

# Experimental Analysis on Solar Desiccant Air Conditioner

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**Abstract—** *The experiment investigated and evaluated the feasibility of a solar desiccant air conditioner. Its effectiveness as a possible air conditioner option used in household air conditioner or as an energy efficient and environmentally friendly alternative to conventional air conditioning units used in houses are evaluated. A solar water heater was used as heat gain. The model utilizes the technology of solar air conditioner system. The purpose in the long term would be reduced the consumption of electricity used for air conditioning, reduce harmful emission and hence saving money.*

**Keywords—** Desiccant wheel, Condenser, Solar water heater, Air cooler, Control unit.

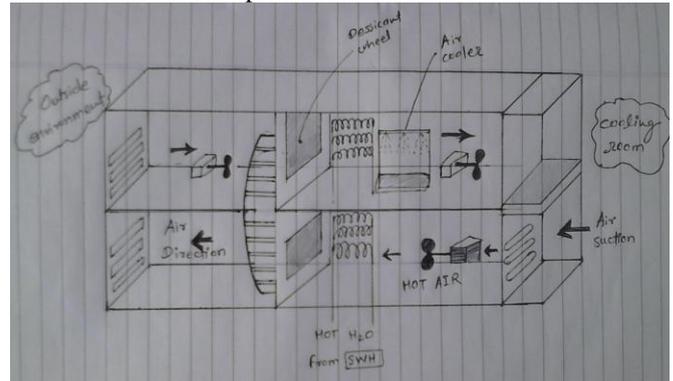
## I. Introduction

From the last few decades the system of solar desiccant air conditioner has been attained efficiently. The necessity to conserve the energy and reduce the harmful emission developing alternative. The solar desiccant air conditioner system contains solar tubes to heat the water. The desiccant wheel made up from the solid shape mixture of fevicol and woodwool, which is fixed in circular wheel. The system contains two processes, one is hot air process and another is cold air process. The condenser used in system to reducing the moisture from the air. In cold air process the air first pass through desiccant wheel, condenser and through air cooler. There are so many researches has been done by many universities which contributed more opportunity in the field of solar air conditioning. Several project for solar cooling has been analyzed within the scope of "SACE project (Solar air conditioning in Europe)" to testing environmentally friendly air conditioning for the use with solar thermal system. The experimental analysis of solar desiccant air conditioning is created to achieve the great result without using the compressor. Without using the compressor we can reduce the electricity which is required in the conventional air conditioning. The solar energy is used to heat the water and flows through the condenser to reduce the moisture.

## II. Methodology

The solar desiccant air conditioning system has two processes which is hot air process and cold air process. In the cold air process, the air from desiccant wheel passes through the condenser. In the condenser the air passes through the flow of hot air from which the fresh air obtained. Then the dehumidified and fresh air finally passed through the air cooler where the dehumidified air reduces its temperature and converted into cold air. By this way the room gets cool. In hot air process, the system takes humidified air from the room which passes through the condenser in which the hot water flows. By passing the humidified air through the condenser,

moisture in the air reduces to some extent. In winter days the room gets fresh warm air by stopping the water supply in the air cooler and cut off the power of air cooler.



The figure showing sketch of Cooling Unit

## III. Main Components

- 1) **Solar tube collector:-** As shown in the Fig.(1) the system contains six solar tubes in the system to heat the water and it gives some tilting angle for receiving solar energy to the solar heater.
- 2) **Water tank:-** The system contains uses the two tanks. One is for storage and another for the outlet of the condenser.
- 3) **Desiccant wheel:-** The desiccant wheel consist of the mixture of woodwool and fevicol .The solid mixture of woodwool and fevicol is fixed in the circular wheel packed by nets from both side as shown in fig.(2).



Fig.(1)



Fig.(2)

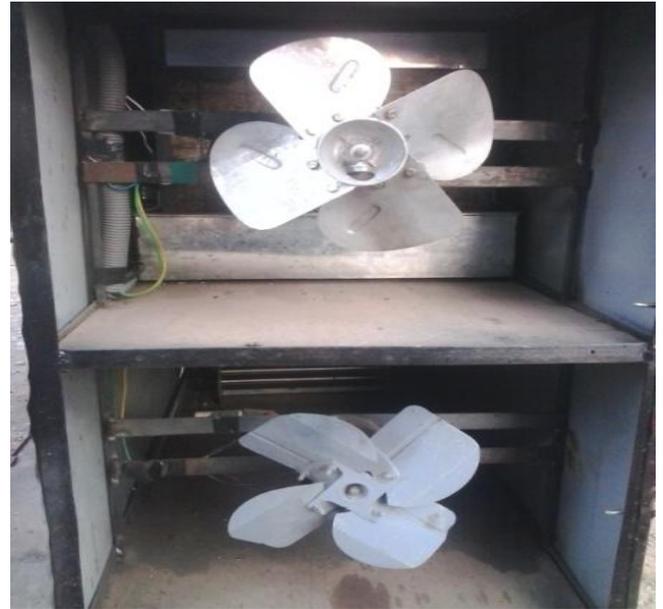


Fig.(5)



Fig.(3)



Fig.(6)

4) **CPVC pipes:-** The CPVC pipes used in this system for transporting the hot water from inlet to outlet.

5) **PCB with sensor:-** The system contains PCB with sensor which gives the temperature of outlet air on PCB display and control the overall system by remote control as shown in fig.(3).

6) **Condenser:-** The system containing two condenser of size 3/8 as shown in fig.(4).

7) **Fans:-** The system contains 3 fans. One for suck the air from the room, the second one for fresh and dehumidified the air and last one is pass the fresh air into the room as shown in fig.(5).



Fig.(4)

#### IV. Experimental Procedure

The experiment was conducted for observing and recording the temperature of different component of the system. The experiment started at approximately 11:30 am. The setup was placed in East-West direction and solar collector was tilted at some angle for receiving the solar energy at high extent. Temperature of condenser coil, air cooler water and room temperature were recorded using temperature sensors. The following tables gives the readings of temperature of different components. Two test results was recorded at the time of experimentation. One test for hot air and another for cool air. The hot air reading temperature attain  $30^{\circ}\text{C}$  after running the system continuously two hour and cool air temperature attain  $20^{\circ}\text{C}$  after running the system continuously two hour. The overall readings of hot and cool air are recorded in following tables. The following graphs shows the temperature profile of different component during hot air testing and cool air testing.

**Table 1: Test for hot air**

Test	Time	Condenser Temp (°C)	Air Temp (°C)
1	11:30	29.8	26
2	11:45	30.4	26
3	12:00	31.3	27
4	12:15	32.1	28
5	12:30	32.9	29
6	12:45	33.6	29
7	01:00	34.5	30

**Table 2: Test for cool air**

Test	Time	Water Temp.	Air
1	01:30	29.1	29
2	01:45	28.4	28
3	02:00	27.3	26
4	02:15	26.5	24
5	02:30	24.1	23
6	02:45	22.8	21
7	03:00	21.6	20

**V. CONCLUSION**

From the experimental analysis it is proved that the system is work well in warm sunny days. The solar desiccant air conditioning system can be improved by using desiccant wheel of silica gel and clay mixture and made in casing which has shaft and bearing connected to the wheel. By testing it is obtained that the cool air gets in the room is up to 20°C and in winter session the system gives air up to 30°C.

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