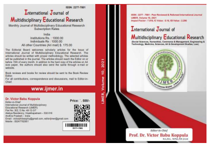
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EXPERIMENTAL INVESTIGATIONS OF AIR CONDITIONING SYSTEM USING EVAPORATIVE COOLED CONDENSER

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Abstract

The average temperature of the Earth is rising because of growing power demands, global warming, transportation, and industrialization. Summer temperatures have risen by 10 to 15 degrees Celsius in the last two decades, especially in tropical climates like India. Refrigeration and air conditioning are very important for living things, especially in hot places. When split air conditioners work, they make a lot of condensates. These condensates are usually thrown away and end up in the environment. When it's running, though, it consumes a lot of energy. The goal of this study is to see if condensation can help air conditioning systems work better. A direct evaporative cooling system utilizing condensate is integrated into the cooling load of split air conditioning to reduce air temperature before reaching the condenser. The performance of split air conditioning for an evaporatively cooled cycle with a wood wool pad and an evaporatively cooled cycle with a cellulose pad is compared in this article. The first part of the cooling pad is a rectangular frame made with a G.I. sheet for a cooling pad with a length, width, and height of 60 cm, 50 cm, and 8 cm. The wood wool pads are then put as a wet medium in a rectangle frame with a thickness of 3 cm for each pad. It is supported by G.I. wire to enable uniform distribution of wetted material. The results show that pouring condensate into the air while going through the condenser reduces compressor discharge pressure. The cooling effect and cop (coefficient of performance) increase as compressor power is reduced. The cellulose cooling pad is placed in the frame in the same way. Direct evaporative cooling, which is when condensate is pumped into the air without going through the condensing system, can improve the performance of the system while also being good for the environment.

Keywords: Split Air Condition System, COP, Evaporative Cooled Cycle, Condensate, Heat Rejection Rate, Water Evaporation Rate.

1. Introduction

High energy costs are the result of an increase in global energy demand and a decline in global energy supply. Air conditioning consumes 20% of total energy in the country and 17% of total global energy in 2008 [1, 2], meaning that increasing the COP of air conditioners will assist in decreasing global energy consumption. Condensing units in air conditioners have a considerable impact on compressor discharge pressure. The temperature difference between the ambient air and the condenser determines the performance of most air-cooled condensers. The thermal stability of air-cooled condensers fluctuates throughout the year, especially in summer whenever the air temperature is high. [3–4] The refrigerant running through the condenser may not completely condense in a high-temperature environment, resulting in a mixture of liquids. The four fundamental components of an air conditioner are the evaporator, compressor, condenser, and capillary tube. The evaporator is responsible for the cooling effect because it absorbs the heat from the room. [5–6] The partially vapor-liquid refrigerant absorbs the heat and transforms into a completely gaseous state. Then it flows into the compressor, which increases the pressure. As a result, we're left with a hot, high-pressure gaseous refrigerant. The refrigerant is converted from gas to liquid and cooled in a condenser. [8–9] The COP improved by 42.2 percent, while the power consumption was reduced by 14.55 percent, according to the Rafik et al. investigation of the energy efficiency of package air conditioners employing spray-type evaporative cooling (Case Study: A Villa in Kuwait). Chien et al. investigated the water spray uniformity in the evaporative condenser of a water chiller. In a hot region, Eidan et al. reported that direct evaporative cooling improved the efficacy of a conditioning system. Cooling capacity increased by 5–7.5%, but compressor power and electric current were reduced, according to the findings. Faisal et al. investigated the effect of pre-cooling incoming air to the condenser on split-type air conditioning. When the temperature of the air that came into the condenser was lower, the temperature of the condensation and evaporation also went down, which made the air conditioner work better.

The use of condensate water to increase the performance of split air conditioning systems has been documented by several researchers. [7-8] Arcita and Subarian presented the use of condensate water in the condenser as an extra coolant fluid intermittently in a split air conditioning system, and the experimental results indicated that the surrounding temperature, cooling power, and COP scheme have risen by 2%, 4%, and 7%, respectively, while compressor energy consumption decreased by 3%. Ibrahim et al. examined the use of condensate for condenser air pre-cooling in a vapor compression system to increase performance. Yang et al. investigated the impact of condensate water on the operation of a split air conditioning system. According to the studies, condensate water could greatly boost air conditioning efficacy in hot situations. As indicated by the literature review above, the authors focused on direct

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evaporative cooling employing condensate to cool the condenser. [10] Condensate water is produced by the evaporator in the split AC system's interior unit, which is generally not used and released into the environment. The goal of this study is to use condensate water for direct evaporative cooling to improve split air conditioning performance. Because the temperature and pressure ratio of the condenser is going to be lower, using condensate water is going to cut down on the amount of power the compressor needs, which will lead to a better overall COP.

1.1 Split air conditioner

A split system is a heating and cooling system with indoor and outdoor units connected by copper tubing. Split systems might comprise a heat pump or air conditioner installed outside the home, as well as a gas furnace or fan coil installed within the home.

- There is a lack of cooling. Split air conditioners are very efficient and can chill space to the desired temperature in a short amount of time.
- Low Refrigerant Level
- Malfunctioning Compressor

1.2 Evaporative cooled system

A device that cools the air by evaporating water is known as an evaporative cooler. The phase shift of liquid water to water vapor (evaporation), which can cool air using considerably less energy than refrigeration, can drastically lower the temperature of dry air. Evaporative cooling is most effective when the relative humidity is low, so it's only useful in dry climates. Evaporative cooling considerably increases internal humidity, which desert residents may like because the wet air rehydrates dry skin and sinuses.

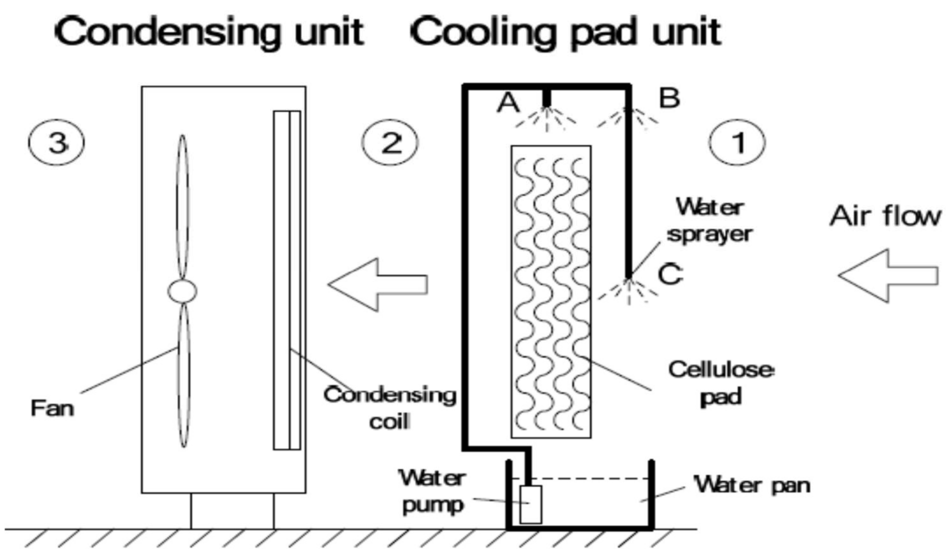

Fig:1. Evaporative cooled system

2. Objective of the study

To improve the performance of a split-type air conditioner's air-cooled condenser.

- ➢ To lower the temperature of ambient air before it passes over the condenser coil by utilizing a wood wool, cellulose evaporative cooling pad.
- ➢ Using direct evaporative cooling to lower the condenser on-coil temperature and boost the system's coefficient of performance.
- ➢ Lower the compressor's effort to reduce the system's energy usage.
- ➢ Determine the relationship between ambient air temperature and the air conditioning system's coefficient of performance (COP).

2.1 Fabrication of Cooling pad used in the System

The cooling pad is constructed in a step-by-step process; first, a rectangular frame with a G.I. sheet is made for the cooling pad, with length, width, and height of 60 cm, 50 cm, and 8 cm, respectively. Then, on the bottom side of the frame, a hole is built for collecting excess water and directing it to the water reservoir. The wood wool pads are then arranged in a rectangular frame as wetted

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media, with each pad having a thickness of 3 cm. It is supported by G.I. wire to ensure that wetted material is distributed evenly. Later, a 2.5 cm diameter PVC pipe is utilized to spray water at the top of the pads. The holes are spaced evenly along their length, with a 1 cm gap between them. It is then connected to the feedwater pump via a 1.5 cm diameter plastic pipe for a predetermined water circulation rate across the pad. Following that, the Cellulose pad is placed in a rectangular frame as wetted media, with a thickness of 5cm and the same water spraying system as the wood wool pads.

Fig:2. Fabrication of cooling pad

2.2 Instrumentation Made with the Experimental Setup

As illustrated in Fig. 1, an evaporative media pad with a thickness of 3 cm was added behind the condenser with a gap of 2.5 cm between them to provide the biggest cooling area without increasing the total capacity of the air conditioner. The experiment used a Voltas split-air-conditioner (1 ton) that was already on the market. A-frame was made and filled with 1) wood wool pad of 3cm thickness and 2) cellulose pad of 5cm thickness in front of the air condenser, as shown in Figure, to match the design of the condenser.

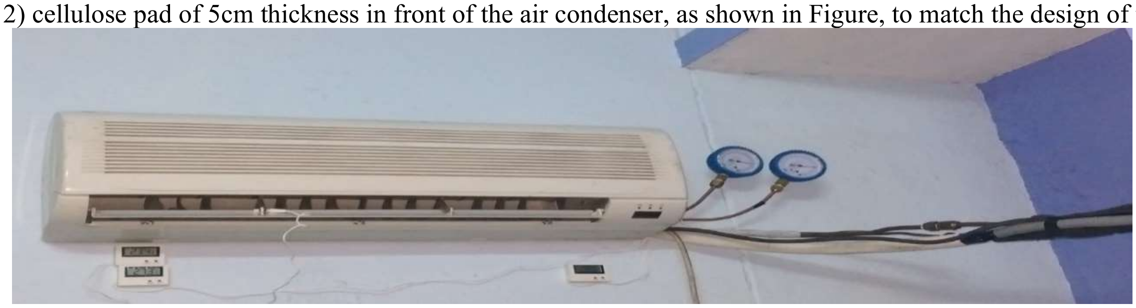

Fig:3. Pictorial view of the Indoor unit of proposed air conditioning system

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Fig:4 Pictorial view of the Outdoor unit of proposed air conditioning system

To pump water on the top of the media pad, a water circulation system with a small pump (18W), a tank, and connected pipes was created. The pads were immersed in water by a master cylinder powered by a feedwater pump that forces water flow so over top of the frame, where small holes made in it allow water to fall into the pads by gravity. Water that was not used to saturate the pad was collected insufficient water and re-circulated.

3. Experimental Procedure

For a comparative investigation of cooling performance, the standard air-conditioning system with and without the evaporatively cooled condenser is examined. The experiment began with the activation of a standard air conditioner without an evaporative-cooled condenser. The results of this test served as a benchmark for the system's performance. The protocol for the experiment is briefly detailed here.

- Install a conventional type of condenser and run the system.
- Keep waiting until the steady-state conditions are met.
- Then, at regular intervals throughout the day, record the pressure and temperature readings at the condenser and evaporator inlet and exit sites.
- Replace the evaporatively cooled condenser with a (wood wool) evaporative cooled condenser to operate the system.
- While operating as an evaporatively cooled condenser, adjust the mass flow rate of water circulated to a predefined value.
- Record temperatures and pressures for the same intervals of time in a day at steady-state circumstances.
- Write out the water circulation mass flow rate and evaporation rates.
- Replace the evaporatively cooled condenser with a (cellulose pad) evaporative cooled condenser to operate the system.
- For the evaporatively cooled condenser, follow the same steps as for the wood wool pad.
- Calculate the compressor power consumption, the coefficient of performance (COP), and heat rejection rate
- Finally, compare the performance metrics acquired from three different forms of condenser operation to derive conclusions.

3.1 Representation of Cycles On P-H Chart

The variation in the P-h chart for conventional and evaporative cooled cycles obtained from experimental results was shown in fig.5. During a conventional cycle, the compressor work was more due to the improper condensation of refrigerant in the condenser. It was reduced in the evaporatively cooled cycle with the help of an evaporative cooling pad due to a decrease in ambient temperature. It was assumed that the expansion process through the capillary tube was ideal.

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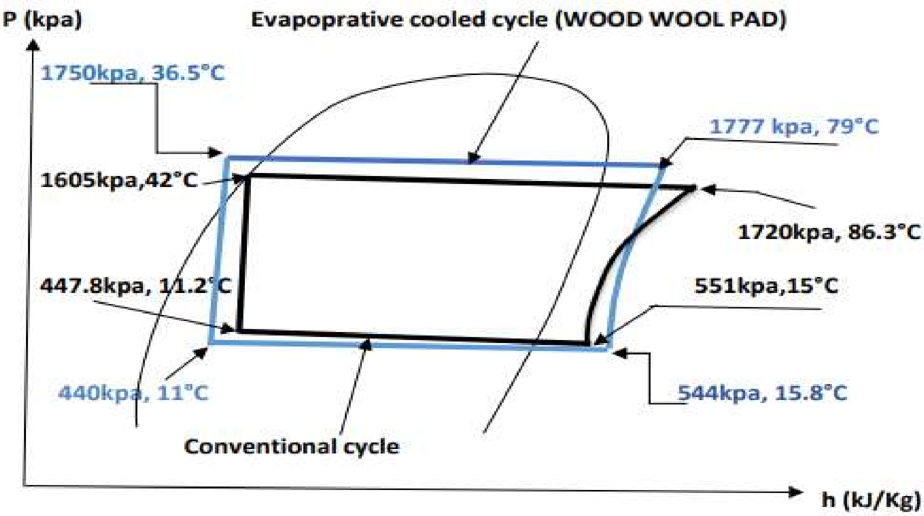

Fig: 5. Comparison of P-h chart for Conventional and Evaporative Cooled cycle (wood wool)

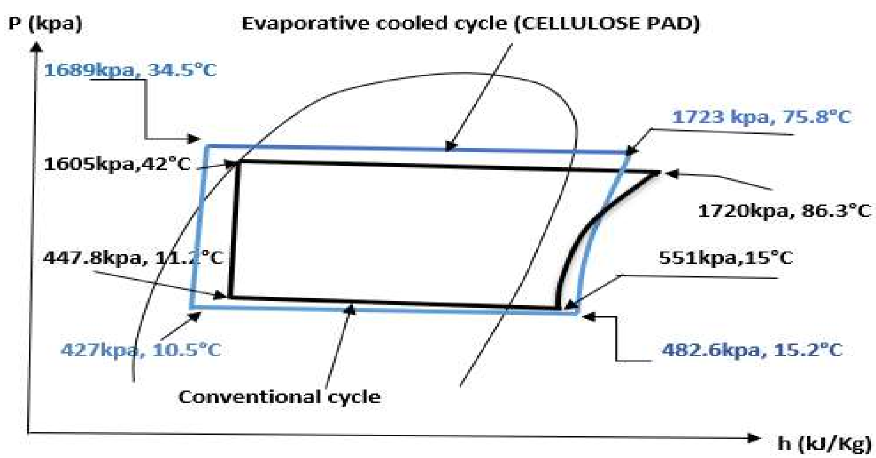

Fig:6. Comparison of P-h chart for Conventional and Evaporative Cooled cycle (CELLULOSE PAD).

The temperature drop through the condenser was more in the case of the evaporatively cooled cycle with the wood wool pad as represented in figure 5, while it was less in the conventional cycle. The refrigerant attained a subcooled state during an evaporatively cooled cycle; it was justified from the refrigerant data book. The temperature at the outlet of the condenser was 36.5^0C which was below the saturation temperature at the respective pressure of 1750 kpa. The increase in suction pressure during the evaporatively cooled cycle was responsible for the improvement in COP.

The temperature drop through the condenser was more in the case of the evaporative cooling cycle with cellulose pad as represented in figure 6, while it was less in the conventional cycle. The refrigerant attained a subcooled state during the evaporatively cooled cycle; it was justified from the refrigerant data book. The temperature at the outlet of the condenser was 34.5^0C which was below the saturation temperature at the respective pressure of 1689 kpa. The increase in suction pressure during the evaporative cooling cycle was responsible for the improvement in COP.

3.2 Effect of Ambient Conditions on Compressor Work

In Fig 7 the effect of ambient conditions on compressor work is shown, with compressor work decreasing from 45.3 KJ/Kg in the conventional cycle to 36.043 KJ/Kg in the wood wool evaporative cooling cycle. While the compressor work decreases from 45.3 KJ/Kg in the conventional cycle to 32 KJ/Kg in the cellulose pad evaporative cooling cycle, the compressor work increases with the increase in ambient temperature in both the conventional and evaporative cooled cycles with cellulose pad.

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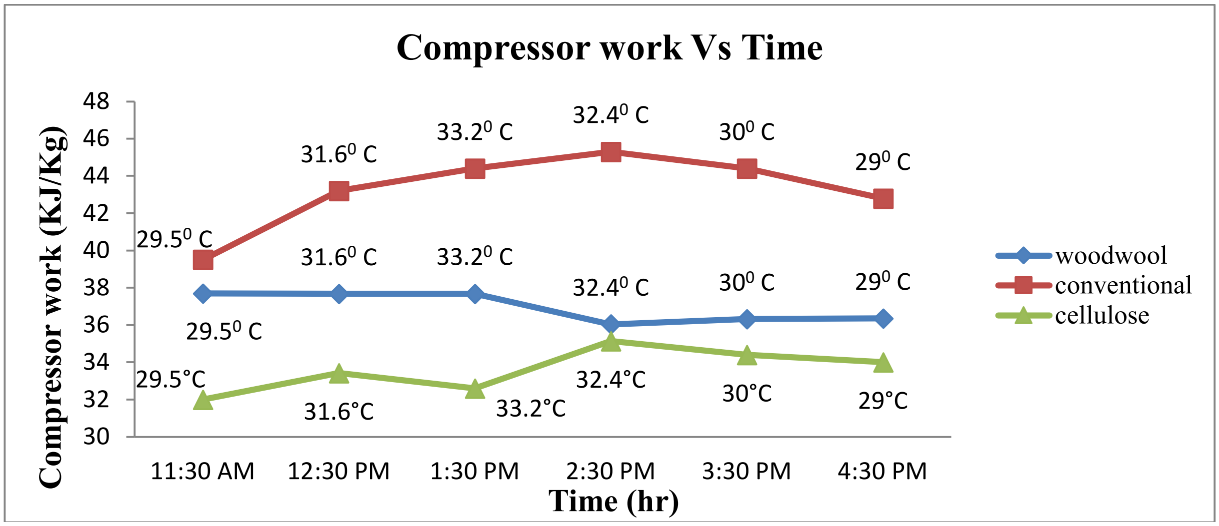

Fig:7. Comparison of Compressor work for Conventional and Evaporative cooled cycles

The ambient temperature has a big impact on the performance of systems that use both conventional and evaporative cooling. The adaption of the wood wool pad evaporative cooled cycle resulted in a 15 to 20% decrease in compressor work, while the cellulose evaporative cooling pad resulted in a 20 to 30% reduction in compressor effort. At an ambient temperature of 33.2°C, the highest reduction in compressor work is seen.

3.3 Effect of Ambient Conditions on COP

Throughout the day, there has been a fluctuation in the system's COP. It is primarily determined by the ambient temperature. In figure 8 the effect of ambient circumstances on COP variation is displayed. At moderate ambient temperatures, the system's COP is shown to be acceptable.

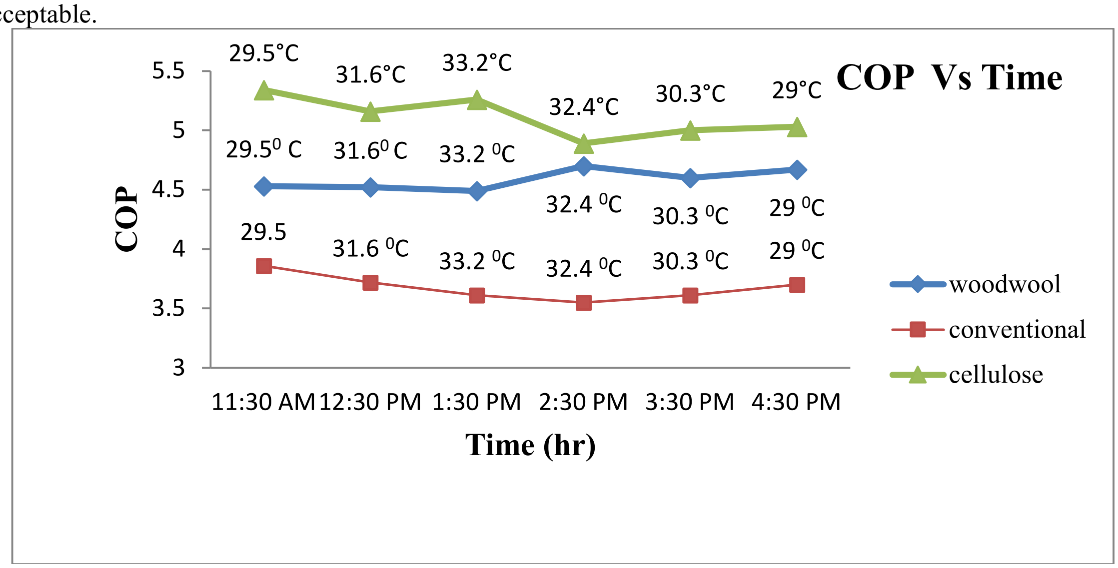

Fig:8. Comparison of COP for Conventional and Evaporative cooled cycles

The application of direct evaporative cooling to the condenser improves the system's COP the most. Because the heat load in the room fluctuated throughout the experiment, the COP also fluctuated slightly. During the day's peak hours, from 12:30 to 1:30 p.m., the air conditioning system has a low COP. The variation in experimental observations is also influenced by changes in direct solar radiation on the outdoor unit. The system's COP for a normal cycle is in the range of 3.5 to 3.8, but it improves from 4.49 to 4.67 with the addition of a wood wool evaporative cooling cycle, and it improves even more with the addition of a cellulose cooling pad, from

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4.59 to 5.34 with the refrigerant being subcooled. At an ambient temperature of 300°C, the maximum percentage improvement in COP is 23.28 percent with a wood wool pad and 35 percent with a cellulose cooling pad.

3.4 Effect of Ambient Conditions on Water Evaporation Rate

The water evaporation rate after heat rejection in the condensation is also an important key parameter while chatting about the performance of the evaporative cooling system. The effect of ambient circumstances on water evaporation rate is depicted in figure 9. The rate of water evaporation increases as the ambient temperature rises.

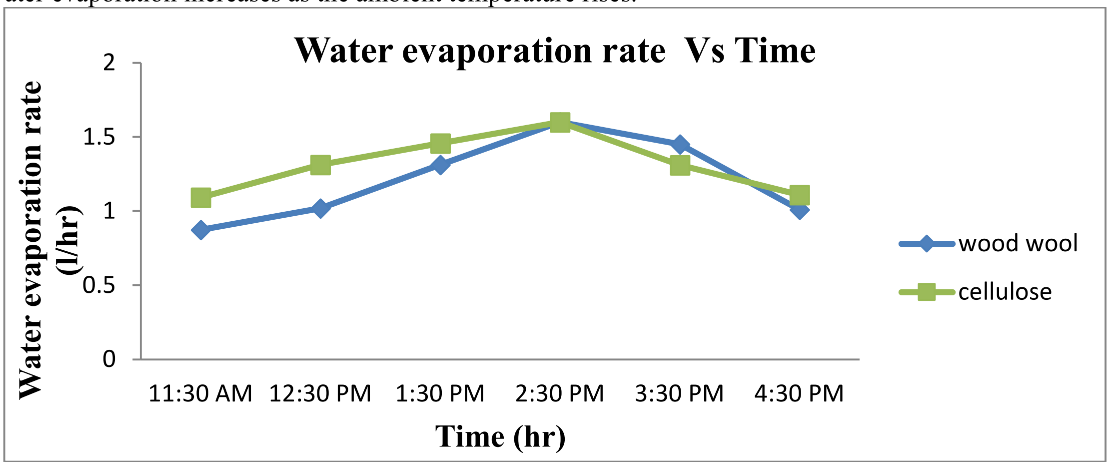

Fig: 9. Variation of Water evaporation rate at various ambient temperatures

The high-water evaporation rate is recorded from 1:30 PM to 2:30 PM i.e., with 1.6 l/hr at an ambient temperature of 33.2^{0}C. Water evaporation is influenced by a variety of factors, including heat rejection from the condenser and direct solar radiation. Previously, it was considered that the water evaporation rate was primarily due to heat rejection from the condenser. Throughout the experiment, the water evaporation rate was changed between 1.05 and 1.8 l/hr.

3.5 Effect of Water Evaporation Rate on COP

From the experimental results it was evident that the COP of the wood wool evaporative cooling system, cellulose evaporative cooling system increased with the increase of water evaporation rate. The effect of water evaporation rate on COP improvement with wood wool & cellulose pad is indicated in Figures 10 and 11.

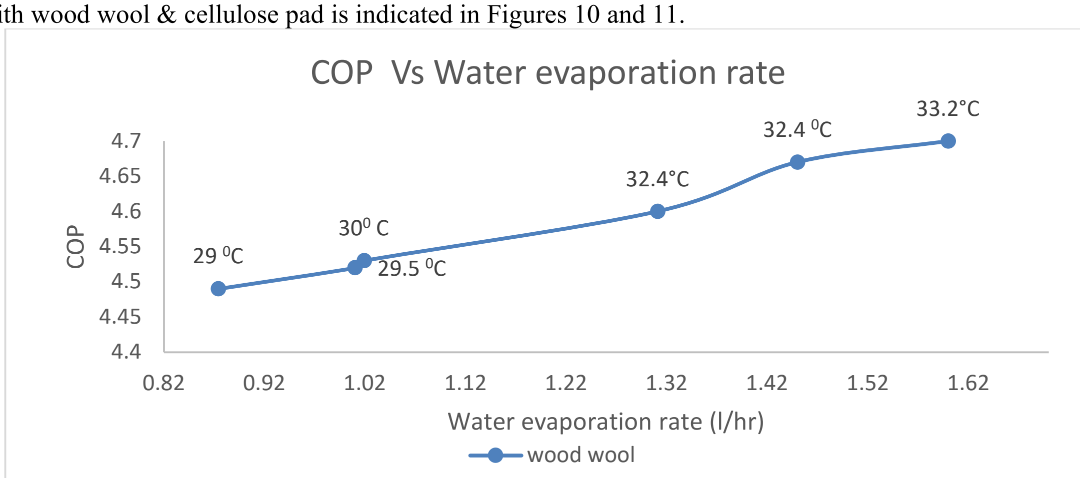

Fig: 10. Variation of COP against water evaporation rate

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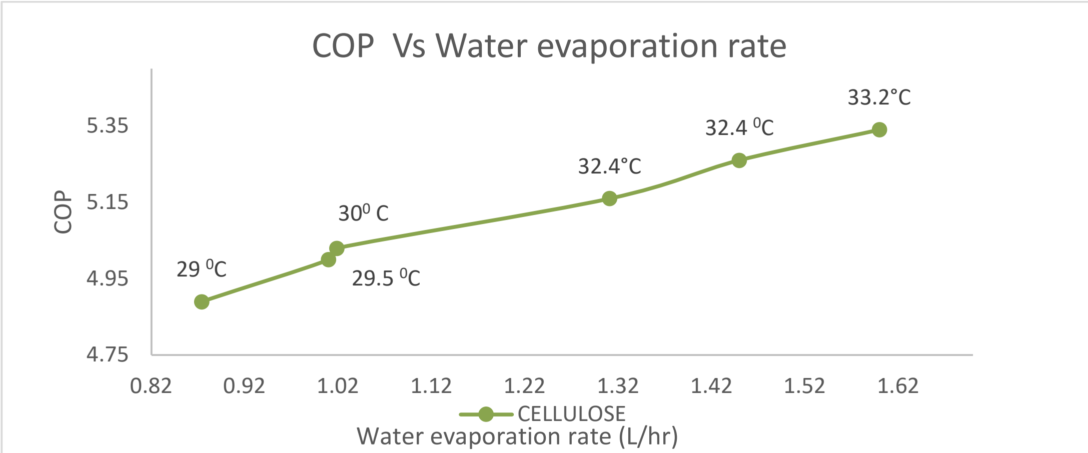

Fig:11. Variation of COP against water evaporation rate

On all days of experiment conduction, the ambient temperature never crossed 40^0C, but literature reveals that when the air temperature increases and approaches 50^0C or higher, the performance of the evaporatively cooled condenser drops down gradually and the air conditioner or split unit works improperly since the temperature and the pressure of the condenser increases and the compressor is forced to work under the greater pressure ratio which results in more power consumption. The COP of the system has been improved from 4.49 to 4.67 with grass pad and 4.89 to 5.34 with cellulose cooling pad with the attainment of maximum COP observed at the ambient temperature of 33.2^0C.

3.6 Effect of Ambient Conditions on Heat Rejection Rate

The heat rejection rate from the condenser is primarily affected by the ambient air temperature surrounding the condenser. The effect of ambient conditions on heat rejection rate is plotted below figure.

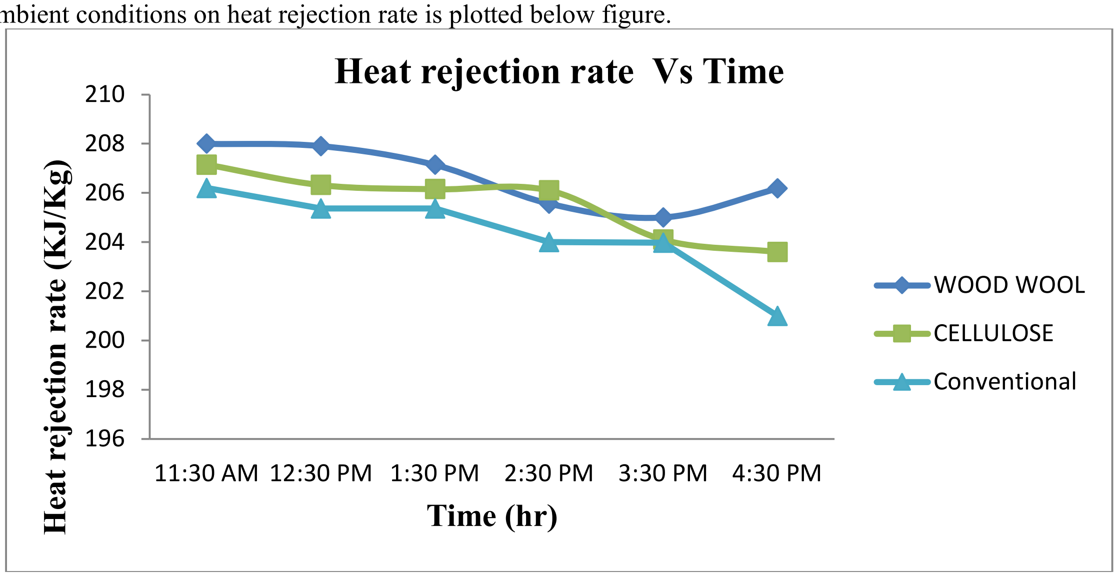

Fig:12. Comparison of heat rejection rates for Conventional and Evaporative cooled cycles

The heat rejection rate is higher in an evaporative cooling system than in a conventional system because the air temperature entering the condenser is reduced with the help of an evaporative cooling pad. When compared to the conventional type, the air temperature leaving the condenser for the evaporatively cooled condenser is 50 degrees cooler. This temperature differential may help to achieve sub-cooling of the refrigerant leaving the condenser, which improves system performance. With the use of evaporative cooling, the enthalpy change of air over the condenser has been increased. When compared to a normal air-cooled condenser, the enthalpy changes in the air surrounding the evaporatively cooled condenser would be greater. The highest heat rejection rate is seen

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during the system's startup hours, which are 11:30 AM to 12:30 PM. While operating on an evaporatively cooled cycle with a higher percentage of 2 to 3 percent, the heat rejection rate improved from 0.9 to 2.25 KJ/Kg.

3.7 Effect of Water Consumption on Compressor Work Savings

The difference between the effort of the compressor for the traditional condenser and the work of the compressor for the wood wool evaporative cooled condensate is plotted against the water consumed by the system.

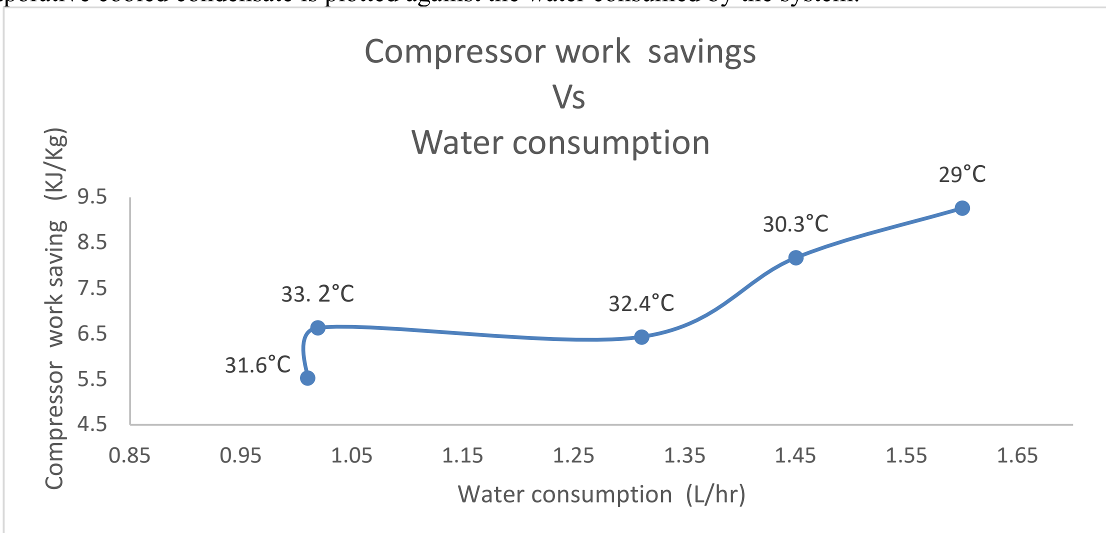

Fig:13. Variation of Compressor work savings against Water consumption

The reduction in the compressor work, defined by the difference between the work of the compressor for the conventional condenser and the cellulose evaporative cooled condenser, is plotted against the water consumed by the system as shown in figure 13.

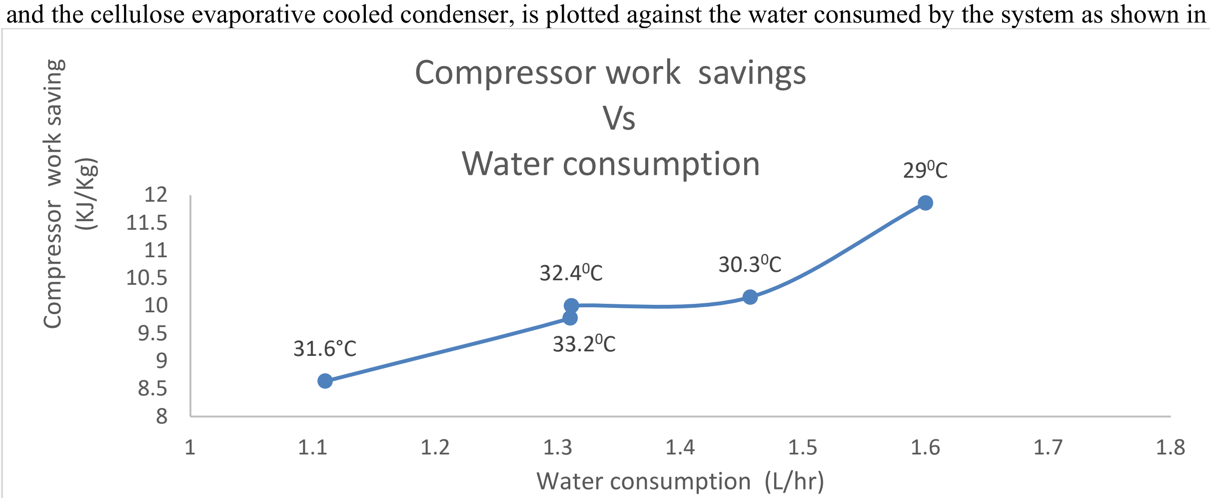

Fig:14. Variation of Compressor work savings against Water consumption

The reduction in compressor effort grows as the amount of water consumed increases, resulting in energy savings. The ambient temperature never exceeded 400°C during the testing, but as the ambient air temperature rises to 500°C or more, the performance of the evaporatively cooled condenser rapidly declines, causing the air conditioner or split unit to malfunction. Because the condenser's temperature and pressure rise, the compressor is forced to work under a higher-pressure ratio. As a result, more energy is consumed. The water consumption rates for the wood wool system are 1010ml, 1020 ml, 1300 ml, 1450 ml, and 1600 ml, respectively, and the energy savings are 5.53KJ/Kg, 6.63 KJ/Kg, 5.43 KJ/Kg, 8.17 KJ/Kg, 9.26 KJ/Kg, while the ambient air temperature was 29.50°C, 31.60°C, 33.20°C, 32.40°C, 33°C The energy savings for the cellulose pad cooling system are 5.53KJ/Kg, 6.63 KJ/Kg, 5.43 KJ/Kg, 8.17 KJ/Kg, and 9.26 KJ/Kg, respectively.

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4. Conclusion

The performance of a split air conditioning system was investigated by contrasting direct evaporative cooling using a cellulose, wood wool cooling pad condenser with a traditional air-cooled condenser. The thermal performance in terms of temperature showed that Direct Evaporative cooling could drive the system into a sub-cooled state of operating condition, resulting in an increase of saturation temperature drop through the condenser from 20^0C to 4.50°C, based on multiple tests on condensers of given design conditions. It also decreases compressor effort, resulting in a COP boost of 15% to 25%.

Experiments on a split air conditioning system with an evaporatively cooled condenser have yielded the following estimates of improvements.

- Power usage is reduced by up to 20%.
- The total performance will be enhanced by about 25%.
- Based on local prices, an economic study reveals that the energy savings can pay for the cost of upgrading the condenser in less than 6 months.
- The system has a minimal installation cost.

As a result, in extremely hot conditions, using an evaporatively cooled condenser is highly recommended. The suggested system has great commercial potential because it can be simply coupled to an existing system at a minimal cost. It was also discovered that by installing a more efficient evaporation system, the system's performance could be significantly enhanced.

References

1. D.Y. Goswami, "Experimental Investigation of Performance of a Residential Air Conditioning System with an Evaporative Cooled Condenser," Fuel and Energy Abstracts, Volume 43, Issue 4, July 2002, Page 284; D.Y. Goswami, "Experimental Investigation of Performance of a Residential Air Conditioning System with an Evaporative Cooled Condenser," Fuel and Energy Abstracts, Volume 43, Issue 4, July 2002, Page 284; D.
2. Y. Hwang, "Experience with Refrigerant Mixtures," Current Applied Physics, Volume 6, Supplement 1, August 2006, e67-e71.
3. Chemical Engineering Research and Design, Volume 78, Issue 7, October 2000, Pages 999-1009, H. El-Dessouky, "Performance analysis of two-stage evaporative-coolers"
4. E. Hajidavalloo, "Application of evaporative cooling on the window-air-conditioner condenser," Applied Thermal Engineering, Volume 27, January 2007, Pages 1937–1943.
5. M.M. Nasr, Renewable Energy, Volume 34, Issue 11, November 2009, Pages 2447-2454, "Experimental and Theoretical Investigation of an Innovative Evaporative Condenser for Residential Refrigerator."
6. E. Hajidavalloo, H. Eghtedari, Evaporatively cooled air condenser improves the performance of air-cooled refrigeration system, International Journal of Refrigeration 33 (2010) 982–988.
7. Tian Wei Wang, Chenguang Sheng, and A.G. Agwu Nnanna, Experimental investigation of an air conditioning system employing an evaporative cooling condenser, Energy, and Buildings 81 (2014) 435–443.
8. E. Hajidavalloo, Hajidavall On the condenser of a window air conditioner, evaporative cooling is used. The Journal of Applied Thermal Engineering, Volume 27, Numbers 1937–1943, is a journal dedicated to the study of thermal.
9. Lina Ismail Jassim, Mechanical Engineering Department, Al Mustansiriyah University, Enhancement of the Performance of the Condenser of Split Type Air Conditioning System Using Evaporative Cooling
10. Navigant Consulting, Inc., September 23, 2009, Energy Savings Potential and R&D Opportunities for Commercial Refrigeration
11. A review on buildings energy consumption information, Energy, and Buildings 40 (3) (2008) 394–398. Luis Perez-Lombard, Jose Ortiz, Christine Pout, Luis Perez-Lombard, Jose Ortiz, Christine Pout, Luis Perez-Lombard, Luis Perez-Lombard, Luis Perez-Lombard,
12. Applied Thermal Engineering 27 (5) (2007) 823–828. [10] Michalis Gr Vrachopoulos et al., Incorporated evaporative condenser.
13. Applied Thermal Engineering 23 (2003) 325-340. [11] Ala Hasan and Kai Siren, Performance investigation of plain and finned tube evaporatively cooled heat exchangers.
14. Standard 55 - 2010 Thermal Environmental Conditions for Human Occupancy, published by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
15. Shan K. Wang, New York: McGraw-Hill, 2000, "Handbook of Air Conditioning and Refrigeration."
16. S. Chand publications, R.S.Khurmi and J.K. Gupta's A Textbook of Refrigeration and Air-conditioning.
17. R.K.Rajput's A Textbook of Refrigeration and Air Conditioning.