

Cooling by Humidity Control in Rainy Season

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Abstract— During rainy seasons desert coolers are ineffective because of more humidity. Humidity creates discomfort to the human body since rate of evaporation is reduced. Human beings feel cooling effect only when water released by the body is evaporated quickly. Therefore, the best way to feel cool is to control the humidity. The efforts made by the team is to provide cooling by controlling humidity and saving energy which is required by the air conditioners.

Keywords— Humidity, Silica Gel, Desert Cooler

I. INTRODUCTION

High dampness levels which makes us crabby and leaves the whole day horrendously moist and soggy. Controlling our indoor condition, particularly our home dampness, is a basic segment of any general push to decrease our sensitivity manifestations. As home moistness and hypersensitivities are connected, air that is either excessively damp or not sufficiently muggy can altogether add to expanded sensitivity.

Relative Humidity is the extent of veritable moistness observable all around to the most raised proportion of dampness that can be held at that air temperature [1]. The more sweltering the air temperature is, the more moistness it can hold.

II. PROBLEM FORMULATION

The normal dampness levels in April are recorded beneath for significant urban communities all through northern India. Every one of the numbers here depend on verifiable climate information gathered from 1961 to 1990.

Table 1: Average April humidity in Northern India

Place	State	% age
Agra	Uttar Pradesh	35
Allahabad	Uttar Pradesh	29
Amritsar	Punjab	47
Indore	Madhya Pradesh	23
Ludhiana	Punjab	44
Mukteswar	Uttarakhand	46
New Delhi	Delhi	34
Srinagar	J&K	64

Table 2: Average July Humidity in Northern India

Place	State	% age
Agra	Uttar Pradesh	72
Allahabad	Uttar Pradesh	77
Amritsar	Punjab	72
Indore	Madhya Pradesh	79
Ludhiana	Punjab	71
Mukteswar	Uttara hand	91
New Delhi	Delhi	70
Srinagar	Jammu and Kashmir	66

Table 3: Average August Humidity in Northern India

Place	State	% age
Agra	Uttar Pradesh	77
Allahabad	Uttar Pradesh	81
Amritsar	Punjab	77
Indore	Madhya Pradesh	85
Ludhiana	Punjab	76
Mukteswar	Uttarakhand	93

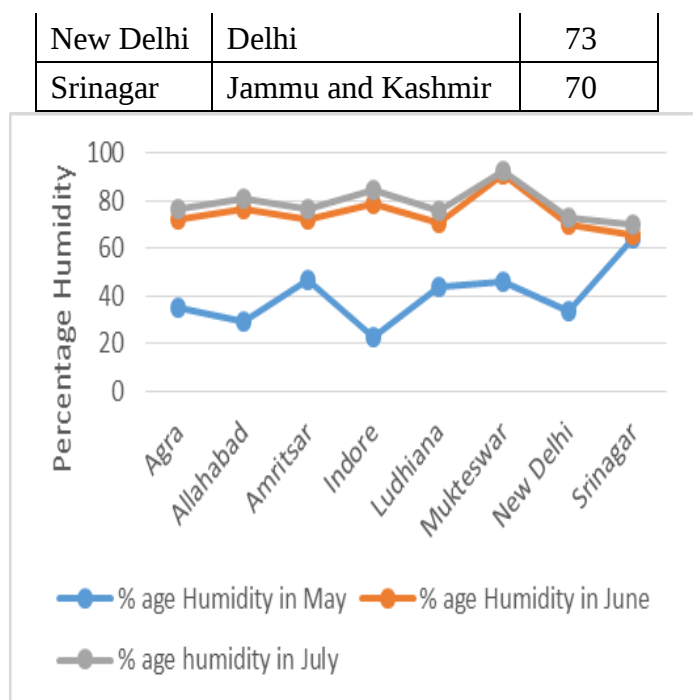


Fig1: Percentage of humidity variation during May to July in Northern Hemisphere of India (1961 to 1990)[2]

III. SILICA GEL AND ITS PROPERTIES

Silica gel is an unformulated type of silicon dioxide, which is artificially created as hard unpredictable granules (resembling precious stones) or hard general dots. A miniaturized scale permeable structure of intertwining depressions stretches a high surface zone (800 m² for every gm)[3]. It is this structure which makes silica gel a high breaking point desiccant. Water particles stick to the Silica Gel surface since it shows a lesser fume weight than the enveloping air. At the point when harmony of equivalent weight is achieved, no more adsorption happens. Along these lines the higher the dampness of the enveloping air, the more vital the proportion of water that is adsorbed before congruity is to come[4]. It is in these higher tenacity conditions (over half Relative Humidity) that set away or in-make a trip thing is frail to hurt. The greatness of silica gel is the physical adsorption of water fume into its internal pores. There is no engineered

reaction, no by things or side effects. Despite when doused with water fume, silica gel still looks like a dry thing, its shape unaltered. Silica Gel is one of the most established and most well-known desiccant and adsorbent utilized for a wide number of mechanical and buyer applications. Silica Gel is an exceedingly initiated adsorbent, outfitted in an extensive variety of work sizes to suit different modern applications. It is non-destructive, unscented, dull, non-harmful, and artificially latent. It is a very permeable type of silica, with a great degree expansive inner surface region. The silica gel doesn't encounter any substance reaction in the midst of adsorption and doesn't shape any by things. It is non-deliquescent and won't change its estimate or shape. Despite when the silica gel is water submerged, it remains dry and free-spilling. Silica gel has a high porosity, around 800 m²/g, empowers it to adsorb water speedily, making it important as a desiccant (drying administrator). It can diminish the relative dampness in a shut space to around 40%. Once submerged with water, the gel can be recouped (desiccated) by warming it to 150°C (300°F) for 1.5 hours for each liter (around 1 dry quart measure or around 30oz weight) in a thick-walled Pyrex dish. Silica gel is non-noxious, non-ignitable and misleadingly dead.

IV. REGAINING OF PROPERTIES

Recuperation of Silica Gel is done by warming the jewels in a stove at a temperature of maximum up to 300° F (149° C) for around 3 hours or till the valuable stones turn blue or direct white. Getting dried out the desiccant may in like manner be master by warming in a microwave oven. Utilizing a 900-watt stove warm the precious stones for three moment interims until the shading change happens. The correct measure of time essential will rely on the stove wattage. Spreading the desiccant in a wide container in a shallow layer will speed the procedure. Warming to 325° F (149° C) or more, or

utilizing a microwave stove more than 900 watts can harm the gel and render it not able to adsorb dampness.

V. BEST UTILIZATION OF SILICA GEL

Silica gel ought to be utilized inside a shut/fixed dampness hindrance or an inflexible, fixed holder. This permits the silica gel to assimilate the caught dampness vapor within the bundle. Items ought to be bundled in a way that does not permit extra water vapor in the encased condition.

Table 4: Absorption Capacity[5]

RH=20% Absorption capacity 10% of its weight
RH=50% Absorption capacity 23% of its weight
RH=90% Absorption capacity 36% of its weight

RH* = Relative Humidity

VI. SILICA GEL AVAILABILITY

Type of Silica Gel	Color before absorption	Color after Max. absorption	*Price in INR/kg	Utilization
White Silica Gel	White	No Change in color	Rs. 90.00	This sort of silica gel is usually utilized as a part of bundle.
Blue Silica Gel	Blue	Pink	Rs. 110.00	Utilized in transformers. Try not to utilize blue silica gel around Food products since the cobalt chloride is toxic
Orange Silica Gel	Orange	Green or colorless	Rs. 120.00	Any item that will harm with high dampness, for example electrical products may have silica gel inside the bundling

- Price of silica gel may vary

VI. PROBLEM FORMULATION

We can calculate how much you will need for a 144 sq. ft. room:

- Volume of the room = 144x10 feet = 1440 cubic feet = 40.776 cubic meters.
- Amount of water vapor in the air on a typical Jalandhar summer day: 21.22 g/cubic meter.
- (Actual vapor density/ Saturation vapor density) *100
- A comfortable relative humidity is around 35%, so you need to get rid of the excess humidity
- So, total amount of vapor to be removed = 7 g/cubic meter x 40.776= 285.4 gms
- Silica gel can adsorb around 25 gm of water vapor per 100 gms at 25C.
- Assuming this does not vary much with temperature, you will need around 11416 gm of silica gel.

In order to apply the silica gel for reducing humidity, A cooler design is modified so that it could be used during the rainy season also because we know that humidity is very high in the rainy season and we don't run the cooler because cooler also increases the humidity, So we have designed this cooler to reduce the humidity. Also, to expand the use of the cooler, one heating element is also connected which will run during the winter season and works as a blower.

One temperature and humidity sensors are installed on the cooler to judge the change in the temperature and humidity after running this cooler.

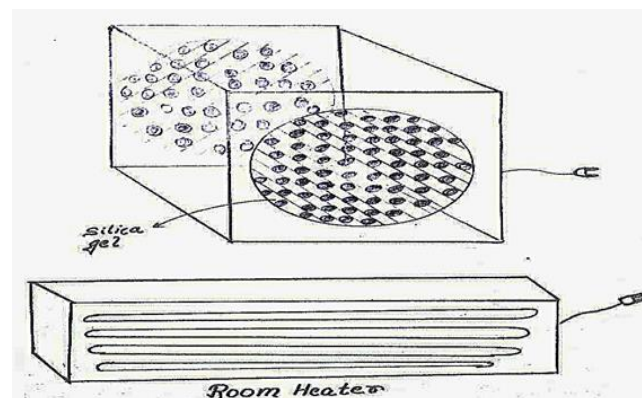


Fig.2 Frame design of the cooler



Fig. 3 Outer body containing Silica Gel

With the help Arduino UNO we have made a temperature and humidity sensor. The programming of the Arduino is shown in fig.3 which is burnt and utilized for the above said purpose. This program helps in displaying the data available for humidity and temperature at the sensors.

```
#include <DHT.h>
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
Int greenPin= A0;
DHT sensor;
Void loop()
{
  Delay(1000);
  Lcd. Clear();
  Lcd.setCursor(0,0);
  Lcd.print("Humidity =");
  Lcd.print(sensor.humidity);
  Lcd.setCursor(0,1);
  Lcd.print("Temp=");
  Lcd.print(sensors.temperature);
}
```

Fig. 3 Programming for the display of temperature and humidity [1]

VII. RESULTS AND CONCLUSION

When we turn on the supply ,ac will first convert into a dc through rectifier and then supply goes to the Arduino after that DHT-111 sensor will observe the humidity and temperature after that it will show the same in the LCD and we will use one way

switch to start the main motor and it will start working as exhaust fan , basically from the back it will dragged the air and throw in forward direction passing through the silica gel layer. Silica gel will start reducing the humidity within ten minutes of running.

In the future, we can make it fully automatic so that it can decide by itself whether it has to throw cool air or hot air, according to the requirement. It can be made more intelligent as per the temperature variation. The speed of the fan motor can be controlled as per the temperature so that energy conservation can also be made possible because as per the speed of the motor the consumption depends. If the speed is less power consumption is less and vice versa.

VIII. REFERENCES

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