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Development of Desert Cooler Design to Control Humidity and Temperature

Abhishek Pratap Singh, Anuj Kumar Jain**, Darpan vashishtha***, Manveer Singh**** and Chaitanya Bhatia******

ABSTRACT

Normal desert cooler works on the process of evaporative cooling and as a result moisture content of the air is increased. A normal desert cooler in the time of monsoon & in humid regions are not very effective. So, aim is to develop an air cooler which doesn't humidify the air and cools it sensibly and hence can be used during the monsoon season as well. This is a type of dual mode cooler which can Work Both As A Normal Desert Cooler And Can Be Switched To Non-humidifying whenever needed like in monsoon season or rainy days. In this mode, the water is made to pass through the tubes and water does not come in direct contact with the air and therefore no water is added into the air. It is found from the experiment a decrease of around 3-4 (°C) in room temperature. However this cooling effectiveness is a little lower than the conventional desert cooler. But the positive is that this cooling is without a significant increase in the humidity level of the air .This cooling can further be increased by using a material of higher thermal conductivity and also by increasing the area covered by the tubes.

Keywords: *Desert Cooler; Indirect Evaporative Cooling; Cooling Efficiency; Wet Bulb Temperature; Wet Bulb Depression; Humidity Control; Temperature Control.*

1.0 Introduction

Normal desert cooler works on the process of evaporative cooling and hence the moisture content in the air is increased due to this. Indirect evaporative cooling is an effective method where we don't want to compromise with the humidity of the air.

In Indirect evaporative cooling direct contact of air and water does not take place and so the humidity content is not increased. Water will be flowing in the tubes of high thermal conductivity materials like Al and the air is forced to come in contact with these tubes and not directly with water.

This leads to decrease in temperature of the air. For different temperature of water, the temperature of the tubes is measured apart from the room temperature and from this we get an idea of the cooling of the cooler.

2.0 Design

This cooler consists of all the parts of a normal cooler namely fan, pump, sump tank, water distribution line etc. This cooler has the same design as a normal desert cooler apart from one additional feature.

This contains all the above mentioned accessories which facilitates in the sound working of a cooler. There is an additional feature added in the form of Al tubes.

When the humidity of the air is high the water can be made to flow through the tubes which will deliver the water to the sump tank. Water is pumped back again to the top of the tubes and this cycle continues.

The cooler is more effective when placed in a closed room as the recirculation of the same room air again and again is more effective than taking new warmer air from outside.

**Corresponding Author: Department of Education, CRS University, Jind, Haryana, India (E-mail: abhishekp@ncuindia.edu; anujkjain@ncuindia.edu)*
*** Department of Education, CRS University, Jind, Haryana, India*
**** Department of Education, CRS University, Jind, Haryana, India*
***** Department of Education, CRS University, Jind, Haryana, India*
****** Department of Education, CRS University, Jind, Haryana, India*

Pump is bigger than normal one, because proper pressure of water should be maintained.

3.0 Fabrication, Testing and Results

A different arrangement is used for water supply, for this 12 mm diameter Al tube is used in entire three windows. This will work as a heat exchanger, for extracting cooling effect from cold water.

An experiment was performed to evaluate the cooling of the cooler with varying water temperatures and the room temperature at that time. Ice is used for the purpose of cooling the water and after certain time readings are taken. Infrared laser is being used to measure the temperature of the water and the tubes. The room temperature at different interval is also measured .Following are the results found out from the experiment:

Normal room temperature - 31 (°C).

Fig 1: Design of Tubes

Fig 2: Infrared Laser Gun Reading

Table 1: Temperature Measurement

S.N.	Time	Temperature of Water (ºC)	Temperature of Tube (ºC)	Room Temperature (ºC)	Outside Temperature (ºC)
1.	1Hr	15.1	21	28	39
2.	3Hr	19	24	26.7	39.6

Table 1: Humidity Measurement

	Pads		Tubes	
	DBT	WBT	DBT	WBT
Temperature	29.8	26.2	31.6	22.4
Saturation Pressure (KPa)	4.1	3.7	4.4	2.5

With pads: P(wv) = 3.46, Relative humidity = 84.5 %

With tubes: P(wv) = 1.89, Relative humidity = 43.16%

4.0 Conclusions

The cooler can work as a dual mode cooler which can be used as a normal desert cooler in the normal time and in non-humidifying mode when the humidity level of the air is high. This cooler can help with the problem of humidification of the air From the results of the experiment this can be concluded that with the decrease in the temperature of the water, the cooling of the air also increases Also with the increase in the conductivity of the tube material; the cooling of the air will also increase.

Also the increase in the density of the tubes i.e. more area covered will increase the cooling. The wastage of the water in the cooler is far less than the normal desert cooler as the water is flowing in a closed cycle So this cooler can also find application in water deficient areas.

The cooler will be more effective when it is placed inside a closed room and recirculation of the same air takes place.

References

[1] Apte, Michael G., et al. Report on HVAC option selections for a relocatable classroom energy and indoor environmental quality field study." Lawrence Berkeley National Laboratory, 2001.

[2] Duan, Zhiyin, et al. "Indirect evaporative cooling: Past, present and future potentials." Renewable and Sustainable Energy Reviews 16(9),2012, 6823-6850.

[3] Xie, Xiaoyun, and Yi Jiang. "Comparison of Two Kinds of Indirect Evaporative Cooling System: To Produce Cold Water and To Produce Cooling Air." Procedia Engineering 121, 2015, 881-890.

[4] Reichmuth, Howard, et al. "Assessment of Market-Ready Evaporative Technologies for HVAC Applications." Vancouver, WA: New Buildings Institute, 2006.

[5] http://removeandreplace.com/2013/03/18/how-does-an-evaporative-cooler-swamp-cooler-work

[6] http://www.airah.org.au/imis15_prod/Content_Files/TechnicalPublications/AIRAH_residential_evap_cooling_bpg.pdf

[7] https://en.wikipedia.org/wiki/Evaporative_cooler#Physical_principles