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Performance Assessment of Dehumidified Air Cooler

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Abstract

An air cooler is a conventional air-cooling system in which cooling takes place because of the transfer of heat from the air as latent heat is required for evaporation of water brought in an air stream. This air is generally exhausted out of the comfort area as air temperature increases due to heat load. In case this air is recirculated, it will not cool further due to saturation. If moisture from this air is extracted out, then the air can be recirculated and cooled further with evaporative cooling. Thus a mixture of fresh and recirculated air will result in better cooling conditions. The experimental setup is designed to test this effect. After modification of the air cooler, the humidity of air approaches towards a comfort zone. After modification, it was found that the dehumidification effect increased by 10-12%, which gives a better cooling effect with the same cooling temperature. As silica gel is used to control humidity, so cost is less as well as no smell problem occurs.

Keywords: Air cooler, Humidity, Dry-Bulb Temperature, Wet-Bulb Temperature, Psychrometry, Silica gel.

1. Introduction

The air cooler system is designed in such a way that the atmospheric air is sucked by the exhaust fan due to the generation of the suction pressure inside the cuboids chamber. The water pump circulates over to grass pads. The water pump and the fan run simultaneously. When the atmospheric air enters into the system it gets humidified and gets cool due to the vaporization of water in it and the transfer of required latent heat from the air.

An air cooler is a device which constitutes of a cuboid structure made of sheet metal, an exhaust fan powered by electric supply, horizontal and vertical flappers of the fan blades attached with the front of the structure, a water pump to re circulate the water, over grass pads attached with the vertical walls (except the front) of the cooler etc. The air cooler system is designed in such a way that the atmospheric air is sucked by the exhaust fan due to the generation of the suction pressure inside the cuboids chamber. The water pump circulates over to grass pads. The water pump and the fan run simultaneously. When the atmospheric air enters into the system it gets humidified and gets cool due to the vaporization of water in it and the transfer of required latent heat from the air. (Fig 1)

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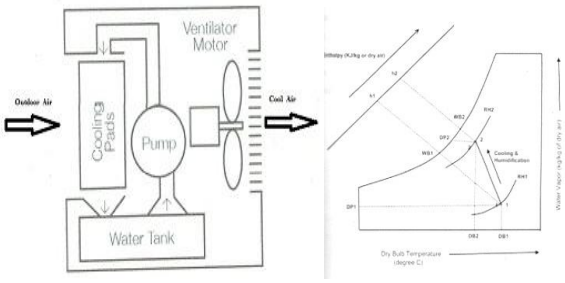

Fig.1: Air cooler

The objective of the work is very simple and is a modified version of the air cooler which will be more economically efficient and provide more temperature drops to give cooler air compared to the conventional desert cooler for a user in comfort conditions.

2. Experimental Setup

In the working setup, a part of the exhaust air from the room is further led to absorbent silica gel through the duct.

In our setup, Aluminium is used as duct material. Fresh air along with part of recirculated air is mixed in the duct and this mixed air is passed through silica gel, moisture is removed by silica gel and dehumidified air is delivered in the room. (Fig.2)

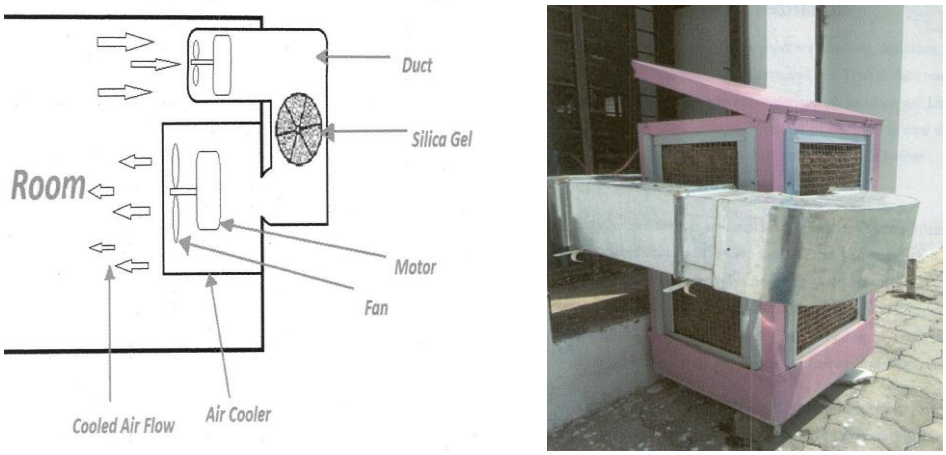

Fig 2: Actual Setup

3. Results and Discussion

Before & after modification DBT, WBT & Humidity are measured at the front and back of the air cooler.

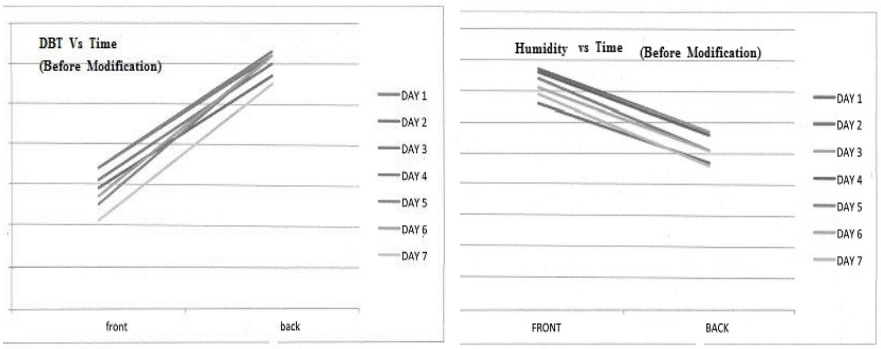

Fig.3: (Before Modification)

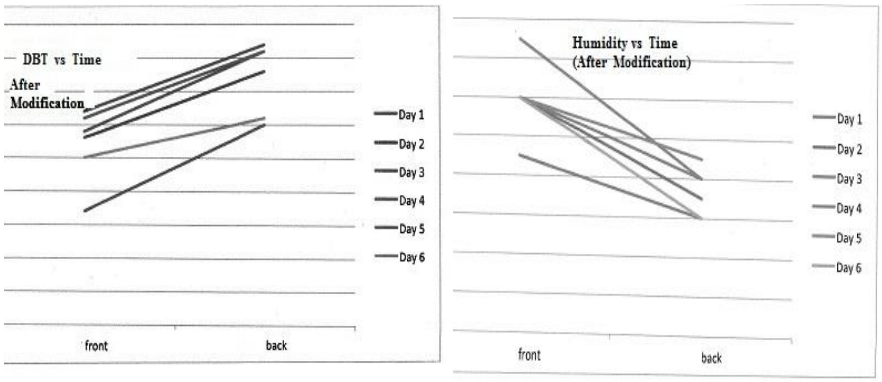

Fig.4: (After Modification)

From fig 3 & 4, it was found that the dehumidification and cooling effect of the air cooler increases.

4. CONCLUSION

During peak summer of the season, the cooling effect was observed by repeating dehumidification by making different mixes of fresh and dehumidified air and noted that the temperature differential does increase in air-cooled area by 2ºC-3ºC. However, the observation was not consistent as the experimental model was small and the mass flow rate of air was less.

After modification, it was found that the dehumidification effect increased by 10-12%, which gives a better cooling effect with the same cooling temperature. As silica gel is used to control humidity, so cost is less as well as no smell problem occurs.

5. REFERENCES

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