural soil moisture is used, the pit must eventually be moved as the productivity drops. To prevent losing moisture by taking apart the still to retrieve collected water a length of plastic tubing can be used to sip water as it accumulates.

IV. WORKING

The Solar Still consists of various material that group together to form the apparatus of the solar water purification unit. Initially the water is passed through the water filter where the various heavy particles are filtered. The carbon filter is used to filter the water regularly. The water level of the container is adjusted by the float valves which are fitted in between filter and tank.

For optimum performance they require 60degree slope of the triangular shape. This complicates their practical application for water and space heating. The solar water purifier works on the basic principle of water cycle where water gets evaporated and then condenses to form water. The Solar Still follows the same principle where water enters the setup through the ball cock and the water is stagnant at the lowest portion of the apparatus. The water gets heated and evaporated due the difference in atmospheric pressure created inside the setup thereby evaporating the water.

The impure particles, heavy metals and hazardous chemical solutions gets stayed behind where it can be cleaned and removed from the apparatus. The evaporated water condenses along the internal side of the slope mirror place atop of the setup.

The condensed water slides due to the inclination and the gravitational pull. The condensed water gets collected through the duct present along the send of the sliding mirror end and is collected in a dedicated storage tank, where the water is stored and can be used for later purposes according to the necessity.

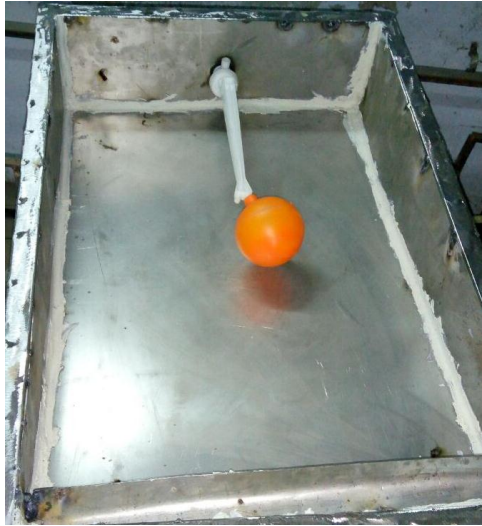


Fig.3

V. PROCEDURE

The water enters the setup through the carbon filter where it filters the larger sediments and passes it into a tank. The tank pressurizes the water and sends it into the valve of the inlet of the still setup where it is in connection with the ball cock float valve. Then water from the tank is passed onto the still setup by means of the float valve. The float valve gives water when the water is of less quantity thereby regulating the constant supply of water into the still setup. Due to the copper and the black paint inside the still the water gets heated and evaporated, these evaporated water gets condensed along the glass surface. The condensed water is then collected by the semi duct present inside the still where it is transmitted to the storage tank for later usage.



Fig.4

VI. TABLES OF FIGURES

Table.1

NAME OF THE MATERIAL	QUANTITY	SPECIFICATION
SHEET METAL	1	20m x 2m
FIBRE GLASS	1	2m x 2m
MILD STEEL FRAME	1	2m
RUBBER INSULATION	1	5m
BOOSTER PUMP	1	220v, 30w 5 Psi, 1litre/s
SILICONE SEALANT	1	340g
COPPER TUBES	1	10m
OTHER INSTRUMENT		Welding, Cutting Blanking

VI. FUTURE SCOPE

There is a huge scope to the scientist, researchers; engineers to continuously improve in various kinds of designs and methods to enhance the productivity of solar still which is beneficial to enlarge the solar sector. A solar still may be used in villages and mass production of fresh water. Globally the problem of impure water is increasing day by day hence there is huge chance to produce fresh water by using solar still, and in special situations a solar still can provide fresh water economically than any other method. The solar distillation process requires low grade energy which is freely available and also there is no greenhouse pollutant as in the case with other purification techniques using fossil fuels. In future it can be used in remote places where there is no electricity and fuels.

The Future Solar Purification method can be implemented by increasing the rate of production of the solar water still by enhancing the purification device to work both during day and night time by the use of solar panels where its power can be stored during the day for implementing their operation at night. To improve efficiency, we use the same system with a reflector and an auxiliary heater. By using reflector sun rays (short-wavelength) are collected and reflected in to the system, by means of this arrangement we are able to absorb maximum sun rays (short-wavelength) to the system and improve the efficiency.

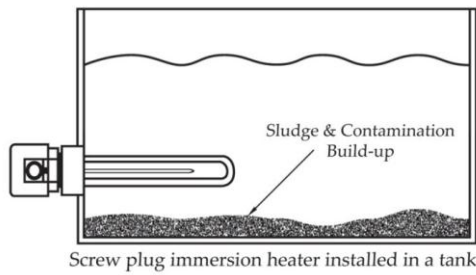


Fig.5

VII. CONCLUSION

Moreover, the Solar still is perfectly suitable for daily consumption purpose of the future community and serves as a cause for the greater good. Solar distillation is most economically effective when sunlight is allowed to pass through a transparent glass and into a black evaporating basin with little concentration of the sun rays. Solar water purifier productivity mainly depends on temperature difference between water and glass. The effect of water flow over the glass cover has a significant effect on the heat capacity of water mass in the basin. The still consisted of a vertical conical shaped blackened cotton wick (representing absorbing/evaporating surface) with good capillarity is increasing the yield. Energy storage medium increases the solar still productivity and efficiency. An addition of black dye increases the daily productivity and the efficiency of the system by about 10%.

Tested parameters	Results	
TDS	Before desalination	15120
	After desalination	193.46
pH	Before desalination	7.35
	After desalination	5.94
Conductivity ($\mu\text{S}/\text{cm}$)	Before desalination	65.2
	After desalination	67.6×10^3

Fig.6

Solar water purifier in combination with greenhouses could be designed to provide technically feasible systems suitable for arid areas. In active solar distillation system, the optimum flat-plate collector inclination is 20° and the still glass-cover inclination is 15° for a Solar water purifier which provides maximum annual yield.

The Solar water purifier is more suitable for commercial applications like distilled water for selling purposes, extraction of essence from different seeds and green leaves use in batteries, chemical laboratories etc.

VIII. RESULTS AND DISCUSSION

Through the solar purification method, we can get not only purified water but also, we can get water which is of high purity level that not only contain any impurities but also is free from all sorts of germs and pathogens.

After analyzing the structure and working of the solar still used for solar water purification we have come to the conclusion that the apparatus purifies nearly 6litres of purified water from 10litres of impure water that was introduced into the system by means of a ball cock.

The method also requires at least 10hrs for purification of 6litres of water. The rate of pure water from the impure water production increases when the sun is at the highest and depending upon the atmospheric temperature.

ADVANTAGES

Economical aspect:

1. Low maintenance cost.
2. No requirement of transportation from long distances.
3. Does not require electric supply.
4. No need of additional fuel for initiation of the process.

Technical aspect:

1. No moving parts, therefore increase in life.
2. No person required for the operation of the system.
3. Noiseless process of purification.

Manufacturing aspect:

1. Simple in construction, so easy to fabricate.
2. No heavy materials are required.

Safety aspect:

1. Free from Pollution.
2. No Chances for accident occurrence.

DISADVANTAGES

1. Low production capacity compared to other methods of water purification.
2. The Rate of production increases by summer and decreases during remaining seasons due to the positioning of the Sun.
3. Cleaning of the solar still basin from impurities and brine.
4. The large area tilted glass might attract attention to bugs and insects.



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