

Solar Desalination using CPC and Heat Pipe

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Abstract: In India as well as around the world there is abundance of water but scarcity of potable or usable water. The basic idea of the project is convert unusable sea water into desalinated water using renewable energy. To get the desired results we have used a Compound Parabolic Concentrator (CPC) which focuses the solar energy. A heat pipe is combined with the CPC to maximise the efficiency.

Keywords: Compound Parabolic Concentrator (CPC), Heat Pipes, Desalination, Solar Energy.

I. INTRODUCTION

Increasing population demands for more usable water. Scarcity of water is a major common problem. There are quite a few water purification techniques like Reverse Osmosis (RO), filtration, sedimentation, chlorination etc. These techniques are often expensive and non-eco-friendly.

Solar Energy is one of the most abundantly available green energy sources. It is harnessed using various techniques like solar panels, solar cells, photovoltaic cells etc.

As we know, the need of the hour is maximum use of clean and renewable energy sources. There is a necessity to develop a technique which uses renewable energy (solar energy) for water desalination.

Hence, we have come up with a solution which integrates solar energy with water purification using Compound Parabolic Concentrators with Heat Pipes.

II. DESCRIPTION

A. Field of Experiment

The project includes the use of CPC combined with a Heat Pipe to desalinate water used for residential purposes.

B. Methodology

The sunrays get concentrated in the CPC at its base. This heat which is generated further heats the liquid solution in the heat pipe. The heat pipe is placed slanting at the base of the CPC. The heated solution from the heat pipe goes to the insulation box, where the sea water is kept.

Heat exchange takes place in the insulation box and the sea vaporises. These vapours are further condensed, thus we get pure distilled water.

C. Major Components Used

• Compound Parabolic Concentrator

CPC is an efficient solar energy collector. It concentrates a large amount of sunlight in small area with minimum

loses. It can reduce the required solar cell area by four times, depending on the angle of acceptance. Moreover, CPC is a concentrator which does not require solar tracking.

Considering the size and concentration ratio of the CPC we selected the angle of acceptance to be 30 degrees. Material selected is lexan polycarbonate corrugated sheet. It has excellent light transmission, uniform light diffusion, and is both sides UV coated. More importantly it is easy to manufacture into a CPC.

• Heat Pipe

A heat pipe is a device which allows high heat transfer with minimum losses. The choice of the operating liquid depends on the operating temperature range and material compatibility.

For example, water with copper, ammonia with aluminium, etc. The approximate temperature range for various operating fluids is

– H₂O (30-200°C), Na (600-1200°C), NH₃(-60 – 100°C).

• Heat Exchanger Box

In the heat exchanger box the sea water gets evaporated due to the heat exchange taking place between the heat pipe and sea water.

This vapour is further condensed to form pure distilled water. The residue of salts and other contaminants are collected in a separate tray. The insulating material prevents heat losses.

• Biomass Gasifier

A biomass gasifier converts solid biomass into heat by certain chemical processes. The advantage of a biomass gasifier is that it produces clean energy.

During the period of year when the sunlight is weak a biomass gasifier can be used as a secondary source so that the process of desalination is not halted.

The following figure shows the basic layout of the setup

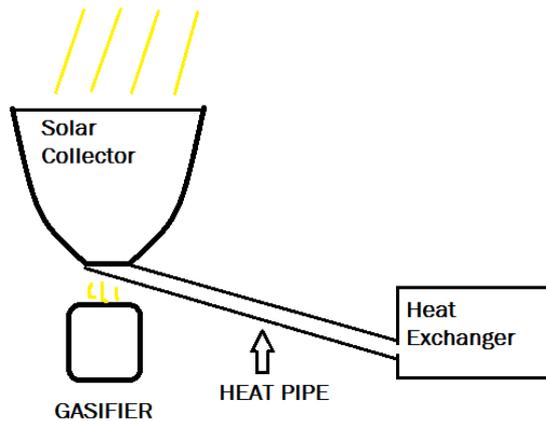


Fig.1 Basic Layout of the Setup

III. CONCLUSION

A CPC and Heat Pipe based system thus is a effective use of renewable energy to obtain desalinated water. This is done without the use of electricity and thus can be used in rural and coastal parts of the country.

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