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Desalination of Water using Non-Imaging Optics and Solar Still

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Abstract: In this world desalination of water is highly energy consuming process where they spend million tons of fuel, on the other hand use of conventional energy is polluting the environment. In this paper we explain the new non-conventional way for desalination of water by solar energy using non imaging optics as a solar concentrator and solar still.
Keywords: solar still, solar energy, compound parabolic concentrator.

I. INTRODUCTION

On earth we have only 2.5% of total available water as fresh water which we generally obtain from lake, river as well as underground water, and rest of the water is salinated water which mainly occurs in sea/ ocean. In this world approximately 1.1 billion people do not have adequate access to safe drinking water. There are 26 countries which do not have enough water to maintain agriculture and economic developments which have serious periodic droughts. If we could make use of the remaining 99% of water by processing it to make safe drinkable water, hence the scenario will be better. But in that matter excess
amount of energy is needed which is used in desalination of water.

Many researches are being held on renewable energy sources more efficiently to make the least use of conventional non renewable energy sources. At present we are surrounded with massive quantity of solar energy which is being wasted every day. In upper atmosphere $17.4*10^4$ terawatts of incident
energy is available from which 30% of it, reflects back to atmosphere. Modern science has come up with the technology which converts this solar energy into usable form of energy, which is being used here for the desalination of sea water using solar energy with the use of non-imaging optics along with solar still.

A. Non Imaging Optics

Non imaging optics is the branch of optics which deals with the maximum transfer of light radiation from source to the target. Non imaging optic has ability to give sunlight of concentration up to 84000 time the ambient intensity of sunlight and approaching the theoretical limit of heating objects upto the temperature of sun's surface. We can design the non-imaging optic by method of string based on "Edge ray principle" conveniently.

Compound parabolic concentrator is used here as a non imaging optic to concentrate sunlight as a source to hit target which is solar still in our case study.

The concentrating ratio of CPC is highest amongst all the collectors, with the large aperture area so tracking only for certain season is required. Even for efficiency we can add a sun tracking arrangement which will make our cpc moving instead of static. Sun tracking system is the combination of the machine vision and Data Acquisition by using web camera as a sensor and sound card as an output channel to the initial starter motor. Motor will react as a mechanism to make camera focus on the target of sun. Camera is sensor of the system, be eye of a human to take care and observe sun. Because we track the sun at every moment and acceptance angle is constant, the voltage, current, and power received will be maximum always.

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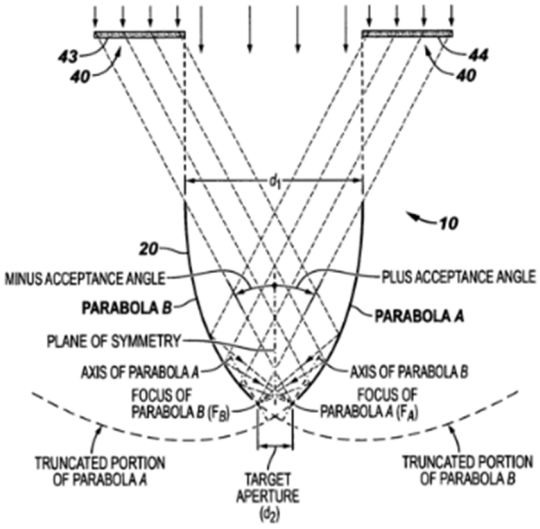
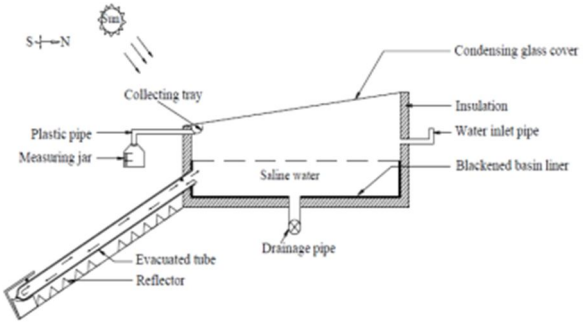


B. Solar Still

Solar still uses the greenhouse effect to evaporate salty water. The function of the solar still is to extract pure water from salinated water. The radiation of sun evaporates water from a chamber which is covered by a glass at a higher temperature. As black colour is the great absorber of heat or energy the base of solar still is plated with black colour, the material used for colouring the basin can be a dye or charcoal. The saline water is poured into the basin (black plated) which is the lower portion of solar distiller which is made up of mild steel, in upper portion of solar still there is a glass or plastic transparent film where the vapour of the water condenses. The preference for the material of upper film is glass because- water vapour faces difficulty to condense at plastic surface as compared to glass, and in case of plastic there may occur the degradation of plastic due to ultraviolet radiation. The glass used in solar still should be thick enough so that it cannot be break. The upper part of the solar still have a slant cut on which glass rests, by which condensed dropped accumulate in one side from which it further takes to the reservoir of pure water.



II. METHODOLOGY

The compound parabolic concentrator**(cpc)** along with the solar tracking has been arranged at the top face of the device to receive the sun rays from the source. The cpc used here is moving type and has flexibility to move in the direction of sun to get maximum intensity of radiation and make acceptance angle constant.

Solar still is placed below cpc, and the concentrated or the high intensed radiation fall on the surface glass of the solar still, which then penetrate through it and comes in the black plated basin where the salinated water is kept to be processed. The still act as a heat trap because the glass is transparent to the incoming sunlight but opaque to the outgoing radiation emitted by the hot water. The saline water get vaporised and the water vapour goes up to the glass and get condense there. By placing the fan in the solar still it is possible to increase the evaporation rate.

The condensed water droplets at the inner surface of the glass trickles down due to gravity and through channel it is stored in the collector.

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III. CONCLUSION

In this paper, solution to desalinate water using renewable source of energy that is solar energy has been presented.
Instead of conventional parabolic concentrator, here compound parabolic concentrator is used hence efficiency is increased.
By this method we can produce 6-7L of water per m^2 per day which can be sufficient for a family.
This method is purely eco-friendly and non-polluting.
This method of desalination of water ensures one time installation cost and less maintenance is required.

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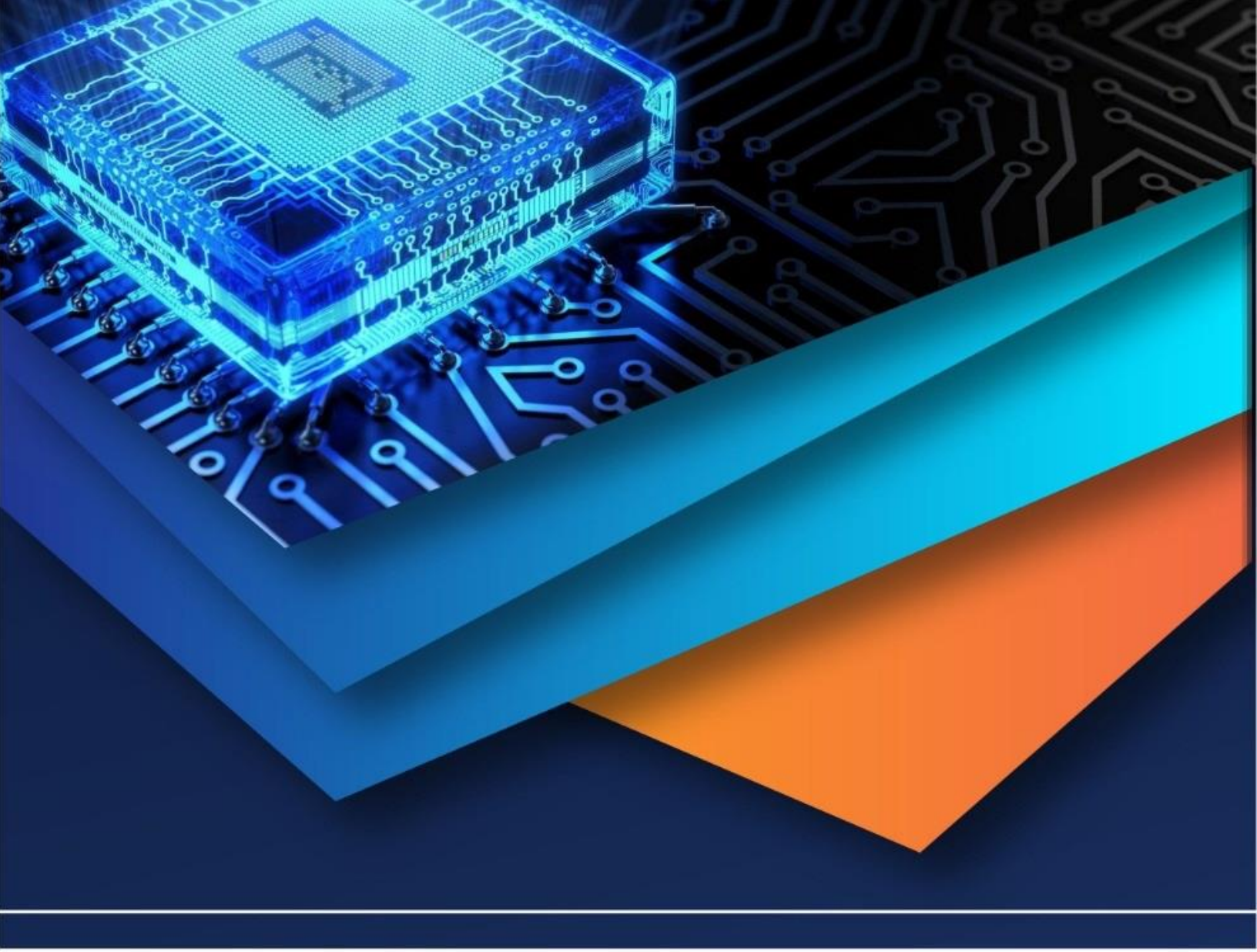

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