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"A REVIEW ON SOLAR POND TECHNOLOGY"

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ABSTRACT

Solar energy is an abundant and renewable energy source. The annual solar energy incident at the ground in India is about 20,000 times the current electrical energy consumption. The use of solar energy in India has been very limited. This is because solar energy is a dilute energy source (average daily solar energy incident in India is5 kWh/m² day) and hence energy must be collected over large areas resulting in high initial capital investment; it is also an intermittent energy source. Hence solar energy systems must incorporate storage in order to take care of energy needs during nightstand on cloudy days. This results in further increase in the capital cost of such systems. One way to overcome these problems is to use a large body of water for the collection and storage of solar energy.

Keyword: *Solar pond, energy, salt water,CFD, pcm*

I. INTRODUCTION

Heat may be used in a variety of contexts and result in significant savings in terms of fossil fuel consumption. Various chemical, culinary, and textile goods can be manufactured with the use of the pond's extracted heat. In addition to heating greenhouses and swimming pools, the pond's heat may be utilised to warm cattle barns. The organic Rankine cycle engine, which uses the heat to generate electricity, is a cost-effective and efficient way to transform solar energy into usable forms in rural areas. Through desalination, the solar pond can clean water for municipal systems, and it can also be used to dispose of brine left over from the offshore drilling process to obtain crude oil.

SOLAR POND

Individuals may also use a solar pond as a collector if you don't need really high temperatures for your project. Applications in industry and agriculture at low temperatures, as well as heat and energy generation, water desalination, and more, are all possible with this versatile resource.

It takes use of an elementary phenomena to function. Hot water causes the lake or pond's surface to rise. Salt is put to a solar pond to act as a thermal mass, with the concentration of the salt increasing with depth. Due of its density, it remains on the ground, preventing the sun's warmth from escaping into the atmosphere. When the sun hits the water, the temperature can reach over 90 °C, but the surface of the pond is often only around 30 °C.

There are three distinct layers of water in the pond:

- The upper layer, also known as the surface, or UCZ (Upper Convective Zone), is the warmest part of the atmosphere. It has barely any salt.
- The hot zone, or lower convective zone (LCZ), is located at the bottom of the water column (Lower Convective Zone). 70–85 ° C. The salt content is rather high. The power it provides comes mostly from the

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heat it produces.

- The separation zone is referred to as the "NCZ" (Non-Convective Zone). As one delves deeper into this region, the concentration of salt increases. Since the water above a certain layer is less dense due to its reduced salt content, that water cannot rise into the lower layer. Sunlight is trapped by the salt gradient, which also functions as an insulator.

The acquired energy is of a somewhat low quality and can only produce temperatures of around 70–80 °C. Larger systems, on the other hand, may be constructed for far less money by utilising a membrane to cover the pond. While these solar ponds might be built anywhere, but are also most effective when situated near the ocean.

Principal of solar pond

In a clear natural pond about 30~ solar radiation reaches a depth of 2 metres. This solar radiation is absorbed at the bottom of the pond. The hotter water at the bottom becomes lighter and hence rises to the surface. Here it loses heat to the ambient air and, hence, a natural pond does not attain temperatures much above the ambient. If some mechanism can be devised to prevent the mixing between the upper and lower layers of a pond, then the temperatures of the lower layers will be higher than of the upper layers. This can be achieved in several ways. The simplest method is to make the lower layer denser than the upper layer by adding salt in the lower layers. The salt used is generally sodium chloride or magnesium chloride because of their low cost.

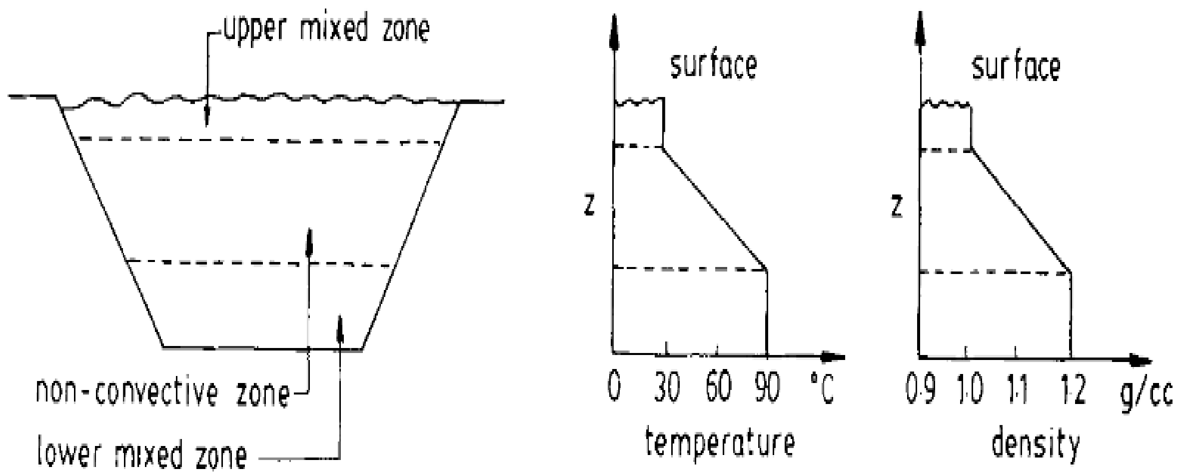

Fig. 2 Different zones in a solar pond

II. LITERATURE REVIEW

Anjum (2021) investigated, Essential oil from several agricultural plants has recently been extracted using a solar distillation technique. Traditional distillation devices are inefficient and often powered by hot gases. The solar-powered distillation system, on the other hand, is based on renewable energy and is far more efficient. “There is a Scheffler reflector *concentrator*, a newly designed steam receiver, distillation still, steam condenser, florentine flask, and a biomass-based boiler that make up the redesigned solar distillation system.” Utilizing CFD, the pattern of steam flow and temperature distribution was studied when a circular perforated pan was placed to the still's bottom. In order to get the most out of the distillation still for extracting essential oils, the CFD simulations indicated that steam distribution uniformity was necessary. Mathematical modelling was used to assess the dispersion of energy at various points in the newly designed solar distillation system. “Different investigations found that the production of essential oils from fresh Rosemary and Cumin was 0.17% w/w and 1.11% w/w, respectively.” Adding a perforated pan and steam receiver to an existing solar distillation system increased its efficiency by 8 percent.

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Jegadheeswaran (2021) Energy is a very variable factor in driving people's enormous energy needs on a worldwide scale. There are many potential sources of energy, but solar has the most staggering potential. Clean solar energy is a viable solution to environmental degradation and water scarcity. A look back at recent years' worth of advances in solar pond technologies, solar desalination, and the integration of the two systems is provided in this article's review section. The solar pool is a thermal energy storage technology that acts as a massive solar radiation collector to absorb and store energy from the sun. The thermal energy stored in the solar pool is categorised as light. Therefore, improvements are essential to improve performance. Tests are conducted first on the usage of unusual salts and other additions. Thereafter, inventive empirical studies and several layers are displayed in an effort to minimise heat losses from the top and lower levels. Methods of extracting heat from the heat-storage region and its analysis using math are explored. Additionally, a solar desalination plant is a viable option for turning any type of unclean water into drinkable supplies (marine, brackish and contaminated water). A solar still is a simple apparatus that makes use of condensation and evaporation to purify water using solar energy. In this study, we attempted to categorise the many still designs that are mass-produced. To arrive at a conclusive verdict, it also examines the mechanism of thermal energy transmission and the latest advancements in the field. Since the efficiency of a desalination plant is proportional to the temperature of the water entering the plant, a solar pond connected to a desalination unit can improve the performance of a standard desalination system. Utilizing a brine concentration and recovery system in addition to a multi-stage flash, fins, and a flat plate collector increases the useful output of a solar pond used for desalination. This in-depth analysis will serve as a roadmap for future scientists who aim to improve pond and desalination unit performance.

Yılmaz (2021) Researchers have paid particularly close attention to solar energy in recent years. Large-scale solar energy applications and associated projects are on the rise to fulfil the rising worldwide need for energy. Solar power is attractive because it is cheap, clean, and renewable. This research seeks to empirically and quantitatively explore the effects of various solar air heating wall (SAHW) plenum and absorber combinations.

Sathyamurthy (2021) demonstrates The solar still is a simple device that uses sun energy to purify salt or brackish water that is readily available. Higher water temperatures inside the solar still basin are required for distillate production. Water temperature is observed to be lower in a solar still due to the fixed area and fixed quantity of solar energy intensity input, leading to decreased distillate yield. Surface area has a significant part in raising the water temperature; consequently, fins may be connected with a solar still to raise the surface area and, in turn, the water temperature.

Arellano-Garcia (2020) investigated Collecting and storing solar energy with solar ponds is a promising technique. In order to evaluate the thermal efficiency of salinity gradient solar ponds, thus, accurate, trustworthy, and flexible models are required. In order to get a model applicable to any real-world scenario, a CFD simulation setup were developed in this work. In order to further analyse the improvement in accuracy as well as the increase of processing resources required, this study compares the findings obtained to use an existing onedimensional MATLAB model with those created with the two- and three-dimensional CFD models developed here. "When compared to a 1-D model, the accuracy of 2-D and 3-D models is much improved. These approaches offer reasonable estimates of heat loss to the environment, irradiance absorbed by the solar pond, and annual thermal performance. Bafgh, Iran, and Kuwait City, Kuwait, were researched.

III. CONCLUSIONS

Solar pond and the heat from solar radiation heats up a pond, its heat energy is retained inside the lowermost layer, allowing it to function as both a heat source. From the literature review the following can be drawn as gaps in the current research work. ―Latent heat thermal energy storage is constantly attractive method to store thermal energy due to because of its capacity to give high energy storage density and its property to store heat at nearly constant temperature to the phase transition temperature of phase change material (PCM).

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REFERENCES

[1] Afzal, A., Munir, A., Amjad, W., Alvarado, J. L., Umair, M., Azam, M., & Anjum, M. N. (2021). Use of Perforation and Mathematical Modeling to Increase Solar-Based Steam Distillation System Efficiency. Journal of Solar Energy Engineering, 143(6).

[2] Sathish, D., & Jegadheeswaran, S. (2021). Evolution and novel accomplishments of solar pond,desalination and pond coupled to desalination systems: a review. *Journal of Thermal Analysisand Calorimetry*, *146*(5), 1923-1969.

[3] Panchal, H., Mevada, D., & Sathyamurthy, R. (2021). The requirement of various methods to improve distillate output of solar still: a review. *International Journal of Ambient Energy*, *42*(5), 597-603.

[4] Anagnostopoulos, A,Sebastia-Saez, D.,Campbell, A. N., & Arellano-Garcia, H. (2020). Finite element modelling of the thermal performance of salinity gradient solar ponds. *Energy*, *203*,117861.

[5] S El-Sebaey, M., Ellman, A., Hegazy, A., & Ghonim, T. (2020). Experimental analysis and CFD modeling for conventional basin-type solar still. *Energies*, *13*(21), 5734.

[6] Adhikari, K., & Fedler, C. B. (2020). Pond-In-Pond: an alternative system for wastewater treatment for reuse. Journal of Environmental Chemical Engineering, 8(2), 103523.

[7] Chakrabarty, S. G., Wankhede, U. S., Shelke, R. S., & Gohil, T. B. (2020). Investigation of temperature development in salinity gradient solar pond using a transient model of heat transfer. Solar Energy, 202, 32-44.

[8] El Kadi, K., Elagroudy, S., & Janajreh, I. (2019). Flow simulation and assessment of a salinity gradient solar pond development. Energy Procedia, 158, 911-917.

[9] Verma, S., & Das, R. (2019). Concept of triple heat exchanger-assisted solar pond through an improved analytical model. Journal of Solar Energy Engineering, 141(5).