

# MODIFICATION AND DEVELOPMENT IN AIR COOLER

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## ABSTRACT

In Conventional Air Cooler, the outside air comes in contact with the water on the cooling pads. This outside air gives latent heat of vaporization to the water. Due to this water evaporates and that vapor gets mix with the air and thus the humidity of the air has been increase. This increase in the humidity reduces the Human comfort, the chances of bacteria, viruses have been increase sandal so this condition is not suitable to asthmas patient. So we modified an Air Cooler, which will not increase the percentage of humidity in the air. The aim of this project is to develop pan Air Cooler which will not increase the humidity of the air as incase of Conventional Air Cooler. Air Cooler is an appliances that keeping the atmosphere cold. The basic concept is to make the indirect contact of water and air which goes out of the cooler for giving comfort. This project is to design and develop a low cost air cooler as compared to Air-conditioning system which can be used in house sand office.

**Keywords:**Air cooler, WaterPump, Blower Motor, CellulosePads,

## 1. INTRODUCTION

Air Cooler is one that is used forgiving comfort to human being as like Air conditioning. But the difference between this two is that Air Cooler gives humid air at outlet and Airconditioning gives de humidified air at outlet. Middle-class peoples cannot afford to purchase Air-conditioning system which cost more than Air Cooler. So we design and develop a Air Cooler which reduce the humidity of air and gives output like a Air-conditioning system. This product has minimum cost than Air-conditioning system which the middle-class people can purchase for comfort. In this we make the indirect contact of air and water which reduces humidity in the out let air.

## 2. TYPES OF AIR COOLER

The air cooler scan broadly classified based as two types

- 2.1 Personal air coolers or room air coolers
- 2.2 Desert air coolers

## 3.WORKING PRINCIPLE

This modified cooler works on the principle of indirect contact of air and water. When hot air comes in contact with water on cooling pad, the water gets evaporated. This will give cooling effect, due to this the temperature of air as well as water has been reduce. Now this cooled air and cooled water in contact with the cooling pad mounted on the duct. Due to this the temperature of duct which is made up of galvanized iron is reduce and as air flow sin side this duct, the temperature of air will get reduce without increasing the moisture content.

## 4. COMPONENTS

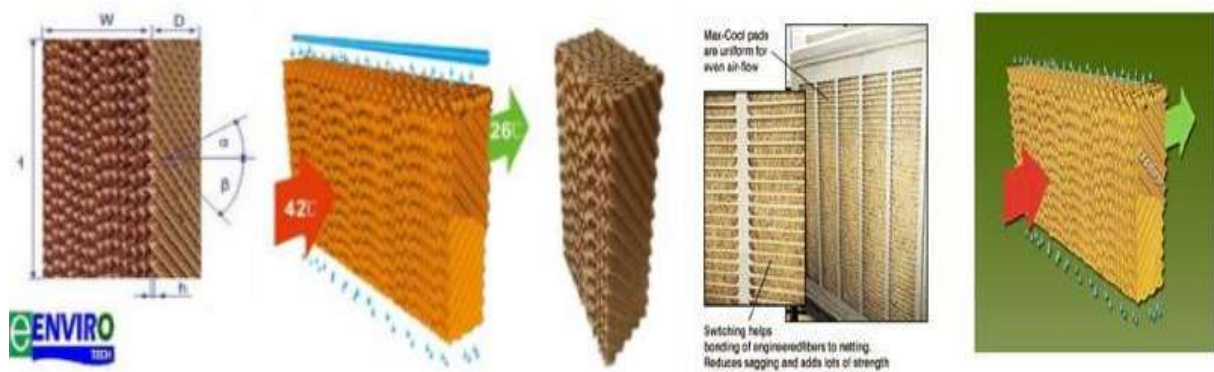
### 4.1 Cooling Pad

Most of the cooling pads are made of either as pen fiber or cellulose. A cellulose pad typically needs more air and water flow than does an aspen pad. More evaporation can take place through a 6-inchpadthana4-inchpad.

Wide Range of Evaporative Cooling Pads are available in the market. Evaporative Cooling is the process in which air is cooled by using the heat in the air to evaporate the water from an adjacent surface. A temperature reduction of 10 to 20°C (50-68 degree F) can be achieved by passing the hot fresh air through the wetted pads. Eco Cool Evaporative Cooling Pads that were manufactured using special cellulose material. Top quality material is useful in achieving high cooling efficiency.[8]

Cellulose Material pad has following advantages over Aspen cooling pads:

- High Durability than aspen cooling pads.
- Less Maintenance.
- High Efficiency.



**Fig-1: Cooling Pad[8]**

#### 4.2. Blower Motor



**Fig-2: Blower motor**

Blower Motor is used to rotate the Fan mounted on its suction fan.

#### 4.3. Blower Fan

Forced air is passed through cooling elements and circulated to the desired locations with the help of Blower Fan.



**Fig-3: Blower Fan**

#### 4.4 Re-Circulating Water Pump



Fig-4: Re-circulating Water Pump

Re-circulating pump draws water from the basin and pumps it through a system of sprays (or water distributors) from which the water is directed on to the cooling pad surface.

#### 5. MODIFIED AIR COOLER VS CONVENTIONAL AIR COOLER [4]

Feature	Modified Air Cooler	Conventional Air Cooler
System	Indirect contact	Direct contact
Cooling pads	Honeycomb cooling pads	Aspen cooling pads
Increase Humidity of Air	No	Yes
Restricted the growth of bacteria	Yes	No
Noise	Less	More
Cooling Area	More	Less

Table -1: Modified Air Cooler Vs Conventional Air Cooler

#### 6. PRODUCT DESIGN SPECIFICATION (PDS)

Product Design & Specification		
Modified Air Cooler		
Sr.No.	Description	Specification
1	Product	Modified Air Cooler
2	Cooler Design	Compact
3	Climatic Condition Suitability	Dry & Humid
4	Mode of Usage	Electrical & Mechanical
5	Material	Steel Sheet
6	Manufacturing Process	Machining & Assembly
7	Cooling Medium	Exhaust Fan
8	Cooling Area	150 (sq.ft.)
9	Blower Motor Speed	1300 rpm

10	NetWeight	10 kg
11	WaterTank Capacity	80 Liter
12	AirThrow Distance	10 feet
13	Environment	Home, Office
14	Aesthetics	Color,Material&Texture
15	Market	Indian Market
16	Estimated Cost	Below 10000 Rs.

Table-2: ProductDesign&Specification

## 7. WORKING MODEL

The principle of modified air cooler is relatively simple. There are two phases, one is suction of air and the other is delivery of cooled air. Air passes through two ducts & this air is cooled by indirect evaporative cooling. Due to indirect cooling of air, we get the moisture-free air, i.e. dehumidified cooled air which provides the comfort as like air-conditioning system. The cellulose pads are used for the ducts surrounding air cooling by simple evaporation process. Secondary air moving through cellulose pad will cause the water to evaporate. The heat necessary to cause evaporation is drawn out of the passing air stream and hence the surrounding air is cooled. The human body uses this principle to control body temperature by varying the amount of moisture on the skin surface. The evaporation of this moisture cools the skin and helps to lower the body temperature. The modern evaporative cooler uses a fan to draw outside air through wet filter pads. This filters the air of impurities and lowers the air temperature due to the evaporation of water within the pads. The cooled air is then distributed or directed into the building. The filter pads are wet by a pump which pumps water up to the top of the pads, from where it trickles down. The moisture content of the supplied air is increased, however this does not matter provided the air is cooled sufficiently.

The ducts are surrounded by grass and carpet, which is wetted by continuous supply of water from the upper tub and also water is supplied to the cellulose pad by same way. The upper tub has the small hole at both sides and also at the center of tub as per the arrangement of ducts. The suction of air is done by bladeless fan through the rectangular duct. When the air passes from the rectangular duct, air liberates heat to the duct and temperature of air is decreased. After that this air stream from bladeless fan is sucked by another fan which is mounted in conical duct. When the air stream passes from conical duct there again indirect evaporative cooling is done and also due to shape of the duct the small amount of reduction in temperature of air happens. By this way dehumidified cooled air is supplied for cooling purpose. Most of the people can't afford the air conditioning system for comfort and they preferred the direct evaporative air cooler which have less cost and consume less electric power but it has some disadvantages.

- High dew point (humidity) conditions decrease the cooling capability of the evaporative cooler.
- No dehumidification
- The air supplied by the evaporative cooler is typically 80-90% relative humidity, very humid air reduces the evaporation rate of moisture from the skin, nose, lungs, and eyes.

High humidity in air accelerates corrosion, particularly in the presence of dust. This can considerably shorten the life of electronic and other equipment.

- High humidity in air may cause condensation of water. This can be a problem for some situations (e.g. electrical equipment, computers, paper, books and old wood).

To overcome these disadvantages we design & make the "Air Cooler" which work on the principle of indirect evaporative cooling & in which cross flow heat exchanger type arrangement is used. Indirect evaporative cooling systems have the advantage of being able to lower the air temperature without increasing humidity of the conditioned space.



Fig-5: Different Views of actual Modified Air Cooler

8. ASSEMBLY

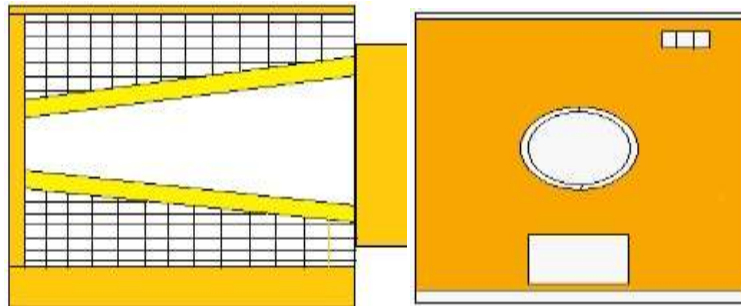


Fig -6: Side View

Fig-7: Front View

Figure 6 & 7 shows Side View and Front View of modified Air Cooler. It consists of Tub, Conical Duct, Rectangular Duct, Rectangular Body, Suction Fan, Motor, Switch, Cooling pads. The bottom section shows the water tank.

9. OBSERVATION & ANALYSIS

Date & Time of Observation	Temperature of air at inlet	Temperature of Ducts (ADP) in °C	Temperature of air at outlet of cooler (T <sub>a2</sub> )	Ambient Temperature in °C
04 <sup>th</sup> @ 9.00 am	30	20	23	30
06 <sup>th</sup> @ 12.00 pm	36	21	25	36
07 <sup>th</sup> @ 3.30 pm	37	21	26	37
10 <sup>th</sup> @ 10.00 pm	32	20	23	32

Table-3: Observation & Analysis

ADP = Apparatus Dew Point

Calculation:

Thermal Efficiency =  $(T_{d1} - T_{d2}) / (T_{d1} - ADP)$  At 9.00 am  $\eta_1 = (30 - 23) / (30 - 20) = 0.7 = 70\%$

At 12.00 pm  $\eta_2 = (36 - 25) / (36 - 21) = 0.73 = 73\%$  At 3.30 pm  $\eta_3 = (37 - 26) / (37 - 21) = 0.68 = 68\%$  At 10.00 pm  $\eta_4 = (32 - 23) / (32 - 20) = 0.81 = 81\%$

Average Efficiency =  $(\eta_1 + \eta_2 + \eta_3 + \eta_4) / 4 = 0.73 = 73\%$

10. PRODUCT ESTIMATE

Sr.No.	Particulars	Quantity	Amount
1	Cooling Pads	02	1200
2	Electric Motor	01	1000

3	Electricand PipeFitting	01	200
4	WaterPump	01	200
5	CoolerBody	01	2000
6	Transportationand Miscellaneousexpenses	01	500
	<b>TOTAL</b>		<b>Rs. 5,100</b>

Table-4: ProductEstimate

## 11. ADVANTAGES

- Thismodifiedaircooleruseindirectcoolingsystem,by theuseofthishumidityofanairwillnotincreasesasincase oflocal aircoolerswhich usesdirectcooling system.
- Apartfrombeingaffordable,theAirCoolersusewaterforcoolingascomparedtoACsystemwhichu sesrefrigerant such asCFC, HCF etc.forcooling .HencetheyareEco-friendly.
- LowcostascomparetoACsystem.
- AirCoolersareportable.Hencevery easytoplacethemin theroom thatwewanttocool.
- Low noiseascompared tolocalaircoolerswhich makesnoiseon running.

## 12. DISADVANTAGES

- Thedisadvantageisonlythatwecannot reducethehumidity oftheair.

## 13. CONCLUSION

Asinmodifiedaircooler, wehaveemployedindirectcoolingsystemi.ewe arenotmaking directcontactofairwiththewater.

Duetothisthemosturecontentoftheairwillnotincrease.Thuswesucceedindevelopingaircoolerwhichwillnotincrease thehumidity oftheair.Sothismodified aircoolercan beused in moderatehumidclimate condition also

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