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Fabrication of Advance Evaporative Cooling System

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Abstract:
Direct evaporative cooling (DEC) uses evaporating water, combined with a wetted medium to cool the temperature of air as it passes through. Heat is removed from the surrounding air in the vaporization of the water by passing through or around a wetted surface. The air is cooled in the process and the humidity is increased. Unfortunately, evaporative cooling requires an abundant water source and is only effective when the relative humidity is low, restricting its efficient use to dry climates. The air supplied by the evaporative cooler is nearly 100% humid. Very humid air prevents the evaporative cooling of sweaty or wet skin. The High humidity in air accelerates corrosion which is considerably shorten the life of electronic equipment. High humidity in air may cause condensation. Direct evaporative Coolers are aesthetically unattractive. The efficiency of direct evaporative cooler mostly depends on the cooling pad and hence, the material used in the cooling pad plays a very vital role. In this project, a new model of direct evaporative cooler having a good aesthetic look and light in weight will be fabricated. The performance of this fabricated cooler will be analyzed by using cooling pads of four different materials such as cellulose paper pad, wood fibers, wood wool (Aspen) and coconut fibers. Apart from these four types of cooling pads, also the performance of direct evaporative cooler will be analyzed by using a combination of three different types of cooling pads simultaneously on three sides of the cooler. Two most important terms considered in this analysis are temperature and humidity. The readings of these two terms will be taken for each type of cooling pad and also, the further calculations will be done based on these readings.

Keywords: Air, Cooling Pad, Evaporative Cooling, Humidity, Temperature.

I. INTRODUCTION

Evaporative coolers, often called "swamp coolers", are cooling systems that use only water and a blower to circulate air. When warm, dry (unsaturated) air is pulled through a water soaked pad, water is evaporated and is absorbed as water vapour into the air. The evaporative cooler works on one of the oldest principles of air conditioning known to Man. Cooling of air by the evaporation of water. It is the most common form of household cooling found in arid areas. The popularity of evaporative cooling in such areas is due to its relatively low initial and operational cost compared to refrigerated cooling. Conventional direct evaporative coolers consist of a large water reservoir, a pump that draws water from the reservoir and discharges it through spray nozzles directly into air stream or through cooling pads. The direct evaporative cooler cools the air when the air comes in contact with water in the wetted media (cooling pads). During evaporation of water in air stream, the required heat is taken from air itself..

II. WORKING PRINCIPLE

Evaporative cooling is a process by which moisture is added to air in order to reduce air temperature and increase relative humidity. It occurs when moisture is added to air that has a relative humidity of less than 100 percent. The lower the relative humidity, the greater the cooling affect that is possible when moisture is added. In order to evaporate water, heat is required. This heat comes from whatever the water is in contact with as it evaporates. As heat is removed from an object; the temperature of that object is decreased, in this case, the air. The efficiency of any evaporative cooling device is directly related to its ability to evaporate water (cool) at a given relative humidity.

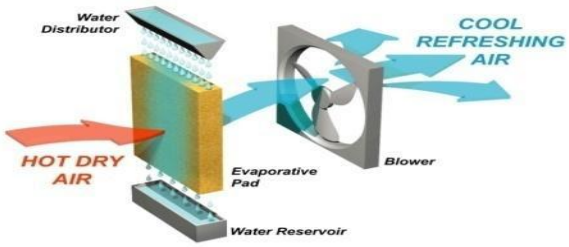

Figure.1.Basic Principle Of evaporative Cooling

III. DESIGN OF EVAPORATIVE COOLING

In this project, we have designed a small model of cooler. So, instead of considering the room area first, directly a small model of direct evaporative cooler is designed and developed by making some design considerations for finding out the capacity of fan to be used in the desired model. And finally according to the size of the developed model, a room of thermocol is prepared which is having a size slightly larger than that of the model of the cooler. All the readings of the developed model of the cooler is taken inside the thermocol room prepared, in order to analyse the cooling effect of the cooler properly.

Figure.2. Thermocol Room

Table.1. Experimental Analysis of a Fabricated Cooler

Sr. No.	Type of cooling pad (material)	Inlet DBT(^{0}C)	Initial Humidity (%)	Outlet DBT(^{0}C)	Final Humidity (%)
1	Wood fiber pad	28	56	25	70
2	Aspen wood wool pad	28	57	23	73
3	Cellulose paper pad	30	55	22	72
4	Coconut fiber pad	27	59	24	68
5	Combination of 3 different pads	28	60	22	68

IV. CONCLUSION

An experimental analysis of direct evaporative cooler by varying materials of cooling pads is performed. The cooling pads of materials such as Wood fibers, Aspen wood wool, Cellulose paper (honeycomb) pads and coconut fibers are used in the fabricated model of cooler for doing the analysis. So, a combination of these three cooling pads i.e. Cellulose paper pad, Aspen wood wool and Coconut fibers is used in the fabricated cooler and it is analyzed. From the analysis of direct evaporative cooler using this combination of three different types of cooling pads, it is seen that this combination of three different types of cooling pads provides a good cooling efficiency with least increase in humidity.

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