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A Review of Analysis in Water Purification by Solar Still and Electric Heater

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ABSTRACT: Water purification is the process of removing undesirable chemicals, Biological contaminants. Water samples selected are tap water, sea water, and well water. This process includes research design and manufacture of water purification using renewable energy. This process can be used in remote area also.

KEYWORDS: Solar still, Renewable energy, Water energy nexus, Heater

I. INTRODUCTION

Water is the most common liquid on earth. Pure drinking water is necessary for human survival. The water supply for drinking water is either ground water or surface water. The water from each source contains sediments and other solids. It is necessary to provide pure drinking water at low cost with high reliability. Also according to UN world water development report in 2009 it has been estimated that 2 billion people affected by water shortages

Solar distillation is a relatively simple treatment of brackish (i.e. contain dissolved salt water) to convert fresh water. Distillation is one of many processes that can be used for water purification and can use any heating source. Solar energy is a one best option. In this process, water is evaporated using the energy of the sun then the vapour condenses as pure water. There are classified in two groups: the phase-change or thermal processes and membrane process. In phase change process further classified multi-stage flash (MSF) distillation, multiple effect distillation (MED), vapour compression (VC), and thermal process is further classified as reverse osmosis (RO), electro dialysis (ED)

II. PRINCIPLE

Solar water purification is a relatively simple treatment of brackish water or sea water into fresh water. Distillation is one of many processes that can be used for water purification and can use any type of thermal energy

III. MATERIAL SELECTION

- 1) Nickel sheet
- 2) Reflector sticker
- 3) Glass
- 4) Electric Heater capacity of below 600W
- 5) Inverter Battery

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IV. HUMIDIFICATION DEHUMIDIFICATION (HDH) DESALINATION TECHNOLOGY

Nature uses solar energy to remove dissolved salts from ocean water by means of the rain cycle. In the rain cycle, sea water gets vaporized (by solar thermal energy) and humidifies the air. Then the humidified air rises and forms clouds. Eventually, the clouds condense this water vapor as rain. The man-made version of this rain cycle is called the humidification dehumidification desalination (HDH) cycle.

The main drawback of the solar still is that the various practical processes (solar absorption, evaporation, condensation, and heat recovery) all occur within a single Container. By separating these functions into distinct processes, thermal inefficiencies may be lowered and overall performance drastically improves. This separation of processes is the crucial characteristic of the HDH system. For example, the recovery of the latent heat of condensation, in the HDH process, is affected in a separate heat exchanger (the dehumidifier) in which the seawater, can be preheated. The unit for solar collection can be optimized almost autonomously of the humidification or condensation process.

The HDH process, thus, promises higher efficiency due to the separation of the basic processes. Hefei Zhang et al present a hybrid solar desalination process of the multi-effect humidification dehumidification and the basin-type unit. The solar evacuated tube collector is employed in the desalination system, multi-effect humidification dehumidification Desalination (HDD) process is calculated, and then the water excluded from the multi-effect HDD process is reused to desalinate in a basin-type unit further ahead.

The research proves that the multi-effect HDD has much room to be enriched. M. Amid pour et al experimentally evaluate and optimize the humidification–dehumidification desalination process for production of fresh water from brackish water. Experimental results show that two-stage HD desalination unit can increase thermal recovery in condensers and hence, reduce thermal energy Consumption and investment cost of the unit. Productivity can also be increased by 20% compared with the single stage unit

V. SOLAR STILLS

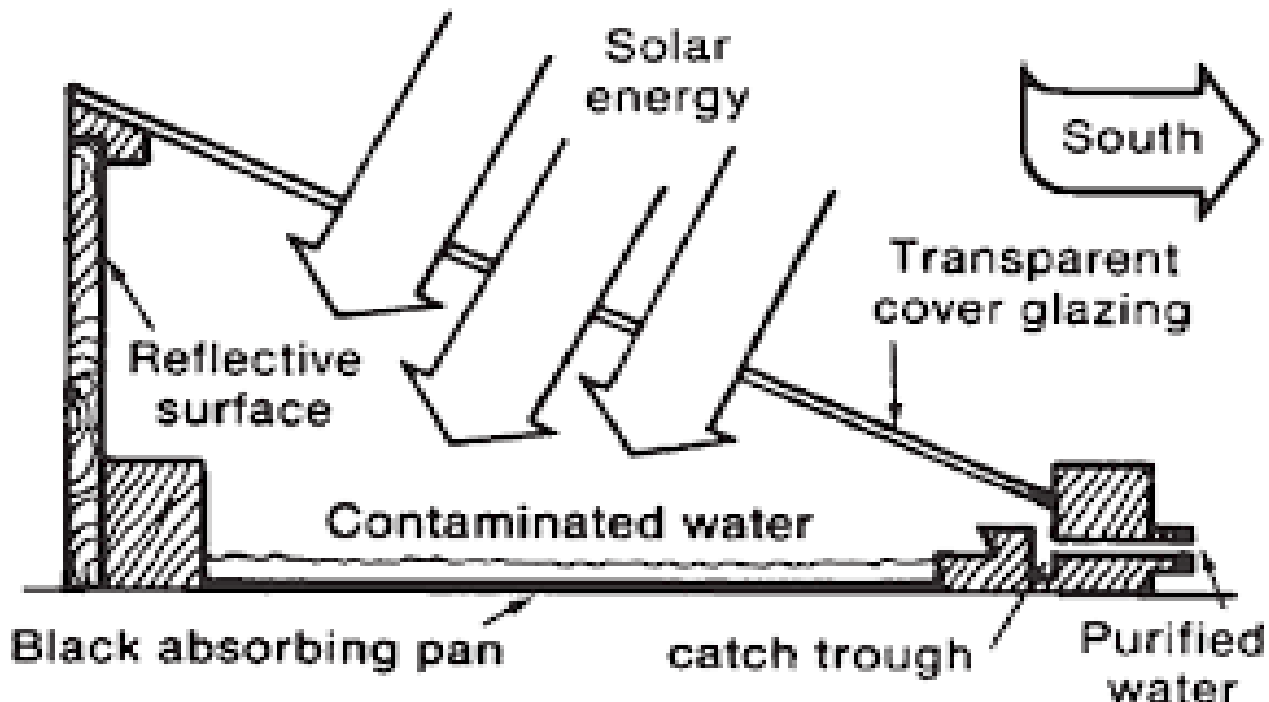
Solar still is an apparatus to desalinate impure water like brackish or saline water. It is a simple device to get fresh distilled water from impure water, using solar energy as fuel, for its various applications in domestic and industrial sectors. The basic concept of using solar energy to obtain drinkable fresh water from salty, brackish or contaminated water is quite straight forward. Water left in an open container in an open area will evaporate into the air. The purpose of a solar still is to capture this evaporated (or distilled) water by condensing it onto a cool surface. Increasing water temperature and the area of water in contact with the air can increase the rate of evaporation. A wide, shallow black painted pan makes an Ideal vessel for containing the water. The pan is painted or coated black (or some other dark color) to maximize the amount of solar energy absorbed. It should also be wide and shallow to increase the surface area, assuming the availability of a material with good thermal energy absorbing properties and resilience in heated salt water. To confine and condense the evaporated water, we need some kind of surface close to the heated salt water, which is, quite a few degrees cooler than the water. The evaporating pan is usually covered by a sheet of clear glass or transparent plastic (to allow sunlight to reach the water) which is slanted at a slight angle to let the fresh water that condenses on its underside, to drip down to a collecting trough. The glass creates a cavity and also holds the heat inside.

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Murasehave analyzed a specific problem associated with the feeding system of a roof type solarstill and they have also analyzed a specific problem Associated with the metallic materials i.e. metallic materials would not be suitable for the construction of solar stills with low productivity. Copper Nickel alloys have been widely used for the tube material

Mousa also have focus in achieving high efficiency with respect to temperature difference between the water in basin and glass cover. Several improvements have been proposed such as the use of forced convection, a dye, and external condensers. Authors found drawbacks, i.e. the need for a controllable air supply, the effect of dye on distillate quality and the need for an electric power supply.

Toyama et al. Have developed a technology for trouble free operation of this type of still, i.e. to form a stable liquid film flow below the surface of wick.

Varol & Yazar fabricated and compared performances of a conventional and an improved solar still, both covered with low Fe₂O₃ composed glass of 4 mm thickness and 1 m × 1 m area, tilted at an angle of 15° with the horizontal and with 96% transmissivity.

VI. REVERSE OSMOSIS

Reverse osmosis is a pressure driven process where a pressure difference greater than the osmotic pressure is applied across a suitable semi permeable membrane. Fresh water passes from the concentrated salt solution to the dilute one. In practice, the saline feed water is pumped into a closed vessel where it is pressurized against the membrane

Herold and Neskakis they find a small PVdriven RO desalination plant with an average daily production of 0.8-3 m³/day is presented. The authors investigated the influence of feed pressure on product water quality, on plant productivity and on energy consumption.

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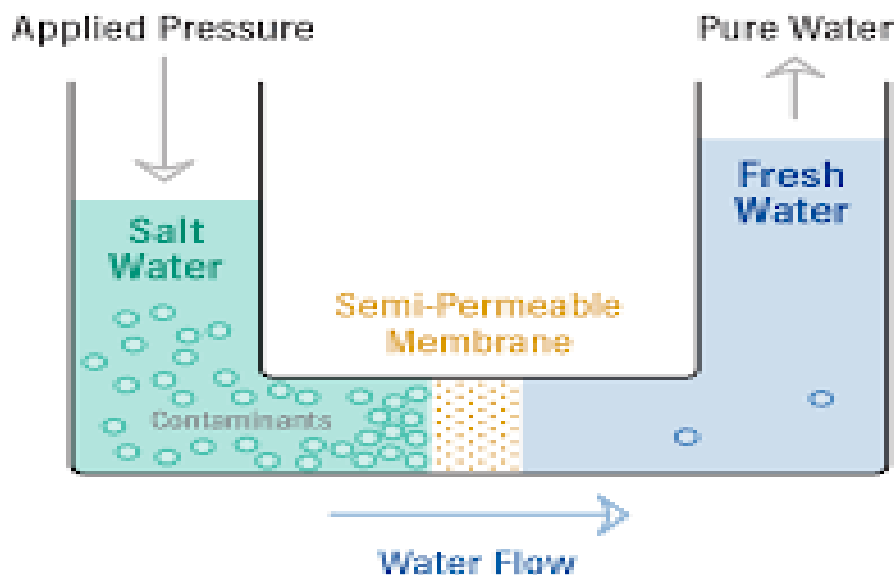
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Bier constructed another SPMD using an air gap membrane distillation (AGMD) module instead of the direct contact membrane distillation (DCMD) module tested in the SPMD pilot plant constructed by Hogan.

Reverse Osmosis



Koschilkowski et al used a similar membrane module to that used by Bier et al. in their study of a SPMD pilot plant. According to their calculations, without heat storage, the plant can distil 150 L/d of water in the summer in a southern country.

Richards and Schafer reported on the design and field-testing of a photovoltaic (PV)-powered desalination system. The system described was Intended for use in remote areas of the Australian outback. The system was based on a hybrid membrane configuration, with an UF module for removing particulates, bacteria and viruses and a NF or RO membrane for removing salts. The system produced clean drinking water from a variety of feed waters, including high salinity (3500 mg/L) water. The specific energy consumption ranged from 2 to 8 kW h/m³ of disinfected and desalinated drinking water, depending on the salinity of the feed water and the system operating conditions.

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VII. MINI IMERSION HEATER



This type of heater can be used to evaporate the water to purify it. Capacity of the heater is 250 watt and it can be used in inventor battery capacity of 800 watt. The advantage of the heater is its price is very low that is Rs 150.

| SI.NO | DESCRIPITON | PROPERTIES |
|-------|-----------------|----------------|
| 1 | Voltage | 230 volts |
| 2 | POWER (watts) | 250- 500 W |
| 3 | Heater material | Copper |
| 4 | Weight | Nickel plating |

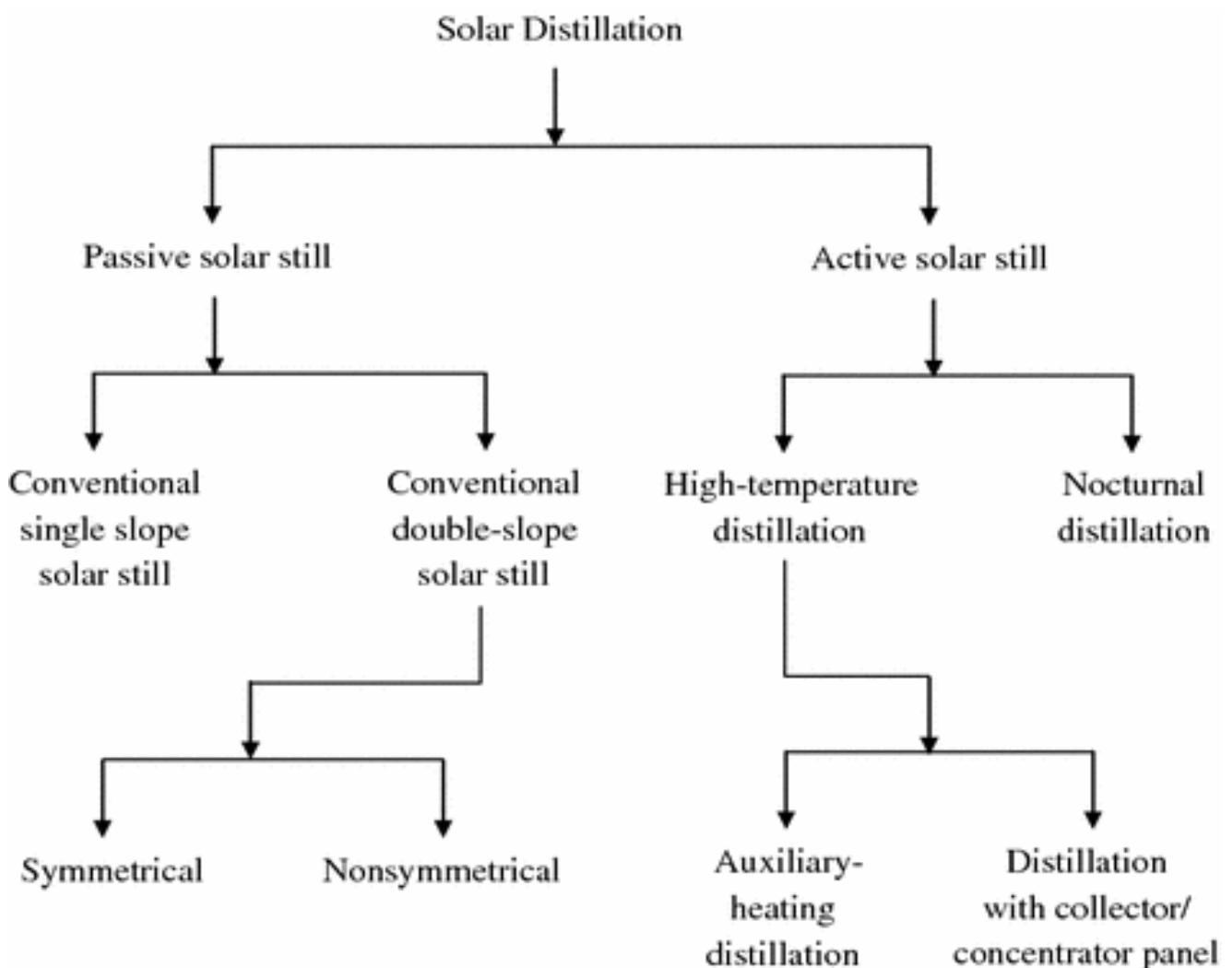
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VIII. CLASSIFICATION OF THE SOLAR STILL



These are types that comes under the solar still.

IX. APPLICATIONS

Solar stills are used in homes due to its low cost and simple procedure to work. Other than house solar stills are seen in office, hospitals and even in industries. Now a days solar still are seen in Hotels and Motels.

X. CONCLUSION

It is found that various methods are develop for distillation of water .These method are subjected to the demand of fresh water ,quality of water source and the involved expenses .Conventional reverse osmosis system are currently prevalent domestically at the cost of plenty of waste water .

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Multi-effect distillation method can be used for mass production of fresh water. The detailed review reveals that there is a need to develop a hybrid system of water purification which can overcome the limitations of all existing water purification systems.

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