

A review on the potential of Solar Energy for Desalination system

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Abstract:

The use of solar energy in seawater purification application has so far been restricted to small scale system in rural areas. In India there is wide scope of using solar water purifier because sunlight is present almost throughout the year in places like Thar desert (Rajasthan), southern India, on coastal region. Distillation is the process of removing undesirable chemical, biological contaminants, solid particles from water. In the present study, a review on the solar energy for the distillation system has been conducted for different types of solar distillation systems.

Introduction

Water is necessary for human body along with food and air to live. Fresh water resources are lakes, rivers and underground water reservoir. Planet earth is cover about 71% in water yet of all that 96.5% of the planet water is found in ocean, only 1.7% in groundwater, 1.7% in glaciers and ice caps , only 2.5% of earth water is fresh water and 98.5% of that water is in the form of ice and underground water . Less than 1% earth water is present in rivers, lakes.

The use of solar energy in seawater purification application has so far been restricted to small scale system in rural areas. The reason for this has mainly been explained by the relatively low productivity rate compared to high capital cost. However, the coming shortage in fossil fuel supply and growing need for fresh water in order to support increasing water and irrigation needs, has motivated further development of water distillation and purification by renewable energies.

In India there is wide scope of using solar water purifier because sunlight is present almost throughout the year in places like Thar desert (Rajasthan), southern India, on coastal region . The geographical location of India is beneficial for the generation of solar energy.

History of Distillation System

Solar water distillation is a solar technology with a very long history. Use of solar scale began in sixteenth century. Large scale solar still was built in 1872 to supply drinking water to mining community in Chile. Mass production of solar still was start during second world war when 200,000 inflatable plastic still were made to be kept in life craft for the us navy. Indian is tropical country and its receive solar radiation almost every day which amount to 3000 hours of sunshine. This is equal to more than 5,000 trillion kWh. Almost all parts of India receive 4-7 kWh of solar radiation per sq meters. This is equivalent to 2,300–3,200 sunshine hours per year. States like Andhra Pradesh, Bihar, Gujarat, Haryana, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, and West Bengal have great potential for tapping solar energy due to their location. Since majority of the population lives in rural areas, there is much scope for solar energy being promoted in these areas. Use of solar energy can reduce the use of firewood and dung cakes by rural household.

APPLICATION OF SOLAR ENERGY

- **Homes:** Use of solar energy is increasing in homes as well. Residential appliances can easily use electricity generated through solar power. Besides this solar energy is running solar heater to supply hot water in homes. Through photovoltaic cell installed on the roof of the house energy is captured and stored on batteries to use throughout the day at homes for different purposes. In this ways expenditure on energy is cutting down by home users.
- **Commercial use:** on roofs of different buildings we can find glass PV modules or any other kind of solar panel. These panels are used there to supply electricity to different offices or other parts of building in a reliable manner. These panels collect solar energy from sun, convert it into electricity and allow offices to use their own electrical power for different purposes.
- **Ventilation system:** at many places solar energy is used for ventilation purposes. It helps in running bath fans, floor fans, and ceiling fans in buildings. Fans run almost every time in a building to control moisture, and smell and in homes to take heat out of the kitchen. It can add heavy amount on the utility bills, to cut down these bills solar energy is used for ventilation purposes.
- **Power pump:** solar power not just help in improving ventilation system at your homes but with that it can also help in circulating water in any building. You can connect power pump with solar power supply unit but you must run it on DC current so that water circulate throughout your home.
- **Swimming pools:** swimming pools are great joy for kids and adults in all seasons. But during winters it is tough to keep water hot in these pools with minimum power usage. Solar energy can help many in this matter as well. You can add a solar blanket in the pool that will keep the water hot with energy generated from sunlight. Besides this you can install a solar hot water heating system with solar hot water heating panels.
- **Solar Lighting:** these lights are also known as day lighting, and work with help of solar power. These lights store natural energy of sun in day time and then convert this energy into electricity to light up in night time. Use of this system is reducing load form local power plants.
- **Solar Cars:** it is an electrical vehicle which is recharged form solar energy or sunlight. Solar panels are used on this car that absorb light and then convert it into electrical energy. This electrical energy is stored in batteries used with the car, so that in night time as well we can drive these vehicles.
- **Remote applications:** Remote buildings are taking benefit of solar energy at vastscale. Remote schools, community halls, and clinics can take solar panel and batteries with them anywhere to produce and use electric power.

Distillation System

It is the process of removing undesirable chemical, biological contaminants, solid particles from water. The goal is to produce water that is fit for specific purpose. Most water is purified for human consumption especially for drinking but water purification is also designed for various purpose. For example medical, pharmacological, chemical and industrial applications. Method used include physical processes such as

filtration distillation, biological process such as sand filtration and chemical process include chlorination and the use of electromagnetic radiation such as ultraviolet light. Water purification is a very important piece of research in today's world, and so many scientists are doing research on it. There are a lot of methods being studied and are currently being used in the world to purify polluted water. These are all used for many reasons across the world. For instance, the softening of water is used to make water pure enough to use in sterilization processes in hospitals. According to C. Schultz in an article in PM Engineer in 2004, -Water softening is usually accomplished by passing the raw water over a bed of granular sodium cation-exchange resin. This process removes these dissolved impurities that cause hardness by replacing them with sodium ions. This is just an example of deionization. (Schultz. 2004) Filtration is an excellent way to purify water with large particulates. Filtration is done by running the water through a layer of filters, often permeable stone or plastic filters. When the water is forced through, any solids get stuck within the layers of filters. Water is also chemically purified, a process reserved only for bacteria and other microorganisms. Iodine and chlorine are added to the water to help clean it, killing off microorganisms. Chemicals also react with one another, neutralizing the water and making it safer to drink. A much more common water purification technique- one of the most common used- is called reverse osmosis. While used in hospital sterilization, it also is used to purify laboratory grade water and industrially applied water. Reverse osmosis simply reverses normal osmosis, which is also a purification technique, the flow of water from a point of low concentration of solution to a point of high concentration through a semi-permeable membrane. This is reversed with the application of pressure. (Dialysis Fluid Purity. 2002) As feed water flows over the membrane, a percentage is forced through due to pressure, becoming purified water called the permeate. The rest of the water that has the pollutants, chemicals and particulates is drained away, leaving only the permeate. This is the most effective method to purify water of heavy metals for kidney dialysis patients, who require some of the cleanest water possible. In laboratories, it is not pure enough for Type I laboratory water according to the National Committee for Clinical Laboratory Studies. Type I requires about 100 times the purity of reverse osmosis water. The procedure's produce is good for Type III laboratory grade water, however, which generally is used for quantitative analysis. Reverse osmosis is also used in industrial practices. It produces both of the common industrial water types, purified water and water for injection, but water for injection requires an extra round of reverse osmosis. (Schultz. 2004) Another quite common type of water purification is deionization. This process neutralizes all ionized chemicals in the water by passing it through ion-exchange resins. The big drawback to using this type of water purification is how little it decontaminates water with organics in it. The process of deionization does nothing to destroy organic chemicals, bacteria or other microorganisms. This is a large problem. The process is used in conjunction with both reverse osmosis and the other main water purification technique, distillation, to create Type I purified laboratory grade water, which is extremely pure. (Schultz. 2004) There is also a type of deionization called continuous deionization or electrode ionization.

It is a process of, according to C Schultz (2004) -continuous water purification process that uses direct current, permeable membranes and a mixed-bed ion exchange resin. This is used with reverse osmosis to

produce water with a very low bacterial content, which is more pure than typical ionization. (Schultz. 2004) Another water purification technique that is common is the process of distillation. While more costly in energy than reverse osmosis, it is very effective across the entire range of contaminants, eliminating organic and ionized chemicals, particulates of matter and much of the bacteria in the feed water. The water is boiled so that the water evaporates as steam, leaving most of the contaminants behind. The resulting condensate is then collected in a separate vat as pure water. The drawback is that it is extremely energy intensive. It requires a lot of energy to boil the water and to make it evaporate, but the good thing is that boiling water is fairly easy to do in multiple ways (Schultz 2004).

Conclusions

Distillation was used in the experiment, but boiling the water to take out impurities is something that can be done in many ways. Solar distillation is one of the most common. There are two types- passive and active solar distillation. Passive distillation is less productive than active, as it simply uses solar energy absorbed into the unit. The water absorbs the heat and is distilled from pollutants, chemicals, microorganisms and particulates like a normal distillery. Active solar distillation uses extra thermal energy supplied through an external mode to speed up evaporation of water and so increase the rate at which the water is purified. In 2009, 327 portable solar powered water purification systems were deployed to Iraq to help stop an outbreak of cholera. The machines, purchased by the Iraqi government, now provide safe clean drinking water for 600,000 people. Thus, upon viewing the several advantages of solar water purifier, it can be said that this technology must be used on a very large scale and it is a very good prospect for future.

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