

Comparative Analysis of Efficiency of Evaporative Air Cooler with Two Different Cooling Pad Material

Rakesh Roshan¹, Upendra parashar²

1 & 2, Research Scholars, SRCEM Banmore Gwalior, (M.P), India)

ABSTRACT: Air cooler has become a most essential house hold good of all classes of the society. In the summer seasons the temperature shoots 50°C and above. The existing desert cooler serves the purpose undoubtedly. But it has some demerits. It consumes more water quantity .It becomes ineffective during rainy season when relative humidity have greater values. Maximum part of the water gets wasted. The present research work is an attempt to reduce the water consumption and power consumption in the field of air cooler .In the present work in place of khus a cotton based cooling pad has been used as evaporator. An extra fan has been used to have effective evaporation. In order to understand the physical phenomenon of desert cooler over the evaporative system, the experimental investigation of cooling system without using pads and save water 70% to 80% depends on atmospheric condition. In this investigation four different temperature were taken. During the experiment an excellent result was noticed. Almost same bypass factor was observed for the half the value of water consumption by the existing desert cooler. Also the present cooler showed the better relativehumidity value than the existingone. Therefore it gives more comfort than the existing one.

Keywords:cooling pad, Fan, water tank, cooling tower.

INTRODUCTION: Evaporative cooling has many benefits and advantages over other forms of cooling .It is the healthiest way to cool your home .It uses clean fresh airto replace the air in your home many times an hour. The air inside the house is fresh re-circulated it means smells are expelled.

Evaporative cooling is also an inexpensive cooling option it is 50% cheaper to install and seven time to cheaper to run than refrigerated cooling

- Air conditioning effect (temperature obtained is less than 8 to 10 as compared common cooler)

- Storage space for perishable goods
- Evaporative dessert cooler constant humidity to human comfort level.

This Evaporative dessert cooler is less expensive than other appliances available in the market (airconditioner,cooler,Etc.) & consume less electricity .the Evaporative dessert cooler can be used in homes, office, banks, auditorium hall etc.



In the above shown fig. the evaporation media is khuselements. Air coming into contact of watercarry away water particle, water getting evaporated and air gets cooled. Herewater takesits latent heat of vaporization from air and reduces the air temperature.

LITERATURE REVIEW: Shrivastava et al.,in his paper investigates the performance of coconut coir fiber, in evaporative cooling pads . This pads are fabricated and tested on law cast desert cooler use in this region .the results are coconut coir fiber pad similar cooling effectiveness of near about 60% and the relative humidity also drop. Observed 80to 85% Aspen wood to 50-60% of coconut coir pad the coconut coir pad from 27to 32°C commercial development pads good performance and easily availability all over the country the life of coconut coir pad as compared to aspen wood pad is more.

Ashok Kumar Sharma and Pawan Bishnoi in his paper discussed to save electricity. The developed desert cooler which is described in this paper uses naturally blowing air to generate the effect the cooling effect. The naturally blown air is circulated inside the room through desert cooler. A testing setup is present which was prepared to test the effectiveness of this cooler. This experiment is clearly providing cooling without using electricity for blowing the air.

Chandra Kant B. Kothari and Nitin Borkar It is the modification of the conventional desert cooler. It is the air conditioner cum refrigerator for people who can't afford costly equipment's like air conditioner, refrigerator and other such appliances. In this modification mostly make, a purifier humidity controller and connecting tubes or pipes. The desert cooler can be used to store regular food items, vegetables and fruits etc.

Vivek W. Khond Evaporating cooling requires an abundant water source a an evaporate and is only efficient when the relative humidity is lowest restricting its effective use to dry climates. In this paper investigate a performance of desert cooler using four different pad materials in terms of cooling. Efficiency, water consumption and air velocity pads of stainless steel wire mesh coconut coir, khus and wood wool were fabricate and tested using a laboratory scale experimental arrangement maximum water consumption in wood wool pad (0.21lit/min) also shown less water consumption rate as compare to convectional wood wool pad. Maximum and minimum cooling efficiency have found in wood wool pad and stainless steel wire mesh pad.

PROPOSED WORK -The main disadvantages of the desert cooler is, it produces excessive noise and it consume more electricity. More ever it carries water with its air stream and consumes more water too. In the proposed work a cooling pad has been designed such that cotton layers have been wrapped over a cylindrical duct and a cotton based cooling pad is developed. In the above mentioned cooling pad air is cooled without coming into direct contact with water or coolant eliminating the problem of desert cooler with khus as evaporative media without much more variation in the efficiency of the cooling pad.

RESEARCH METHODOLOGY: IN this project a working desert evaporative cooler was developed to study the change in bypass factor of an evaporative cooler. The cooling effect of the cooler was experimented at various temperature. Relative humidity was also observed and the whole experimental result was compared with the existing

desert cooler in which the khus made cooling pad was used as the evaporative element.

COOLING TOWER: The cooling tower is mounted at the top of the cooler. The water flow is made to strike onto the bowl of the cooling tower. The water droplets passes through the air flow and gets cooled before it passes through the cooling duct.



THE STRAINER: The strainer is used at the exit of the cooled air flow. The purpose of strainer is to eliminate the extra water particle from the air stream. It has number of small passage through which when air stream passes the suspended water particles gets drained.



The cooling pad: The cooling pad is an aluminum sheet hollow duct. A one cm thick cotton layer has been wrapped around the duct. The cold water from the cooling tower is made to fall on the cooling pad. It takes the heat from the hot air flowing through the duct. Evaporation takes place at the cotton pad leaving the duct cold.



THE EXHAUST FAN: The exhaust fan is used through the cold air from the cooling duct to the cabin bringing down the temperature the temperature

of the cabin. It also limits the flow of the air stream to the cabin. An exact dia and r.p.m exhaust fan should be used to maintain the temperature of the cabin.



Cooling duct: Cooling duct is the hollow aluminum sheet duct on which the cooling pad has been provided. The cooling duct allow the air stream to pass through and air gets cooled in this section. It has a flanged portion at its end to receive the strainer.



Full Assembled desert cooler experimental model:



EXPERIMENTAL RESULTS:

Efficiency of the two cooler at various Wet Bulb temperatures.

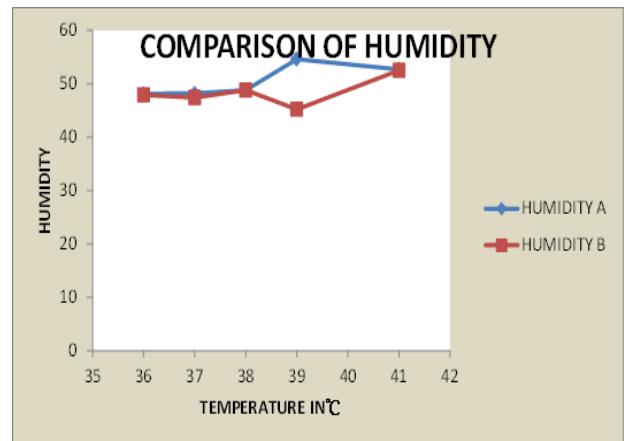
S.no	T1	T2	Td	Tw	η 1	η 2
1	37	32.0	32.8	30	71	70.3
2	38	32.5	32.5	31	80	79.5
3	36	30.4	30.7	28.3	76.4	76.4
4	39	33.0	33.3	31.2	76.9	76.0
5	41	34.2	34.5	32.9	79.7	79.1

TABLE-1

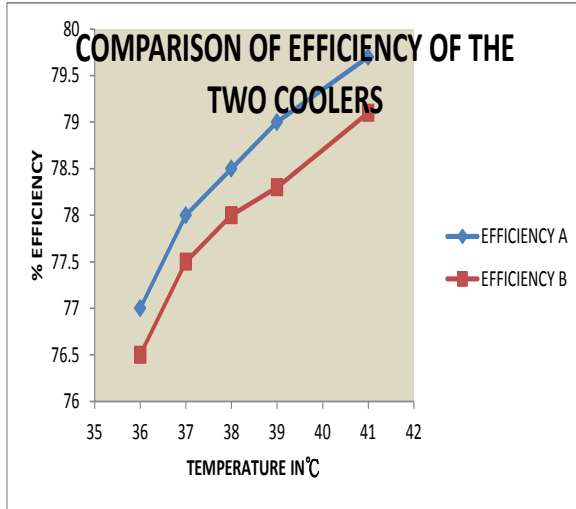
Relative humidity of two coolers at different temperatures.

SL .No	T1	T2	Td	Tw	H1	H2
1	37	32	32.8	30	48.2	47.4
2	38	32.5	32.5	31	48.8	48.8
3	36	30.4	30.7	28.3	48.1	47.9
4	39	33.0	33.3	31.2	45.6	45.2
5	41	34.2	34.5	32.9	52.7	52.5

TABLE – 2



Graph A



Graph B

CONCLUSION: A detailed study on the whole result and experimentation has been done. All the important points were kept in mind during the experiment. The cost effect and the comfort of the user was also taken into consideration. After a detailed study and experimentation following points were observed.

- The bypass factor of the desert cooler are nearly same for the half the value of water consumption by the desert cooler model.
- Humidity can be controlled to an extent in the cooler model where as it is not possible in the existing cooler one.
- During rainy seasons cooler is more effective than the existing one.

Future scope: More experiments can be carried out by using different cooling pad and a detailed study can be done on relative humidity and bypass factor.

References

- [1] Gilani, N. and Shariaty-Niassar, M., 2009, "An investigation of indirect evaporative coolers (IEC) with respect to thermal comfort criteria." Iranian Journal of Chemical Engineering. 6(2), 14-28.
- [2] Srivastava Krishna, Deshmukh Dhirajand M.V. Rawlani, 2007, "Experimental analysis coconut coir evaporative cooler" International Journals of Innovative Research in Science Engineering and Technology. 3:297:2007.
- [3] Al-Sulaiman, F., 2002, "Evaluation of the performance of local fibers in evaporative cooling." Energy Conversion and Management. 43(16), 2267-2273.
- [4] Kothare, C. B. and Borkar, N. B., 2011, "Modified desert cooler (MDC)". International Journal of Engineering and Technology. 3 (2), 166-172.
- [5] Poonia M.P., Bhardwaj A., Upender P., Jethoo A.S., 2011, "Design and development of energy efficient multi-utility desert

cooler." Universal Journal of Environmental Research and Technology. 1, 39-44.

[6] Khond, V. W., 2011, "Experimental investigation of desert cooler performance using four different cooling pad materials." American Journal of Scientific and Industrial Research. 4:18-421.

[7] Erens, P. J. and Dreyer, A. A., 1993, "Modeling of indirect evaporative coolers." International Journal of Heat and Mass Transfer. 36 (1), 17-26.