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Development of Portable Solar Still Using Reflectors

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Abstract:-The purpose of this project is to design a water desalination system that can purify water from nearly any source, a system that is relatively cheap, portable, and depends only on renewable solar energy.
The motivation for this project is the limited availability of clean water resources and the abundance of impure water available for potential conversion into potable water, In addition, there are many coastal locations where seawater is abundant but potable water is not available. Our project goal is to efficiently produce clean drinkable water from solar energy conversion.
Desalination refers to any of several processes that remove some amount of salt and other minerals from saline water. This requires an energy input as heat, electricity and solar radiation could be the source of energy. When Solar energy is used for this purpose, it is known as Solar water Desalination. Solar Desalination is an attractive process to produce portable water using free of cost solar energy. This energy is used directly for evaporating water inside a device usually termed a "Solar Still. Solar Distillation is an attractive alternative because of its simple technology, non-requirement of highly skilled labour for maintenance work and low energy consumption.
The use of solar thermal energy in seawater desalination applications has so far been restricted to small-scale systems in rural areas. The reason for this has mainly been explained by the relatively low productivity rate compared to the high capital cost. However, the coming shortage in fossil fuel supply and the growing need for fresh water in order to support increasing water and irrigation needs, have motivated further development of water desalination and purification by renewable energies. In the present work, an attempt has been made to develop portable solar still using reflectors.

Keywords:solar still, saline water, solar distillation

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I. INTRODUCTION

Water is a necessity of man along with food and air. Fresh water resources usually available are rivers, lakes and underground water reservoirs. About 71% of the planet is covered in water, yet of all of that 96.5% of the planet's water is found in oceans, 1.7% in groundwater, 1.7% in glaciers and the ice caps and 0.001% in the air as vapour and clouds, Only 2.5% of the Earth's water is freshwater and 98.8% of that water is in ice and groundwater. Less than 1% of freshwater is in rivers, lakes and the atmosphere. The provision of fresh water is becoming an increasingly important issue in many areas of the world. In arid areas, potable water is very scarce and the establishment of a human habitat in these areas strongly depends on how such water can be made available.

Desalination 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. To dispel a common belief, it is not necessary to boil water to distil it. Simply elevating its temperature, short of boiling, will adequately increase the evaporation rate. Solar Desalination is by far the most reliable, least costly method of 99.9% true purification of most types of contaminated water especially in developing nations where fuel is scarce or too expensive. Solar desalination is used to produce drinking water or to produce pure water for lead acid batteries, laboratories, hospitals and in producing commercial products such as rose water. Conventional boiling desalination consumes three kilowatts of energy for every gallon of water, while solar desalination uses only the free pure power of the sun. Expensive filtration and deionising systems are even more expensive to purchase and use and will not totally purify the water by removing all contaminants.

1.1 Solar energy

The earth receives radiation from sun in the form of electromagnetic radiations. Solar energy is cheap and free from pollution. India receives solar energy equivalent to more than 5000 trillion kWh per year, which is far more than its total annual consumption.

Solar energy can be used in following applications:-

Heating and cooling of buildings, Air conditioning and Refrigeration, Solar cookers, Solar water heaters, Solar water pumping systems.

A device called Solar Collectors collects solar energy. Solar Collectors collect radiation and transfer the energy to a fluid passing in contact with it.

- **Suspended particles-** Suspended solids refer to small solid particles, which remain in suspension in water as a colloid or due to the motion of the water. Suspended solids are important as pollutants and pathogens are carried on the surface of particles. Removal of suspended solids is generally achieved with sedimentation and/or water filters (usually at a municipal level).
- **Dissolved inorganic salts-** Compounds that do not contain CARBON. Eg- Sodium chloride, sodium sulphate, magnesium chloride, magnesium sulphate, calcium chloride, calcium sulphate.
- **Dissolved organic compounds-** Compounds that contain CARBON.
  Eg- Hydrocarbons.
- **Micro-organisms-** Includes Fungi, Algae, Bacteria etc.
  Pyrogens- Fever inducing substances.
- **Dissolved gases**
  Eg- Argon, Methane, Ethylene, Carbon Mono-oxide, Carbon dioxide, Hydrogen, Heliumetc.

1.2 Water purification

Desalination: The saline water is evaporated using thermal energy and the resulting steam is collected and condensed as final product.

Vapour compression: Here water vapour from boiling water is compressed adiabatically and vapour gets superheated. The superheated vapour is first cooled to saturation temperature and then condensed at constant pressure.

Reverse osmosis: Here saline water is pushed at high pressure through special membranes allowing water molecules pass selectively and not the dissolved salts.

1.2.1 Benefits of Desalination:-

1. It produces water of high quality.
2. Maintenance is almost negligible.
3. Any type of water can be purified into potable water by means of this process
4. The system will not involve any moving parts and will not require electricity to operate.
5. Wastage of water will be minimum.

1.2.2 Needs and specifications of water purification

1. Able to purify water from virtually any source, included the ocean
2. Relatively inexpensive to remain accessible to a wide range of audiences
3. Easy to use interface
4. Intuitive setup and operation
5. Provide clean useful drinking water without the need for an external energy source
6. Reasonably compact and portable

1.3 Solar water desalination

Desalination refers to any of several processes that remove some amount of salt and other minerals from saline water. Solar desalination is a technique to desalinate water using solar energy. There are two basic methods of achieving desalination using this technique direct and indirect. Direct solar desalination produces distillate directly in the solar collector. An example would be a solar still , which traps the Sun's energy to obtain freshwater through the process of evaporation and condensation. Indirect solar desalination incorporates solar energy collection systems with conventional desalination systems such as multistage flash distillation, multiple effect evaporation, freeze separation or reverse osmosis to produce freshwater. Solar still is commonly used in desalination process. Solar still is an apparatus that uses solar radiation to distil salt or brackish water to produce drinkable water. Solar energy is a very large, inexhaustible source of energy. The power from the sun intercepted by the earth is approximately 1.8×1011MW, which is many thousands times larger than the present all commercial energy consumption rate on the earth. Thus in principle, solar energy could supply all the present and future energy needs of the world on a continuous basis. This makes it one of the most promising of all the unconventional energy sources. In addition to its size, solar energy has two other factors in its favour. Firstly, unlike fossil fuels and nuclear power, it is an environmentally clean source of energy. Secondly, it is free and available in adequate quantity. Solar water desalination is a solar technology with a very long history and installations were built over 2000 years ago, although to produce salt rather than drinking water. Documented use of solar stills began in the sixteenth century. An early large-scale solar still was built in 1872 to supply a mining community in Chile with drinking water. Mass production occurred for the first time during the Second World War when 200,000 inflatable plastic stills were made to be kept in life-crafts for the US Navy.

Human beings need one or 2 litres of water a day to live. The minimum requirement for normal life in developing countries (which includes cooking, cleaning and washing clothes) is 20 litres per day .Yet some functions can be performed with salty water and a typical requirement for distilled water is 5 litres per person per day. Therefore, $2m^2$ of solar still are needed for each person served. Solar stills should normally only be considered for removal of dissolved salts from water. For output of 1m3/day or more, vapour compression or flash evaporation will normally be least cost. Solar desalination systems can be small or large. They are designed either to serve the needs of single family, producing from ½ to 3 gallons of drinking water a day on the average, or to produce much greater amounts for an entire neighbourhood or village. In some parts of the world, the scarcity of fresh water is partially overcome by covering shallow salt-water basins with glass in greenhouse-like structures. These solar energy-distilling plants are relatively inexpensive, low technology systems, especially useful where the need for small plants exists. Solar desalination of potable water from saline (salty) water has been practiced for many years in tropical and sub-tropical regions where fresh water is scare. However, where fresh water is plentiful and energy rates are moderate, the most cost-effective method has been to pump and purify. Desalination 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. To dispel a common belief, it is not necessary to boil water to distil it. Simply elevating its temperature, short of boiling, will adequately increase the evaporation rate. In fact, although vigorous boiling hastens the desalination process it also can force unwanted residue into the distillate, defeating purification. Solar desalination is a relatively simple treatment of brackish (i.e. contain dissolved salts) water supplies. In this process, water is evaporated; using the energy of the sun then the vapour condenses as pure water. This process removes salts and other impurities. Solar desalination is used to produce drinking water or to produce pure water for lead acid batteries, laboratories, hospitals and in producing commercial products such as rose water. It is recommended that drinking water have 100 to 1000 mg/l of salt to maintain electrolyte levels and for taste. Some saline water may need to be added to the distilled water for acceptable drinking water. Generally, solar stills are used in areas where piped or well water is impractical. Such areas include remote locations or during power outages .Distillation are therefore normally considered only where there is no local source of fresh water that can be easily pumped or lifted. One of the main setbacks for solar desalination plant is the low thermal efficiency and productivity. In areas that frequently loss power, Solar stills can provide an alternate source of clean water. A large use of solar stills is in developing countries where the technology to effectively distil large quantities of water has not yet arrived.

1.3.1 Basic concept of solar water distillation

The basic principles of solar water distillation are simple yet effective, as distillation replicates the way nature makes rain. The sun's energy heats water to the point of evaporation. As the water evaporates, water vapour rises, condensing on the glass surface for collection. This process removes impurities such as salts and heavy metals as well as eliminates microbiological organisms. The end result is water cleaner than the purest rainwater. There are no moving parts to wear out. The energy required to evaporate water, called the latent heat of vaporization of water, is 2260kilojoules per kilogram (kJ/kg). This means that 'to produce 1 litre (i.e. 1kg as the density of water is 1kg/litre) of pure water by desalinating saline water requires a heat input of 2260kJ'. Solar stills use natural evaporation and condensation, which is the rainwater process. This allows for natural pH buffering that produces excellent taste as compared to steam distillation. Solar stills can easily provide enough water for family drinking and cooking needs. Solar declinators can be used to effectively remove many impurities ranging from salts to microorganisms and are even used to make drinking water from seawater.

1.3.2 Principle of solar still

Solar still works on the principle of solar distillation. A solar still duplicates the way as raining i.e. evaporation and condensation. Saline water is filled in the black painted basin of the solar still. This is enclosed in a completely air tight surface. A sloping transparent cover is provided at the top. Then solar radiations are allowed to fall on it. Solar radiation is transmitted through the cover and is absorbed in the black lining. The desalinator is designed so that an efficient amount of solar radiations is trapped inside it. This increases the internal temperature of desalinator causing the saline water to evaporate leaving behind all the salt contents, insecticides, herbicides, bacteria, viruses etc.

The resulting vapour rises and condenses as pure water on the underside of the cover and is collected in the condensate channel due to the inclination provided to the glass covers. Finally, fresh water is obtained.

- Solar still works on the principle of evaporation and condensation.
- Solar radiation falls on the solar still.
- These radiations are trapped inside the solar still.
- This evaporates the water leaving behind all the salt contents and other impurities.
- Resulting vapour rises and condenses on the glass cover and is collected in the condensate channel.
- Reflectors focus the extra radiation from sun to the still and increase the evaporation rate.

1.3.3 Working of solar still

Solar stills are called stills because they distil, or purify water. A solar still operates on the same principle as rainwater: evaporation and condensation. The water from the oceans evaporates, only to cool, condense, and return to earth as rain. When the water evaporates, it removes only pure water and leaves all contaminants behind. Solar stills mimic this natural process. A solar still has a top cover made of glass, with an interior surface made of a waterproof membrane. This interior surface uses a blackened material to improve absorption of the sun's rays. Water to be cleaned is poured into the still to partially fill the basin. The glass cover allows the solar radiation (short-wave) to pass into the still, which is mostly absorbed by the blackened base. The water begins to heat up and the moisture content of the air trapped between the water surface and the glass cover increases. The base also radiates energy in the infrared region (long-wave) which is reflected back into the still by the glass cover, trapping the solar energy inside the still (the "greenhouse" effect). The heated water vapour 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. There are no moving parts in Solar still and only the sun’s energy is required for operation. The still is filled each morning or evening, and the total water production for the day is collected at that time. The still will continue to produce distillate after sundown until the water temperature cools down. 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. The most important elements of the design are the sealing of the base with black.

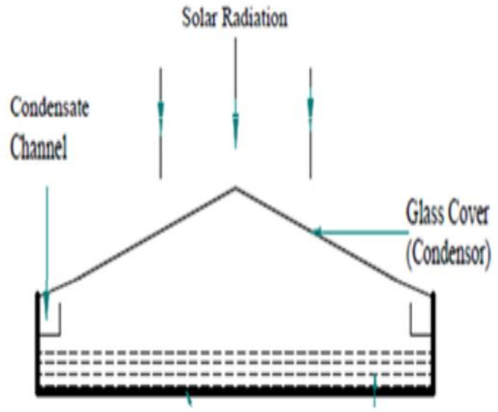

Fig 1 working principle of solar still

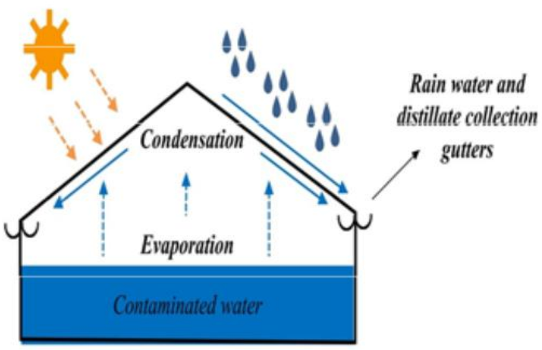

Fig 2 Working of solar still

II. LITERATURE SURVEY

Hiroshi Tanaka, Yuh-Shan Hob [1], in their paper titled “Global trends and performances of desalination research” . in which they evaluated the global scientific output of desalination research to assess the characteristics of the research tendencies and the research performances. Two main respects of the paper characteristics, performances of publication and research tendencies were analysed.

Jinesh s. Machale, prachi d. Thakur, piyush s. Lalwani andGayatri. m. Apte [2], in their paper titled “solar water purification with the help of cspTechnology”. In their paper they explained the solar water purification process by using concentrating solar pwer technology to realize a small scale single slope solar still for personal use with adequate efficiency and low production costs.

JumaYousufAlaydi[3], in their paper "Modelling of a Parabolic Solar-Collector System for Water Desalination". In which the presentation of design of parabolic trough solar collector system for water desalination was done. Along with this a comparision of concentrating collectors against conventional flat plate collectors was done.

Prof. Alpesh Mehta, ArjunVyas, NitinBodar, DharmeshLathiya [4], in their paper titled "Design of Solar Distillation System". In which they explained a model which will convert the saline water in to pure water by using solar energy. The designed model produced 1.5litres of pure water from 14litres of saline water during 6 hours. The efficiency of plant was found to be 64.37%.

TrivediHetal K, Prof. Dr. D.V. Bhatt [5], published a journal titled "Renewable resources used for seawaterDesalination". In which the sea properties of the desalination system such as phase change process, multistage flash, multiple effect boiling and vapour compression and membrane processes such as reverse osmosis and electro dialysis were studied.

Yogesh B Karhe, Mohd. AasimNazeer Ahmad [6], in their paper titled "A Review of Solar-Driven Desalination System Using Humidification-Dehumidification Process". In which the characteristics for several layout for humidification, dehumidification processes were evaluated. Along with this the mathematical model, simulation and experimental work were reviewed.

Saravanan.M and Manikandan.K [7], in their paper titled "Experimental analysis of Single Slope Stepped Solar Still with and without Latent Heat Thermal Energy Storage System (LHTESS)". In which they explained the model having two single slope stepped solar still constructed with and without latent heat thermal energy storage system (LHTESS), where paraffin bags was selected as phase change material. Thermal performance of these still with and without Latent Heat Thermal Energy storage sources were compared.

Amitava Bhattacharyya [8], in their paper titled "Solar Stills for Desalination of Water in Rural Households". In which suitable modification of solar still was done to produce suitable high output using minimum areas of plant and even in cloudy days. An overview of an upgrade version of solar still called as capillary still was explained.

Praveen T. Hunashikatti1, K. R. Suresh, B. Prathima and GulshanSachdeva [9], published a research paper entitled "Development of desalination unit using solar still coupled with evacuated tubes for domestic use in rural areas". In which a sustainable domestic water desalination process for rural India to meet the demand for portable water was explained. In this article experimental studies of single slope, single basin solar still integrated with evacuated tubes in natural mode were carried out for climatic condition of Bangalore. Along with this the chemical analysis of inlet water sample and outlet distillate was carried out and compared with Indian drinking water standards **IS-10500:2012**. It was observed that the values for the chemical composition of distillate were well below the limits of drinking water standards.

A. E. Kabeel, Mofreh H. Hamed, Z. M. Omara, S. W. Sharshir [10], published an online journal entitled "Water Desalination Using a Humidification-Dehumidification Technique A Detailed Review". In which a detailed explanation of solar humidification, dehumidification desalination technology was reviewed. Along with this thermal modelling was done for various types of Humidification-Dehumidification desalination system.

In the present work an attempt has been made to develop a portable solar still using reflectors to enhance the production rate of desalinated water.

II. FABRICATION DETAILS

The fabricated solar still consists of following parts.

Still Basin (Simple glass): It is the part of the system in which the water to be distilled is kept. It is therefore essential that it must absorb solar energy. Hence, it is necessary that the material have high absorptivity or very less reflectivity and very less transmissivity. These are the criteria's for selecting the basin materials and the material can be used is glass.

Reflectors (stainless steel): The reflectors used to increase the rate of heat absorption and concentrate the solar radiations to bottom part of the basin. These reflectors increase the still efficiency.

Top Cover (Toughened glass): The passage from where irradiation occurs on the surface of the basin is top cover. In addition, it is the surface where condensate collects. Therefore, the features of the top cover are:

1) Transparent to solar radiation

2) Non-absorbent and Non-adsorbent of water
3) Clean and smooth surface. The Materials can be used is Glass.

Heat Absorbing Coating: Black paint is used as the coating to absorb the maximum radiation. The black coating is painted only in the bottom surface of the basin

Channels: The condensate that is formed slides over the inclined top cover and falls in the passage, this passage which fetches out the pure water is called channel. The material can be used is PVC and the outlet channel is provided to remove the impurities and salt contents which are settled at the bottom.

Sealant: Arolditeand silicon glues are used to join Glass and channels. Silicon Glue is used to seal the gap, make the still airtight, and leak proof.

Supply and delivery system: two holes are made on the sidewall to collect fresh condensate water. One hole is made to supply the salt water and one hole is made at the bottom to remove the collected salt and other impurities.

Black coating: Solar radiation transmitted through transparent cover is absorbed in the black lining. Black bodies are good absorbers. Black oil paint is used as liner.

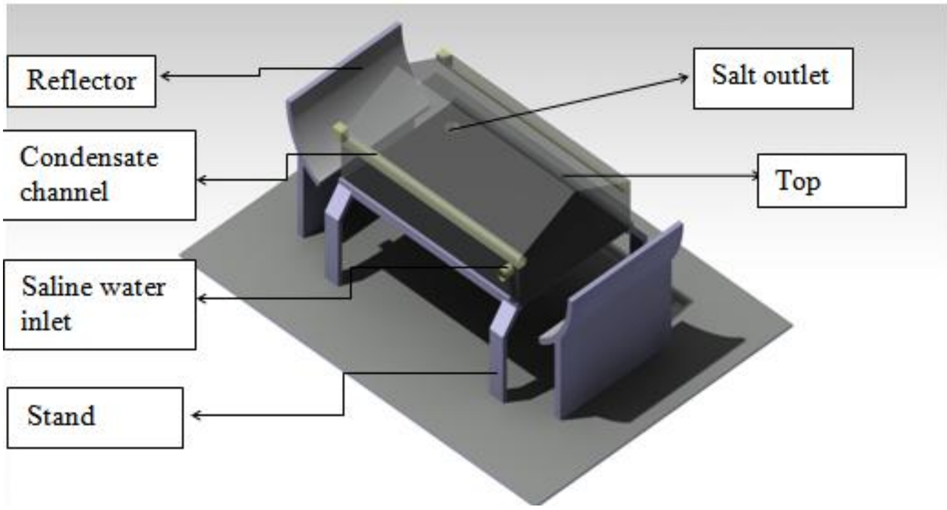

Fig 3 : 3-D model of solar still

2.1 Properties of components used

2.1.1 Top cover (Toughened glass)

Toughened or tempered glass is a type of safety glass processed by controlled thermal or chemical treatments to increase its strength compared with normal glass. Tempering puts the outer surfaces into compression and the inner surfaces into tension. Such stresses cause the glass, when broken, to crumble into small granular chunks instead of splintering into jagged shards as plate glass (aka: annealed glass) creates. The granular chunks are less likely to cause injury. Toughened glass is physically and thermally stronger than regular glass. The greater contraction of the inner layer during manufacturing induces compressive stresses in the surface of the glass balanced by tensile stresses in the body of the glass. For glass to be considered toughened, this compressive stress on the surface of the glass should be a minimum of 69 mega pascals (10,000 psi). For it to be considered safety glass, the surface compressive stress should exceed 100 mega Pascals (15,000 psi). The greater the surface stress, the smaller the glass particles will be when broken. It is this compressive stress that gives the toughened glass increased strength. This is because any surface flaws tend to be pressed closed by the retained compressive forces, while the core layer remains relatively free of the defects, which could cause a crack to begin. Any cutting or grinding must be done prior to tempering. Cutting, grinding,and sharp impacts after tempering will cause the glass to fracture. The strain pattern resulting from tempering can be observed with polarized light or by using a pair of polarizing sunglasses.

2.1.2 Base glass (ordinary glass)

Chemical property

Glass will resist most acids with the exception of hydrofluoric, and at high temperatures phosphoric acid. Alkalis will attack the surface of unprotected glass. General water-born materials from surrounding surfaces and the atmosphere may leave deposits on glass, these should be removed for longevity and optimal performance.

Strength

Glass is a strong building material with greater capacity to resist compression than stretching or sudden impact.

- Compressive strength = 248 MPa for a 25mm cube

- Tensile strength = 20 MPa as a modulus of rupture (highly variable depending upon the glass).
- Impact strength – Highly variable depending upon shape, hardness and velocity of impacting object.
- Hardness scale – Around 6.0 on Moh's scale of hardness and 575 Knoop hardness.

Light transmission

Clear glass is not completely transparent, a 6mm-thick piece of clear float glass will capture around 13-percent of light within the visible spectrum, allowing 87-percent of the visible light to pass through it. As the wave-length of light moves away from the visible range, the transmission changes and for many frequencies, glass is quite opaque. Almost as though it was created for our viewing pleasure and natural light transmission. Glass is relatively transparent to short wave infra-red but opaque to long-wave infra-red.

Weight

Glass, like water, can be deceptively heavy even in relatively small physical sizes. Glass has a density of 2,500 kilograms per cubic meter, making it approximately 2.5 times heavier than the equivalent volume of water and heavier for its size than many other building materials.

Temperature performance

Glass is created at high temperature and will return to liquid form if heated sufficiently. This can be a problem for fire-resistance. Glass products made for fire protection are enhanced with the addition of substrates, laminates and other technologies to maintain rigidity at high temperature. The most common temperature issue with glass is not 'high temperature' but 'thermal endurance'. Normal 6mm-thick float glass will rupture if heated to 75-degrees Celsius and plunged into 20-degree Celsius water (a temperature differential of 55 degrees)

2.1.3 Reflectors (stainless steel)

The reflectivity of mechanically polished (MP) stainless steel containing 18% Cr and 10% Ni was found to be 8–10% lower than with the same material polished electrochemically (EP) at 80°C in a solution of 60% H_3PO_4, 20% H_2SO_4, and 20% H_2O. The SIMS analysis showed that the surface layer in the case of MP stainless steel contained about 15 times more Al than in the case of EP, γ-Al_2O_3 particles embedded in the surface layer are responsible for the lowering of reflectivity compared with the EP samples.

2.1.4 Silicon adhesive

Silicones are extraordinarily versatile. They can bond materials together with enormous power or exceptional lightness, be designed for permanence or temporary adhesion. The excellent adhesion properties of silicones come from their chemical structure. This allows them to bind together materials that were traditionally difficult to unite – such as glass, metal and stone. With silicone technology, formulators are able to define the exact characteristics of the bond needed. Silicones have special properties compared to other adhesives based on organic polymers because silicones have a different chemical backbone. They remain highly elastic at low temperatures, -100oF (-75°C), and also have very good temperature stability; up to 390oF (200°C) continuous exposure and up to 575oF (300°C) for short periods. The properties of silicones remain virtually unchanged over this temperature range. Silicones are nearly inert to chemicals and have excellent resistance to moisture and weathering. Bonds made with silicones can, however, only be subjected to relatively small mechanical loads. That is why they are chiefly used as sealants. Due to their low surface tension they cannot be painted. They are used for bonding metal when the low bond strength is offset by the higher flexibility and resistance to low temperatures.

III. RESULTS AND DISCUSSIONS

Table No:1 Chloride test

Sl. No.	Test sample	Chloride content (mg/ltr)	IS-10500-1991 Desirable limit
1	Sample 1 (Water collected from sea)	8779.54	250 Max
2	Sample 2 (Condensate obtained from solar still without reflector)	1538.00	250 Max
3	Sample 3 (Condensate obtained from solar still with reflector)	226.00	250 Max

The table 1 shows the results of the chloride test conducted for the various samples. It is observed that the sample 1 water collected from sea has chloride content of 8779.54 mg/ltr. But it is very much higher than the desirable limit. Sample 2 which is the condensate obtained from the solar still without reflector and its chloride content was found to be 1538.00 mg/ltr. Even though there is a decrease in the amount of chloride content compared to that of sample 1, even this was high above the desired limit(250 mg/ltr). The sample 3 which is the condensate obtained from the solar still with reflector, when subjected to chloride test, it was found that the chloride content in it was 226.00 mg/ltr. This amount is well below the desirable limit of portable water(250 mg/ltr).

Table No:2 Quantity of water collected without using reflectors

• Sl. No.	• Time (Hours)	• Temperature inside solar still (°C)	• Quantity of water collected (ml)
• 1	• 1	• 45	• 300
• 2	• 3	• 55	• 1000

Table 2 shows the quantity of water obtained from the solar still without the reflector for different time period. When the saline water was kept in the solar still for a time period of 1 hour, the temperature inside the solar still increased to about 45°C. The quantity of portable water obtained at this condition was about 300ml. When the same quality of saline water sample was kept inside the solar still for about 3 hours, the temperature inside solar still increased to about 55 °C, yielding portable water of about 1000ml.

Hence it is observed that the quantity of portable water obtained from the solar still increases with time and temperature.

Table No:3 Quantity of water collected with using reflectors

• Sl. No.	• Time (hours)	• Temperature inside the solar still (°C)	• Quantity of water collected (ml)
• 1	• 2	• 60	• 1000

Table 3 shows the quantity of condensate obtained from solar still with reflector for different time periods. When a sample of saline water was placed inside the solar still with reflector for about two hours, the temperature inside the solar still increased to about 60 °C. The quantity of condensate obtained at this condition was about 1000ml. Thus comparing table 2 and 3, it is clear that the use of reflector in the solar still, influences the quantity of condensate obtained. Hence by using the solar still with reflector, the more amount of portable water can be obtained in less amount of time compared to that solar still without reflector.

IV. CONCLUSION

Distillation is a method where water is removed from the contaminations rather than to removecontaminants from the water. Solar energy is a promising source to achieve this. This is due tovarious advantages involved in solar distillation. The Solar distillation involves zero maintenancecost and no energy costs as it involves only solar energy which is free of cost.

As seen in the previous table 4.2 and table 4.3 the time required to collect the water by using reflectors is less than that of without using reflectors.

The fabricated model serves as a solar still that consumes less time for producing fresh water from saline water. As reflectors are used in the model, the time consumption for the production will get decreased and also higher temperature can be obtained inside the basin.

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