

Modified Conventional Air Cooling System to Enhance Air Cooling

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Abstract— This paper introduces a modified dedicated outdoor air cooling system for comfort cooling that provides significant cooling. There are different cooling systems used for comfort cooling. These systems may be like air-conditioners; desert coolers etc. and have their own advantages, disadvantages and limitations. Our proposed idea envisages a desert air cooling system which lies in between air-conditioning and conventional desert cooling systems. It would reduce the electricity consumption to a great extent compare to air-conditioning in moderate hot climatic conditions and it provides better cooling than the conventional desert cooler. Its cost will also be well below the existing air conditioning systems. Basically the air cooling in a conventional system happens because of transfer of heat from air as latent heat required for evaporation of water brought in air stream. This air is generally exhausted out of comfort area as air temperature increases due to heat load in the comfort area. If this air is recirculated it will not cool further having become saturated already. If by any means moisture from this air is extracted out, the air can be further recirculated and cooled with evaporative cooling. Thus mixture of fresh and recirculated air will result in better cooling conditions. The idea for auxiliary system to extract moisture out of the air to be recirculated with silica gel, as medium is being developed which will be an attachment to the existing desert cooler[1].

Index Terms— Recirculated, silica jel, silica wheel

I. INTRODUCTION

With the advent of the various advanced comfort cooling devices, it has become possible to work comfortably for human being in different workstations having non-comfortable climatic condition. These technologies can be applied to places like home, offices, in various transport systems like buses, trains.

The proposed dedicated outdoor air cooling systems provide the latent cooling while maintaining the space relative humidity and much reduced energy consumption. The provision of cooling in buildings has always presented designers a greater challenge. Early cooling systems made use of natural draft and evaporative effects, and this knowledge is being revisited today as building designers strive to provide cooling that does not incur a heavy environmental cost. It is believed that the productivity of workers is related to the temperature and humidity of their working environment. This study begins with an overview of the requirements for thermal comfort in terms of temperature, humidity and air movement.

Automatic controls, a subject beyond the scope of this paper, are envisioned to offer the potential to further improve the economic benefits of the lower supply air conditions. The author believes that be an economic, comfort, and health benefits brought about by this system. As a result, the occupants of buildings will experience improved health, comfort, and productivity, and the floor-to-floor dimensions may be reduced.

II. EXPERIMENTAL SET UP

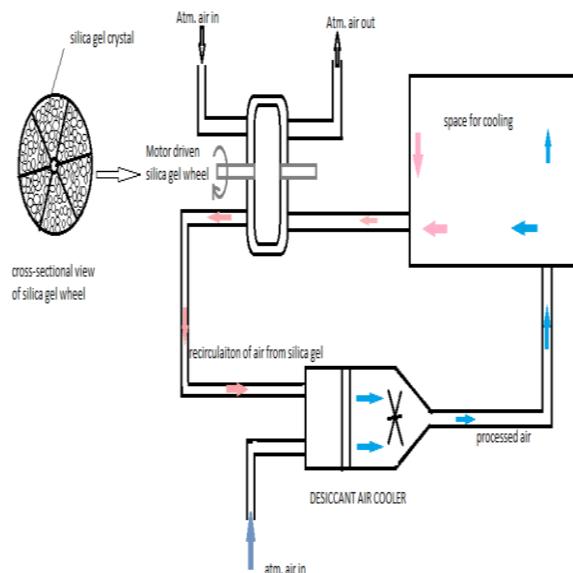


Fig.1, Block diagram of cooling system operation

Desiccant air cooler-Active desiccants are a better choice for indoor comfort cooling by maintaining the relative humidity of within the room air temperature.

Vents- vents are used for the flow of humidified and dehumidified air to various places of the system.

Space for cooling – space for cooling is likely a room or a building.

Exhaust fans- Exhaust fans are used mainly for the forced and controlled flow of humidified and dehumidified air as per load condition.

Silica gel – reference [1] Silica gel is usually prepared by treating sodium silicate of a suitable concentration with an acid such as hydrochloric acid, or with certain salts, such as ferric chloride acid, which are acid in reaction. The gelatinous mass thus formed is broken up, washed free from salts, and dried until the gel becomes hard and glassy in appearance. After the addition of water content to this mass is called as activated silica also termed as silica gel. Spaces between silica threads are filled with capillary held water. The effective

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diameters of these pores have been estimated to be approximately 5 micron. The water content in silica gel gets evaporated due to heat exchange with its surrounding. Due to this property silica gel is used which is reactivated again and again.[2]

Silica gel wheel-Silica gel wheel is a motor driven cylindrical plastic wheel in which the silica gel crystals are packed within the various separated sectors.

III. SYSTEM OPERATION

Initially the atmospheric air enters in desiccant through the inlet vent of the desiccant and it is humidified in it, after humidification the processed air is propelled towards the room where it exchange the sensible heat of the room and it becomes warm. Now the warm air still contains the water particles and the temperature is still lower than the atmospheric air, now this air is further carried to the inlet vent of the rotating silica gel wheel which contains silica gel packed in various sector of the cylindrical wheel.

The air is passed through the silica gel and gets dehumidified due to the property of silica gel, now through the out let of the silica gel wheel which is further a vent connects the out let of the silica gel wheel to the another inlet of desiccant air cooler. Another side of the silica gel wheel is also provided an inlet and outlet vents but opens in atmospheric air. Through this inlet port warm atmospheric air enters and by carrying the moisture of the silica gel which is recently absorbed and due to rotation came to this side, it gets diffuse in atmosphere and therefore the silica gel reaching this side loss the water content with it and now it is again prepare to absorb the moisture from the humidified air stream at the opposite side. Due to rotation of the silica gel wheel the process is repeated again and again and therefore the processed air gets more and more cooled.

IV. CONCLUSION

Properly engineered, this modified system should ensure that thermally comfortable environmental conditions are achieved in the building. The proposed idea of modified cooling system ensures against previous outdoor air cooling systems in reference of good displacement ventilation Airflow rate although with the cooling loads.

In period of continuous and peak cooling demands this system will also work effectively. This system can be used for greater space design occupancy. Along with the comfort, and health aspects the system will be reliable at great extent. This system cannot replace the AC systems but likely to perform well in moderate hot climatic conditions.

REFERENCES

- [1] F.E. Bartell and e. G. Almy, activated silica gel - The Relation of Activity to Water Content and Temperature
- [2] www.silicagel.in