Review on Design and Fabrication of 360 Cooler

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Abstract- *There are so many air conditioner are designed for the home conditioning. "360 Cooler cum Heater" is a new air conditioner with water evaporating-cooling humidifier, based on the demand of home air conditioner. Evaporative cooling has a great many advantages over other cooling processes. Due to the eco-friendly it is one of the healthiest ways to cool ones workplace or living place because of the fact that it uses clean fresh air and replaces the air many times an hour. Doors can be left open allowing one to enjoy the summer. It allow 360 directional cooling .Moreover, evaporative cooling is also an inexpensive cooling option which enhances the lifestyle of people. Manufacturers have come out with different shaped evaporative coolers. The performance of these coolers in terms of efficiency and cooling capacity needs to be analyzed. Therefore a theoretical study of performance of evaporative cooler with different cooling pad shapes and materials is made. Saturation efficiency decreases with increase in mass flow rate of air having highest value rectangular (89 %) pads. Padding media play a major part in cooling efficiency. This work investigates the performance of Desert Cooler using different pads in terms of cooling efficiency, water consumption and air velocity for a sustainable and economic application.*

Keywords- Direct Evaporative coolers, cooling pads, khus-grass, 360 exhaust fan, heating coil.

I. INTRODUCTION

Only in recent years, The EVAPORATIVE cooling is one of the earliest methods employed by men for conditioning their houses as well as it has been sound footing thermodynamically. It is a adiabatic saturation process of air when a spray of water is made to 360 EVAPORATIVE into it without transfer of heat from or to the surroundings. The initial investment cost of this system is low as well as the operation is simple & cheap.Direct evaporative cooling introduces water directly into the supply airstream (usually with a spray or some sort of wetted media). As the water absorbs heat from the air, it evaporates and cools the air.

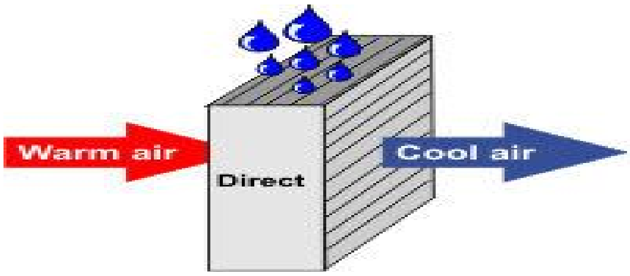

Fig a) Direct evaporative cooler

In direct evaporative cooling the wet bulb temperature remains unchanged but dry bulb temperature is lowered. The operation is carried out in a blower by which air pulls through a permeable, water-soaked pad. In this pad air is filtered, cooled, and humidified. A recirculation pump keeps the media wet, while air flows through the pad. An automatic refill system replaces the evaporated water. The efficiency of direct cooling depends on the pad media.

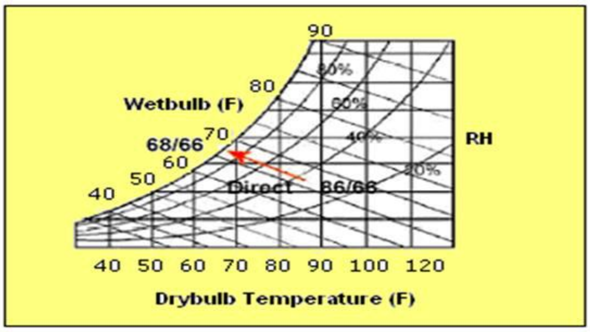

Fig b) Cooling path for direct evaporative cooler

Simple 360 EVAPORATIVE cooling is achieved by direct contact of water particles & a moving air stream. If the source of heat & cooling is not present in circulated water then dry air will become more humid & temperature will decreases. In a complete contact procress, the air would become saturated at WBT of the entering air. Saturation efficiency is given by

$$\epsilon = \frac{T_1 - T_2}{T_1 - T_{wb}}$$

Cooling capacity is given by

$$Q_C = m_a \, Cp_a (T_1 - T_2)$$

Where,

Cp_a = Specific heat of air, J/Kg k
m_a = Air mass flow rate, kg/sec
T_1= Evaporative outdoor dry bulb temperature °C
T_2= Evaporative indoor dry bulb temperature °C
T ωb = Evaporative indoor wet bulb temperature°C
$\in$ = Evaporative saturation efficiency, %
Q_c = Cooling capacity, KW

Before the advent of residential air-conditioning it was the only mechanical means available to make home interiors livable in the hot, dry, desert summers. This coolers function well except for the summer "monsoon" season with its accompanying elevated humidity and thus decreased cooler efficiency. These cooling systems are economical in terms of energy usage. During the energy problemes of the last two years, This cooler use was promoted as one means to control household utility bills. However, little thought was given to cooler water consumption. The index was proposed as a device to evaluate residential water savings and as a management tool to motivate water-saving practices.

1 The researchers noted that for home cooling, the highest index rating is received for having no 360 EVAPORATIVE cooler, the alternative being air-conditioning which although using more energy, uses practically no on-site water.

2 This advice flies in the face of all the energy-conservation practices supported by utility companies, industry and educational institutions and leads to confusion with mixed messages to consumers.

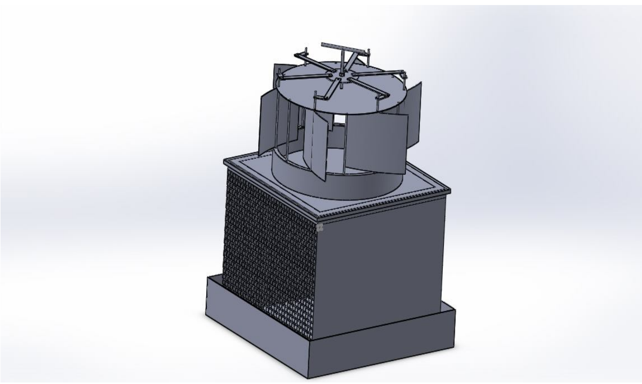

Fig d) 360 Evaporative cooler.

In all but a few dry weather towns, some means of cooling home interiors in the summer is essential. Consumers have learned that air-conditioning uses three to five times as much electricity to cool their homes as 360 EVAPORATIVE cooling. They know how much their utility bills rise in the summer months. Some have added 360 EVAPORATIVE cooling for use during the hot, dry summer months and switch to air conditioning during the "monsoon" season.

Others have changed over completely to 360 EVAPORATIVE cooling, reducing their cooling utility bills. Yet 360 EVAPORATIVE cooling consumes significant amounts of water, and water is a precious and increasingly costly commodity in high temperature region.

II. LITERATURE REVIEW

The first homemade drip coolers were become in 1935 by the scientist 'Watt et al' (1997) Egyptian water jars of 2500BC when they became more popular.

Historically also the ancient Egyptians hung wet mats in their doors and windows while wind blowing through the mats cooled the air making this to be the first attempt air conditioning. The idea was refined through the centuries.In 16^{th} century mechanical fans came to provide air movement, in the early 19^{th} Century cooling towers with fans that blew water-cooled air inside factories and in the 20^{th} Century swamp coolers. Evaporative cooling have existed in different forms and using different materials for centuries ago. Examples include the fired clay porous ceramic jars "Botijos" of Spain and Southern Italy used to provide water for agricultural workers in the fields (Brian and Rosa, 2003). Other areas are Egypt and Sudan, (Ibrahim et al, 2003)

Similarly in Nigeria from centuries to the present days locally fired porous clay pots are very popular for cooling water in homes and farms. The most popular shapes are basically spherical differing in the openings at the top. The size of the opening depends on the nature and shapes of the item to be cooled or stored and the size of the ceramic pot as well. As warm dry air flows over the wet body of the water filled porous clay pot evaporation takes place on the surface. The air downstream becomes coo1. and humidified while the water in the pot becomes cool. The same materials are used for the preservation of some agricultural products such as kola nuts and vegetables (Elkahoji, 2004).

In India (Roy, 1989) drip evaporative cooling method was constructed with simple materials and used for the preservation of fruits and vegetables . It consists of a simple low cost cavity wall evaporative cooler constructed from bricks and termed as "Improved Zero-Energy Cool Chamber" in India, (Lisa and Kader, 2003). The sand filled cavity between the walls and the sand were kept saturated with water by simple dripping system.

III. DISCUSSION

To develop the Energy efficient, environment friendly direct evaporative air conditioning system having low operating cost suitable for hot and dry regions.To test and verify the adequacy of the suggested model and program, the theoretical results from the model was compared with the experimental data , to make sure that the results of the mathematical model program are accurate . In the experimental work , was used the same type of direct evaporative cooler as it was modeled in this paper. The comparison of data received by present model with experimental data received . Therefore, the developed model has satisfactory adequacy and can be successfully used in designing works of direct evaporative coolers.

When the pad thickness is increased, outlet air temperature is decreased, but the period of achieving the steady state condition takes longer, because the bigger mass of the pad. The effect of the frontal velocity on the outlet air temperature from humidifier during unsteady condition which proves that in case of growing of frontal velocity, the outlet air temperature is decreased, and steady state condition is rapidly achieved. The cooling efficiency is increased with increasing of the pad thickness. This is because the contact surface between water and air is increased.

Pad depth (m)	0.45	0.30	0.15
Outside dry-bulb temperature (C)	38	37.66	38.42
Outside wet-bulb temperature (C)	17.01	17.37	17.33
Outside relative humidity (%)	11.28	11.59	10.23
Conditioned dry-bulb temperature (C)	19.95	23.46	27.28
Conditioned relative humidity (%)	78.15	77.19	64.68
Reservoir water temperature (C)	18.87	18.96	19.48
Cooling efficiency (%)	85.17	82.92	73.29

Fig f) Average of the Parameters and cooling efficiency recorded for different pad depth.

The curve of cooling capacity revealed that the higher cooling capacity could be achieved with the higher temperature and lower relative humidity of ambient air. Which is desirable also for obtaining the unvarying air conditioning.

This shows that thicker the pad higher is the effectiveness. In India khus-grass is widely used as wetted media for evaporative coolers. Above the chamber fabricated 360 cooler is implanted ,so that air can flow in all direction.

IV. CONCLUSIONS

Now a days power crisis is much more importance should be given to power saving and energy conversation. Efforts being concentrated on finding resources or method of saving energy. In this project 360 EVAPORATIVE COOLER will be design, developed and fabricate to low operational and overall cost. It doesn’t create any type of pollution so it is eco-friendly. This A.C. supplies air without increasing humidity compared with conventional air coolers. 360 direction will allow to sit people any where.

V. FUTURE SCOPE

. Every machine have scope for its future modification for gaining more and more beneficial out put with the least input. Hence human is always trying for achieving it. Being technology it comes under the research and development activity. Our product being the small and compact one, still it has so many scopes for it’s future developments as following:-

1) We can install thermostatic expansion valve for auto cut off for the heater coil, so that the temperature of the heater coil can be set at the required and the desired value as per the temperature conditions

2) We can regulate the capacity of the blower fan by installing potentiometer so that as per the requirement the flow of air can be regulated.

3) The water level indicator can be installed so that the level of water can be easily detected and maintained.

4) The tank material can be replaced by stainless steel to save it from the environmental corrosion and erosion.

5) The front side air diverting strips mechanism can be made auto diverting as well as manually operated by coupling the lever using belt and pulley drive.

6) The temperature can also be controlled by controlling and regulating the speed of the pad roller and drive motor.

VI. ACKNOWLEDGMENT

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