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ACADEMIC PROFLIE

- Ph.D. (Thermal engineering) from N.I.T Raipur
  (Research area: Solar desalination)
- M. Tech. (Energy systems and pollution) from N.I.T. Raipur
  (Research area: Solar thermal energy)
- B.E. in (Mechanical) from RIT Raipur

ACADEMIC ACHIEVEMENTS

- Cleared GATE 2007 with AIR-507.
- Cleared GATE 2008 with AIR-378.
- Gold medalist in M. Tech**.**
- Cleared Indian Engineering Services (Written)

ACADEMIC EXPERIENCE

- Assistant Professor in Department of Mechanical Engineering of SSIPMT Raipur from July 2009 to till now.
- Assistant Professor in Department of Mechanical Engineering of NIT Raipur from July 2007 to July 2009.

ADMINISTRATIVE EXPERIENCE

- PG Coordinator (Production Engineering) in SSIPMT Raipur from July 15 to till now.

PROJECTS UNDERTAKEN

- Jet mixer nozzle design for ARTSON ENGINEERING LIMITED (subsidiary of TATA projects limited)
- CO PI in CSVTU TEQUIP III Project

RESEARCH AND PUBLICATIONS

- **(SCI Journal)** Performance analysis of desalination system working on humidification-dehumidification coupled with solar assisted air heater and wind tower: Closed and open water cycle, Solar energy, March 2020.

- **(SCI Journal)** Solar desalination system integrated to use waste heat of air conditioners for continuous output: suitable for coastal areas, Desalination and Water Treatment, August 2019
- **(ESCI/Scopus Journal)** Comparative thermal analysis of applications using novel solar air heater with u-shaped longitudinal fins: suitable for coastal regions, journal of thermal engineering, accepted, march 2020.
- **(Scopus Journal)** Performance analysis of solar humidification dehumidification desalination system for improved productivity by using waste heat of household chimney, International Journal of Recent Technology and Engineering (IJRTE**),** April 2020
- **(Scopus Journal)** Performance evaluation of arc welding processes for the manufacturing of pressure vessel using novel hybrid MCDM technique, Accepted 2020.
- **(International journal)** A Review on Performance Analysis of Desalination System Working on Humidification-dehumidification Technique, IJRASET, April 2018.
- **(International journal)** Technical Analysis of Desalination System Working with Bubbler Humidifier, International journal of research, May 2018.
- **(International conference)** Performance enhancement of solar humidification dehumidification desalination system by the waste heat of household chimney, SSIPMT Raipur , January 2020
- **(International conference)** Conceptual Analysis of Desalination System working on Humidify and Dehumidify Technique using Solar Air Heater *(*Proceeding of International Conference on Mechanical and Robotics Engineering, May 26-27, 2012 Phuket, Thailand, pp 73-79.)
- **(International conference)** Techno-Economic Analysis of Solar Desalination System working on Humidification and Dehumidification Technique for Climatic Condition of Central India, Proceeding of National Conference on Renewable Energy Sources for

Sustainable Climate Organized by Bag Energy Research Society in Collaboration with IIT Delhi and CERD, IIT BHU at Varanasi , (U.P) , India, from 7th to 9th February 2017.

PERSONAL PROFILE

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Gender - Male

Hobbies - Listening Music

DECLARATION

I hereby declare that the information given above is true to the best of my knowledge and belief.

Date : 05/03/2020

Place : Raipur **Dr. Taranjeet Sachdev**

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Research Article

Comparative thermal analysis of applications using novel solar air heater with u-shaped longitudinal fins: suitable for coastal regions

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Solar energy; Air heater; Fins; Desalination; Solar drying

ABSTRACT

The aim of the present work is to analyse a novel solar air heater configured with U-shaped longitudinal fins. The application of the proposed air heater for freshwater production and agriculture drying has also been analysed for the coastal area of India. The results are motivating for use of the proposed air heater for household requirements and smallscale industrial purposes to improve the earning in coastal regions. The mathematical model for time-dependent behaviour of the proposed air heater has been prepared by considering the energy balance of air heater components and solved to get the outlet temperature of the air from air heater. The results proved that the heater is suitable for the desalination and drying of many agricultural products. The effect of operating parameters has also been analysed to find suitable values for freshwater production. Optimum air mass flow rate of 160 kg/hr in air heater has been found whereas higher water temperature in the storage tank and lower temperature of cooling water in dehumidifier found suitable for higher yield of freshwater. In the drying process, significant improvement has been observed compared to direct solar drying and conventional air heater with 12 hours drying time for banana slices and 10 hours for garlic was found.

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INTRODUCTION

Solar energy is nature's gift to mankind that has been helped to face the energy and water crisis due to growth in population and industrialisation. The solar air heater is a simple yet effective techniques to utilise solar energy in many applications like space heating, desalination, and industrial or agricultural drying. These applications always motivate for improvement in the performance of air heaters. The present work deals with the analysis of novel flat plate air heaters with U–shaped longitudinal fins for effective

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Performance analysis of desalination system working on humidification-dehumidification coupled with solar assisted air heater and wind tower: Closed and open water cycle

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Keywords:
Wind tower
Humidification
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Solar air heater

ABSTRACT

The world which is hot and arid strives for fresh water and thermal comfort, thus there are two basic requirements. In this work, performance of wind tower in combination with solar air heater assisted humidification-dehumidification desalination system working with closed and open air water cycle is analysed ***numerically*** for cooling effect and fresh water production. The behaviour of system has been studied by different air flow rate in tower, temperature drop due to energy stored in wall and clay conduits, temperature drop due to evaporative cooling, humidity of moist air available for cooling, amount of potable water produced in dehumidifier and its variation with design and operating variables.

A mathematical model based on fluid flow, heat transfer, energy and mass balance in components of system has been developed. Study reveals that comfort condition is achieved mainly by evaporative cooling in wind tower. Optimized column height is found as 8–9 m suitable to design the wind tower with 65% decrease in air velocity, 31% decrease in air temperatures and change in relative humidity up to 90%, however 42% reduction in water requirement in humidifier is also achieved at 5 m height with a cooling effect of 3.5 kW. Air mass flow rate of 0.032–0.035 kg/sec in solar air heater found suitable with maximum productivity of 5 and 4.2 kg/day for closed and open water cycle respectively. Water mass flow rate of 0.035–0.038 kg/sec in dehumidifier has been found suitable for 200% increase in productivity.

1. Introduction

It is well established need of world that potable water and thermal comfort are utmost desired entity of today particularly for hot and arid regions. The aim of this paper is to analyze the performance of an innovative combined system to fulfill the need of potable water and cooling requirements in the want of thermal comfort. The proposed combined system uses the wind towers to provide ventilation and passive cooling in the regions where climate allow the air to absorb moisture, thus evaporative cooling can play its role effectively. Wind towers are designed in such a way that they catch the air at higher elevation this air is cooled by evaporative cooling by passing the same through a wet mesh of porous clay and then directed to pass through the required areas of building by the forced suction created as depicted in Fig. 1. Use of renewable energy of wind in place of electricity and no emission of greenhouse gases are the characteristics which makes the wind tower an economical option to fight against the energy crisis and pollution.

This moist air that has well served the rooms for cooling is adequately containing water vapor because of being processed through evaporative cooling. This highly moist air is the best raw material to give potable water by dehumidification of this air. Hence humidifying the air for thermal comfort and dehumidifying for potable water is the technique proposed in this paper. Thus above mentioned two important needs of human beings can be attained by the system proposed. This humidification-dehumidification desalination process is very attractive because of the characteristics like (i) low operational temperature, (ii) suitability with sustainable energy sources, (iii) less technical complications (iv) suitable with small scale production.

1.1. Advances in wind tower

Wind tower is a construction which is designed to provide ventilation and passive cooling of buildings. Temperature of ambient air reduces significantly when it passes through the wind tower due to sensible cooling provide by tower walls and evaporative cooling provided

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Solar desalination system integrated to use waste heat of air conditioners for continuous output: suitable for coastal areas

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ABSTRACT

In this work, a solar desalination system working through cyclic humidification and dehumidification and also utilizing waste hot air of air conditioner is analyzed numerically for the production of potable water during day and night both operations. The productivity of the proposed system is investigated for different operating and design variables and compared with a conventional system by simulation of a mathematical model based on energy and mass conservation of considered components in transient behavior using MATLAB. During simulations, climatic and geographic condition of Mumbai (India) is used due to the availability of saline water, humid air and the high annual operation of air conditioners. In proposed system air is heated by a double pass solar air heater whereas the saline water is heated by the hot air coming out from the air-cooled condenser of air conditioning unit particularly during day hour operation. The same arrangement is used to heat both air and water during night hours. The use of hot air from the condenser of air conditioner proved beneficial by increasing the yield by 21%–31% per day that depends under different operating and design conditions. Air mass flow rate of 0.032–0.035 kg/s in air heater found suitable and resulted in maximum productivity of 6 kg/d. The mass flow rate of cooling water at 0.038 kg/s has been found suitable with a maximum productivity of 7 kg/d. Need for higher Initial water temperature in a storage tank with a productivity of 8.2 kg/d at water temperature 46°C and low temperature of cooling water in a dehumidifier with a maximum productivity of 10 kg/d found by the analysis. Productivity variation in the range 4–10.2 kg/d has been found as the heater area varied from 0.5 to 2.5 m^2. The proposed system found suitable to work in a region with higher wind speed and ensured better utilization of thermal energy with gained output ratio close to 1.

Keywords: Desalination; Humidification; Dehumidification; Solar energy; Heat transfer

1. Introduction

Water is a basic human requirement but continuous rise in the world's population and industrial growth has resulted in a growing demand for fresh water supply. Water is available in abundant quantities in nature in the form of saline water but natural resources of freshwater are limited and declining in quality due to industrial, agricultural and domestic wastes. Desalination seems to be a promising solution to face water shortage problem but most of the commercially famous techniques are expensive due to high energy consumption[1] and suitable for large scale production (100–50,000 m^3/d) [2]. Humidification-dehumidification (HD) desalination technique is emerging as a successful source of freshwater as it can be easily coupled with renewable energy sources for the thermal requirement and suitable for small scale water production. HD desalination system coupled with solar energy can perform effectively only during day hours when solar radiations are available.

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Performance Analysis of Solar Desalination System for Improved Productivity by using Waste Heat of Household Chimney

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Abstract: ***This work deals with the analysis of the proposed innovative humidification-dehumidification (HD) desalination unit in which waste hot air of kitchen chimney has been used for heating brackish water. The proposed system is configured with solar air heater also, thus both heated air and heated water has been used to improve the water yield of desalination unit compared to conventional system. Mathematical modeling of propose unit based on energy balance of flat plate air heater, humidifier, dehumidifier and brackish water tank has been used to evaluate the effect of operating condition. Potable water yield found to increase (with highest productivity of 6.5 kg/day) when mass flow rate of process air increases from 0.6 kg/min to 3 kg/min. Strong dependency of water mass flow rate has also been found as productivity increases (with maximum value of 6.7 kg/day and 7.5 kg/day) by increasing the mass flow rate of brackish water in humidifier and cold water in dehumidifier respectively. The higher initial temperature of brackish water also found beneficial as it increases productivity. Finally, the thermal performance of desalination unit has been evaluated in terms of Gain in Output Ratio and comparison has been made with conventional system. The higher GOR of the proposed system ensures the better utilization of thermal energy in potable water production.***

Keyword*: air heater, desalination, dehumidification, heat transfer, humidification, solar energy.*

I. INTRODUCTION

Nature has blessed mankind with many blessings to survive on earth. Solar energy and seawater are such two resources which can help to face water crisis arise due to surge in industrialization and growth in population. Many desalination techniques are available to convert the huge resource of saline water into potable water but most are facing the problem of high energy requirement. Humidification dehumidification (HD) desalination system has emerged as simple yet effective technique for potable water production with characteristics to easily couple with solar energy for thermal energy requirements. The improved devices for utilization of solar energy and innovation in system design can play an important role in productivity enhancement of HD desalination systems.

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This work presents the performance analysis of an innovative solar HD unit that uses the waste hot air of household kitchen chimney for heating water before supplying it to the humidifier whereas process air has been heated by flat plate solar air heater. Thus proposed system utilizes the fact that increased air and water temperature increases the moisture absorbing capacity of air which finally turns into higher yield of potable water.

Many studies and innovations have been done to enhance the productivity of systems working on HD principle. Bourouni et al. and Ettoney et al. [1] - [3] presented the state of art of HD desalination system and evaluated the scope of renewable energy in potable water production. Cemil et al. [4] analyzed the performance of the solar humidification dehumidification unit to find the key parameters and their effect on water yield. Tiwari et al. [5] numerically evaluated the performance of solar HD system to find the optimum rate of air and water flow in the system. Mohamed et al.[6] investigated solar HD sytem with the help of experimental setup and productivity found to 25 % more in theoretical analysis compared to experimental results.

Hamed et al. [7] performed an experiment to study the solar HD unit equipped with water heater which found beneficial with productivity of 22 L. Zubair et al. [8] presented performance and cost analysis of solar-driven HD unit at multi locations of Saudi Arabia with maximum productivity of about 20000 L. Xin [9] investigated the influence of mass flow rate ratio on energy consumption of the HD unit and presented the graphical method to find the optimum value of operating parameters method.

Zhani [10] performed an experimental analysis of new solar desalination working on humidification dehumidification principle. The HD unit was designed and fabricated to perform an experimental study under different operating conditions. An economic study was also conducted, to determine the cost of potable water and payback period. Sachdev et al. [11] performed mathematical analysis to identify the performance of solar HD system using waste heat of air-conditioners in climatic conditions of coastal areas. The effect of various operating and design parameters on productivity has been studied.