

Review on Solid Desiccant Wheel for Desert Cooler

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ABSTRACT: Experimental investigation on desert cooler shows that they are economical and effective in hot and dry area but not effective in humid area, by using solid desiccant wheel in dehumidifier increases the efficiency of desert cooler in humid area. Experimental uncertainties are analysed and parameters to determine the desert cooler. Performance are investigated our design proposes and successfully implement the use of dehumidifier that absorbs the moisture contained in air and gives dry air. Measurements show that water contained in the ambient air causes the dehumidification capacity to rise while the dehumidification efficiency is not much affected for cooling application in humid climate this is a positive trend.

Keywords: Desiccative cooling, desiccant wheel, desert cooler, dehumidification.

1. INTRODUCTION:

Desiccant-Based Air Conditioning Systems have been recurrently proposed, and investigated, since the early 1930's. In the past 80 years, many developments, many different ideas and dead ends have been undertaken.

A desiccant is a substance that induces or sustains a state of dryness in its vicinity; it is the opposite of a humectant. Commonly encountered pre-packaged desiccants are solids that absorb water. Desiccants for specialized purposes may be in forms other than solid, and may work through other principles, such as chemical bonding of water molecules. They are commonly encountered in foods to retain crispness. Industrially, desiccants are widely used to control the level of water in gas streams. A desiccant wheel is very similar to a thermal wheel, but with a coating applied for the sole purpose of dehumidifying, or "drying", the air stream. The desiccant is normally silica gel. As the wheel turns, the desiccant passes alternately through the incoming air, where the moisture is absorbed and through a "regenerating" zone, where the desiccant is dried and the moisture expelled. The wheel continues to rotate, and the adsorbent process is repeated. Regeneration is normally carried out by the use of a heating coil, such as a water or steam coil, or a direct-fired gas burner.

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(This paper is presented in National Conference ETAT-2019 held at VIMEET, Khalapur)

2. LITERATURE REVIEW:

To remove moisture, solid desiccant wheel technology presents an energy-efficient alternative to traditional systems. Solid desiccant wheels can be coupled with other systems to provide desired air quality. In order to solve the problem of high energy consumption for regeneration of desiccant wheels, systems involving desiccant wheels use desiccant material so the dehumidification process is done by this technology while required energy to dehumidify air. The main component in these systems is desiccant wheel which should operate efficiently. In this study, performance of solid desiccant wheel is evaluated and affecting factors consisting of air humidity ratio, regeneration process and air process temperatures, mass flow rates, and wheel revolution are investigated. Desiccant material such as silica gel is impregnated into desiccant wheel to absorb air moisture. This wheel is divided into two sections, process air and regeneration air sections. In humid process air enters desiccant wheel and its moisture is picked up by desiccant material. Subsequently latent heat is released and process air temperature goes up so warm and dry air leaves desiccant wheel in sorption process. As wheel rotates between two sections continuously, moisture absorbed by desiccant material should be removed in desorption process so it needs to be regenerated by a desiccant heater providing hot regeneration air.

Then hot air goes through wheel regeneration section and the desiccant is reactivated. Desiccant wheels remove moisture based on the difference between desiccant surface vapor pressure and air vapor pressure. Finally the hot desiccant rotates back into the process air, where a small proportion of the wheel should be allocated to cool

the desiccant from regeneration air to process air collect more moisture from the process airstream.

3. METHODOLOGY:

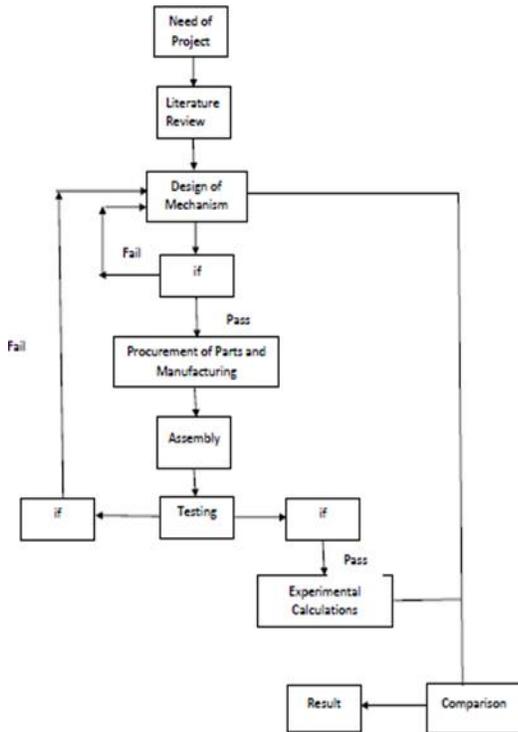


Fig. 1 Methodology

4. FLOW DIAGRAM:

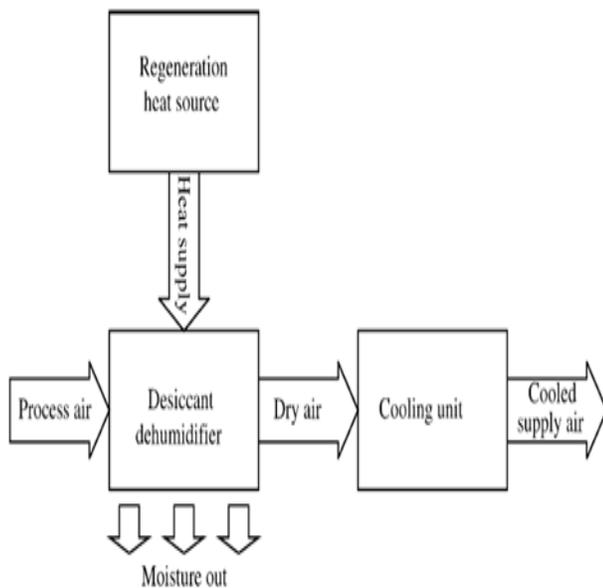


Fig. 2 Process Flow Diagram



Fig. 3 Actual Mechanism

5. DISCUSSIONS:

A. DESICCANT WHEEL:

A desiccant wheel is very similar to a thermal wheel, but with a Coating applied for the sole purpose of dehumidifying drying air stream. The desiccant is normally Silica gel. The wheel turns, the desiccant passes alternately through the incoming air where the moisture is adsorbed, and through a regenerating zone where the desiccant is dried and the moisture expelled. The wheel continues to rotate and the adsorbent process is repeated.

B. THE DRYING PROCESS:

The desiccant wheel rotates slowly. As air is drawn through the wheel, the water molecules are removed and retained by the silica gel that is impregnated within the wheel itself. The air is now dry and is blown into the room or building. This dry air encourages evaporation to take place and therefore buildings, etc. become dry.

The water now trapped in the wheel is removed by heating the wheel and the vaporised water is blown outside. Basic idea of the Munster’s desiccant drying wheel (Rotor) is very simple: Air is blown though the rotor structure and the humidity in the air is absorbed by the desiccant.

C. DEHUMIDIFIER

A dehumidifier is generally a household appliance which reduces the level of humidity in the air, usually for health or comfort reasons, or to eliminate musty odour. Excessively humid air can cause mould and mildew to

grow inside homes, both of which pose numerous health risks. Humid climates, or humid air within buildings, make some people extremely uncomfortable causing excessive body perspiration that can't evaporate in the Already moisture saturated air. It can also cause body moisture precipitation that can disrupt sleeping, create a situation where the cold pipes in this area begin to drip And can prevent laundry from drying thoroughly enough to prevent mustiness.

6. CONCLUSIONS:

Performance of the desiccant wheel based air conditioning system is evaluated conclusion can be made. For a chosen regeneration temperature, this air conditioning system is economically up to certain humidity level compared to window air condition alone. If the regeneration temperature increase the load get completely separated there by performance of cooling coil improve a lot 70% to 80% performance of cooling coil

is significantly governed by latent load. Hybrid air conditioning can be good option when the humidity level is high.

7. ACKNOWLEDGMENT:

We would like to thanks Mr. Akash Bidwaik for providing constant support throughout the work.

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