Solar assisted Vapor Adsorption Refrigeration System Analysis

Ankit agarwal [1], sumen negi [2]
[1]M.tech Scholar, ME, BVP, DELHI, India
[2]Assistant Professor, ME, , BVP, DELHI, India

Abstract: - In many areas of the globe, particularly in mild climates, the demand for air conditioning is quickly growing. The only equipment that consumes more electricity say 70 percent in household articles is air conditioners and refrigerators. Usually a conventional cooling technology is based on the electrically powered cooling scheme. These systems have several disadvantages: they involve elevated concentrations of primary energy consumption, and in many areas of the globe, particularly in mild climates, demand for ir conditioning is quickly rising. In many areas of the globe, particularly in mild climates, the demand for air conditioning is quickly growing. The only equipment that consumes more electricity say 70 percent in household articles is air conditioners and refrigerators. The factors together with the adsorbent-adsorbate couple, the gadget design and the arrangement of the subsystems were chosen with great care for the effective operation of this gadget.

Keywords: - air conditioning, energy consumption, refrigerators, adsorbent-adsorbate, gadget, subsystems

Introduction: -

According to the International Refrigeration Institute, around 15 percent of the world's complete electricity generation is consumed for cooling and air conditioning purposes. Approximately 80% of the world's energy is produced through the use of fossil fuels that substantially increase CO2 emissions, leading to an increase in worldwide warming [1]. The exploitation of current solar energy to run a refrigeration system is reasonable in order to decrease the consumption of fossil fuels and at the same moment encourage the use of sustainable energy. Using solar energy as the demand for cooling and the quantity of solar energy available are directly proportional to each other is quite viable [2]. Solar-driven vapor compression cooling has benefits in energy conservation and environmental protection, but standard solar-driven vapor compression cooling has many disadvantages, such as low effectiveness, intermittent operation, excessive unit size and excessive capital costs [3].
Most cooling systems work on the refrigeration cycle of vapor compression. This system generally consumes high-grade and dearer electrical power as well. Large-scale energy consumption from traditional resources such as fossil fuels also presents critical problems that need to be resolved with the utmost care and circumstances [5]. The on - the-spot mitigation technique is to emphasize all electricity-invasive industries to make use of renewable energy resources that include sun energy, wind power, and so on as well as waste heat from business methods [6]. Different recognized commercial electricity assets, solar power is proven to be readily accessible for energy-hungry places in tropical areas (on our mother planet, the Earth). Although solar power is diluted and intermittent, its cooling urge is due to its abundant and non-polluting accessibility [7].

Proposed methodology:

On the premise of requirement and alertness of refrigeration, system components are designed thermally with the assist of heat switch evaluation alongside thermodynamic standards. the

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principle additives require right design of adsorption mattress, evaporator, capillary and condenser. the subsequent sections illustrate the numerous methodologies followed to estimate the required geometrical parameters of components of adsorption system working with selected working pairs.

Design of adsorption bed:

Figure 1: Algorithm of adsorption bed designer

The above figure 1 shows the Algorithm of adsorption bed designer.

Design of evaporator:

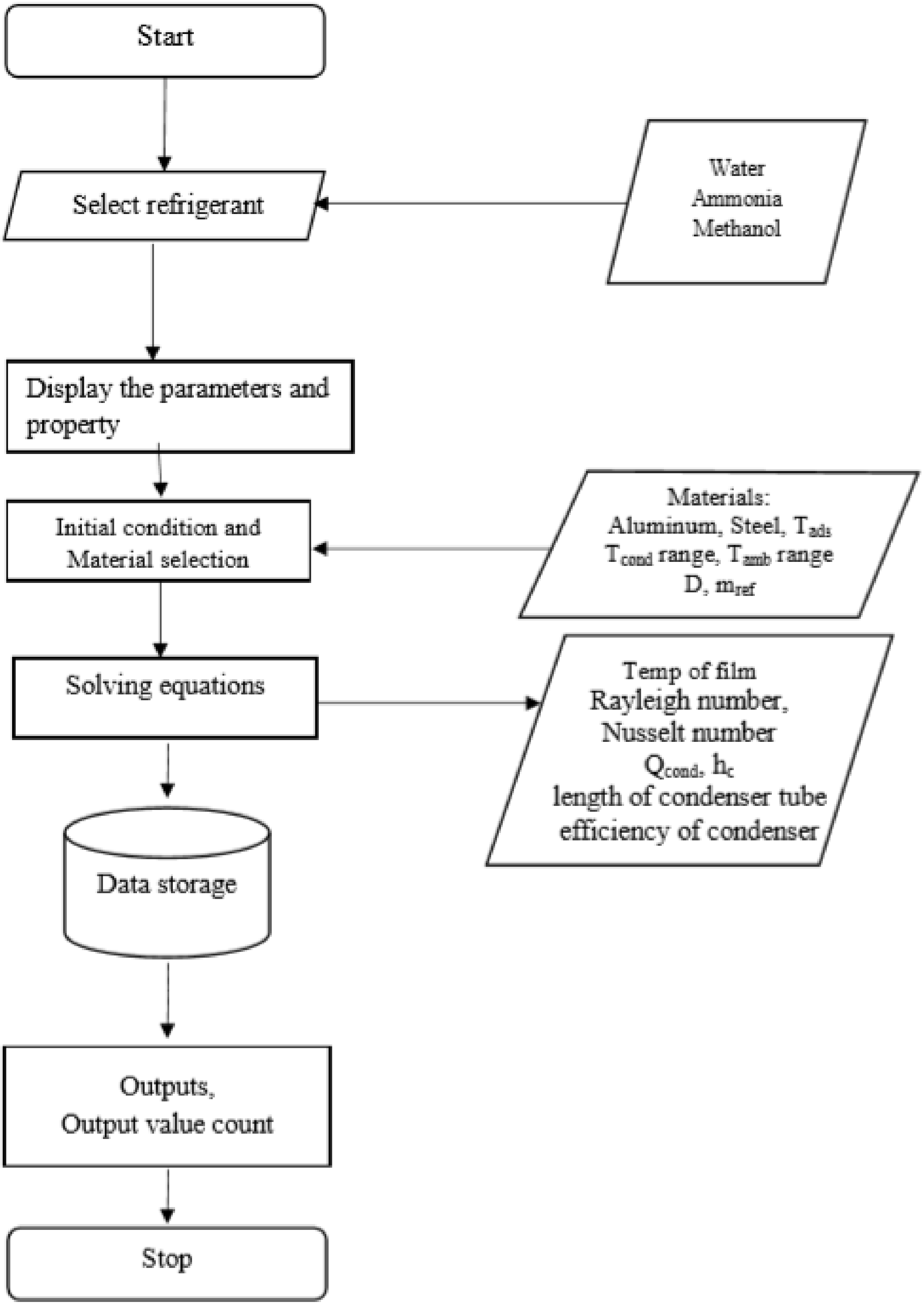

Figure 3: Algorithm of evaporator designer

The figure 3 shows the Algorithm of evaporator designer. The heat needs to be dissipated from the condenser should be accurately calculated to condense the refrigerant to the liquid within the prescribed period of time-shares optimiser condenser designer instrument is a helpful instrument for determining the length and diameter of the pipe needed for a particular implementation.

Result:

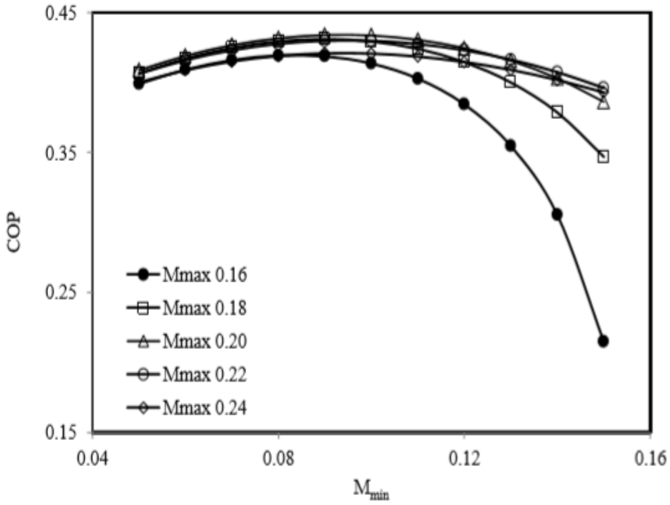

Figure 4: Influence of minimum mass concentration ratio on COP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr for zeolite-water

The above figure 4 shows the Influence of minimum mass concentration ratio on COP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr for zeolite-water

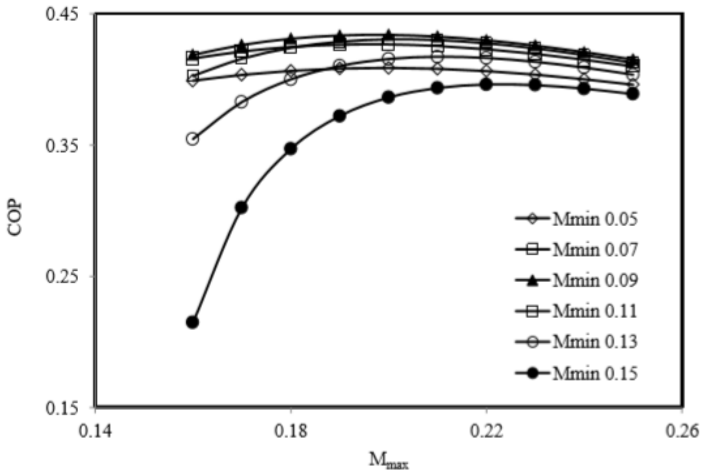

Figure 5: Influence of maximum mass concentration ratio on COP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr for zeolite-water

The above figure 5 shows the Influence of maximum mass concentration ratio on COP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr for zeolite-water.

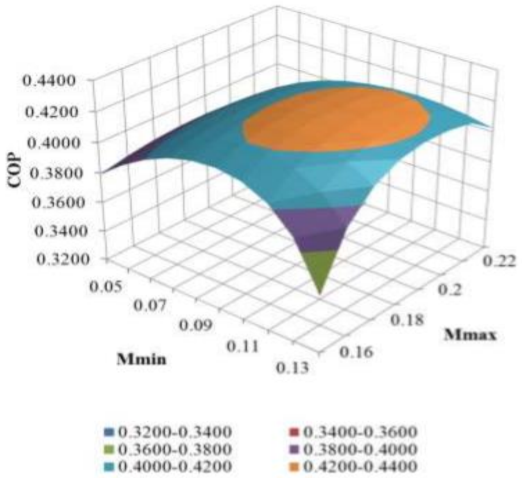

Figure 6: Effect of mass concentration ratios on COP for zeolite-water

The figure 6 shows the Effect of mass concentration ratios on COP for zeolite-water.

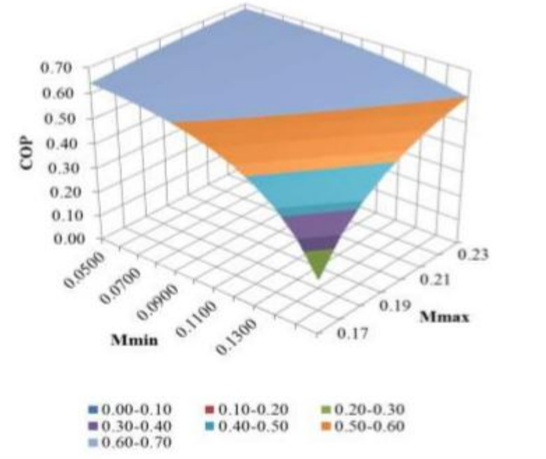

Figure 7: Effect of mass concentration ratios on COP for AC-methanol

The figure 7 shows the Effect of mass concentration ratios on COP for AC-methanol

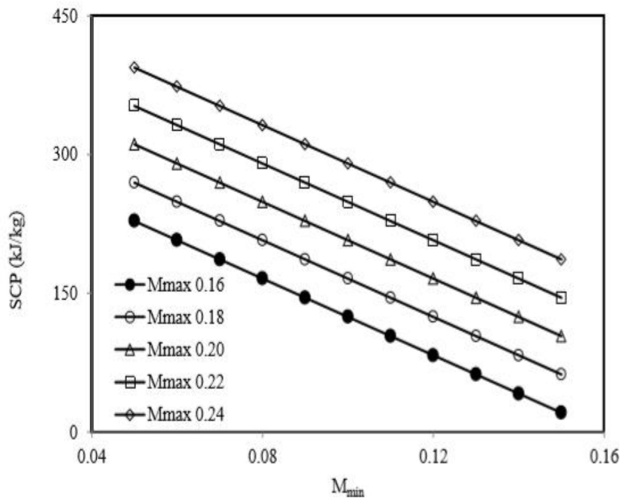

Figure 8: Influence of minimum mass concentration ratio on SCP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr -water

The figure 8 shows the Influence of minimum mass concentration ratio on SCP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr for Zeolite-water

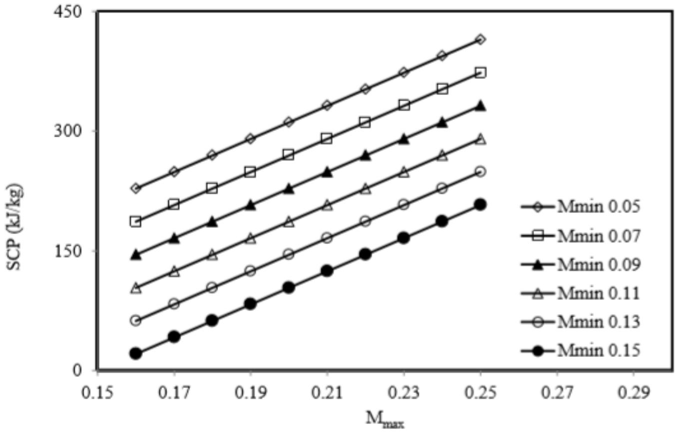

Figure 9: Influence of maximum mass concentration ratio on SCP at Tevap = 274 K Tcond = 298 K Qevap = 1000 kJ/hr for Zeolite-water

The figure 9 shows the Influence of maximum mass concentration ratio on SCP at Tevap = 274 K Tcond = 298 K Qevap = 1000 kJ/hr for Zeolite-water.

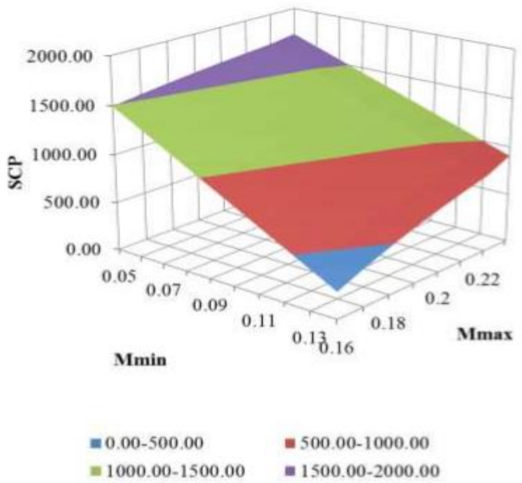

Figure 10: Influence of mass concentration ratios on SCP for Zeolite-water

The figure 10 shows the Influence of mass concentration ratios on SCP for Zeolite-water.

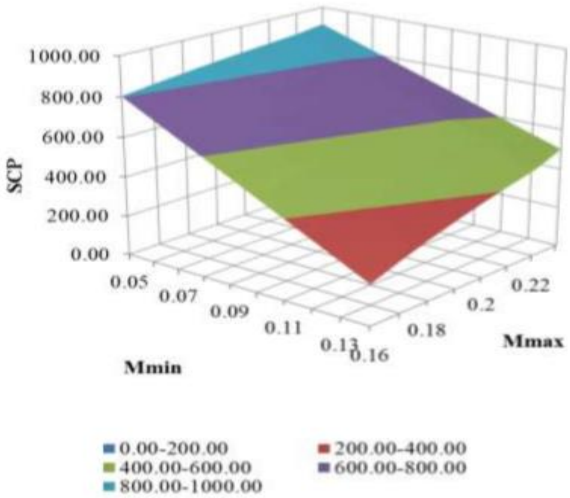

Figure 11: Influence of mass concentration ratios on SCP for AC-methanol

The figure 11 shows the Influence of mass concentration ratios on SCP for AC-methanol.

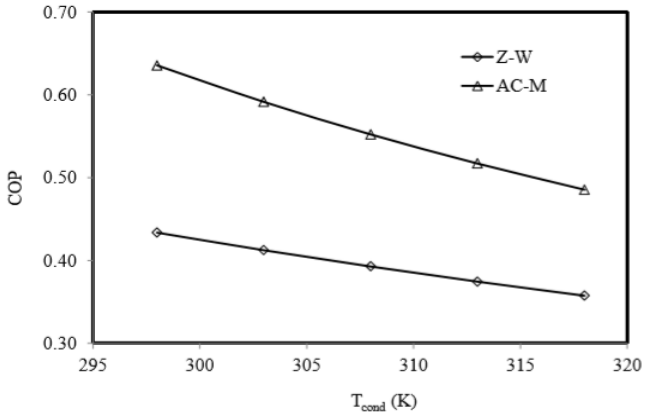

Figure 12: Influence of condenser temperature on COP for two different adsorption pairs for Tevap = 274 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

The figure 12 shows the Influence of condenser temperature on COP for two different adsorption pairs for Tevap = 274 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr.

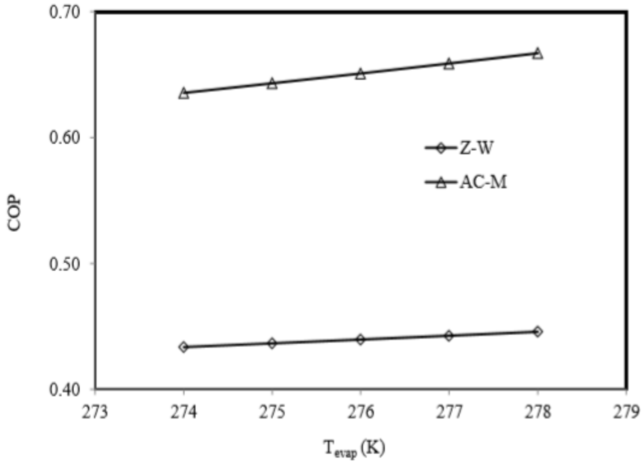

Figure 13: Influence of evaporator temperature on COP for different adsorption pairs. Tcond = 298 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

The figure 13 shows the Influence of evaporator temperature on COP for different adsorption pairs. Tcond = 298 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

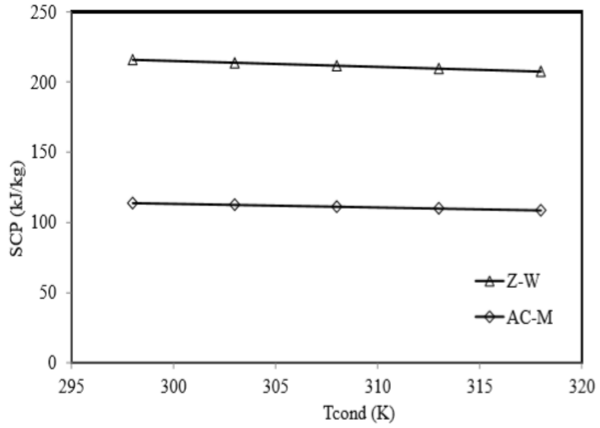

Figure 14: Outcome of condenser temperature on SCP of dissimilar adsorption pairs. Tevap = 274 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

The figure 15 shows the Outcome of condenser temperature on SCP of different adsorption pairs. Tevap = 274 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

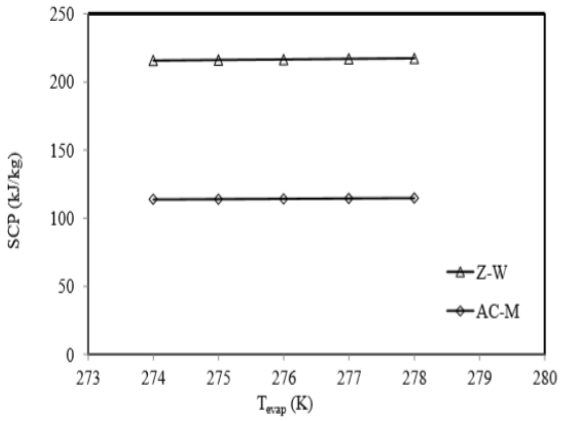

Figure 15: Outcome of evaporator temperature on SCP for dissimilar adsorption pairs. Tcond = 298 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

The figure 15 shows the Effect of evaporator temperature on SCP for different adsorption pairs. Tcond = 298 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

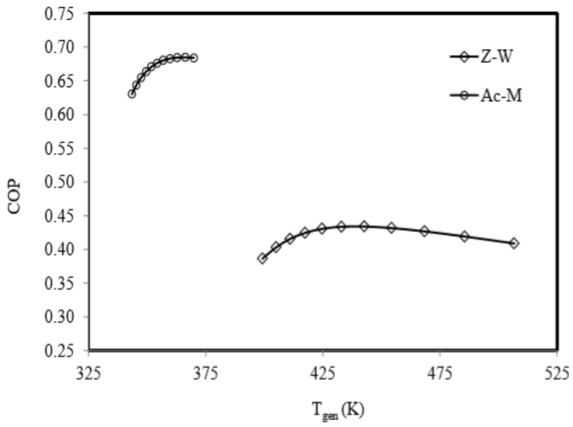

Figure 16: Consequence of generation temperature on COP for different adsorption pairs. Tevap = 274 K, Tcond= 298 K, Mmax = 0.2, Qevap = 1000 kJ/hr

The figure 16 shows the Consequence of generation temperature on COP for different adsorption pairs. Tevap = 274 K, Tcond= 298 K, Mmax = 0.2, Qevap = 1000 kJ/hr

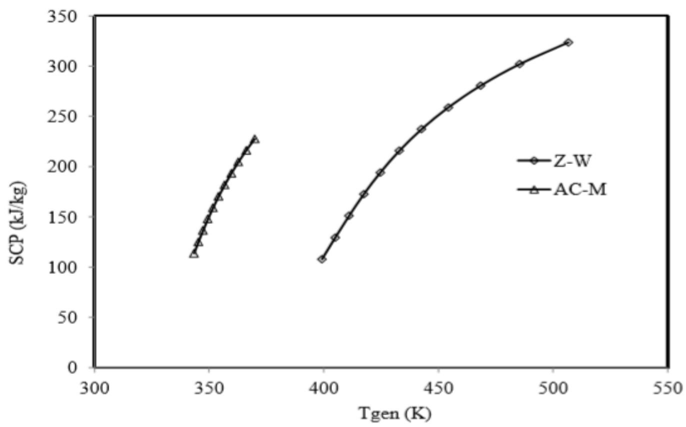

Figure 17: Consequence of generation temperature on SCP for different adsorption pairs. Tevap = 274 K, Tcond= 298 K, Mmax = 0.2, Qevap = 1000 kJ/hr

The figure 17 shows the Consequence of generation temperature on SCP for different adsorption pairs. Tevap = 274 K, Tcond= 298 K, Mmax = 0.2, Qevap = 1000 kJ/hr

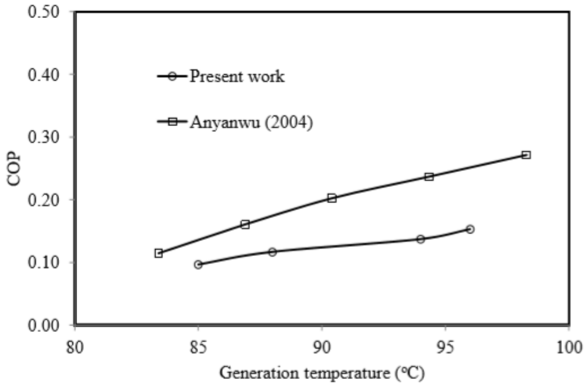

Figure 18: Validation of experimental results

The figure 18 shows the Validation of experimental results.

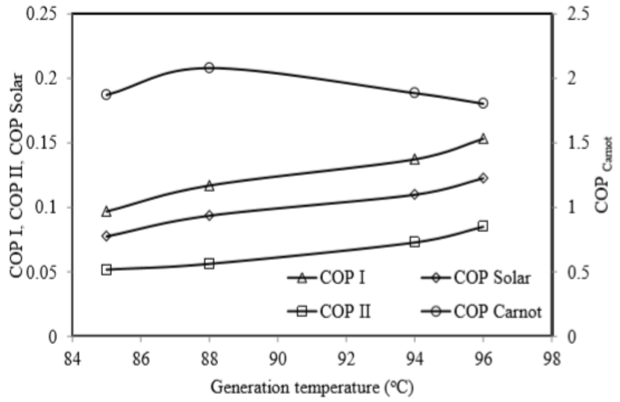

Figure 19: Plot of COP's vs generation temperature

The figure 4.23 shows Plot of COP's vs generation temperature

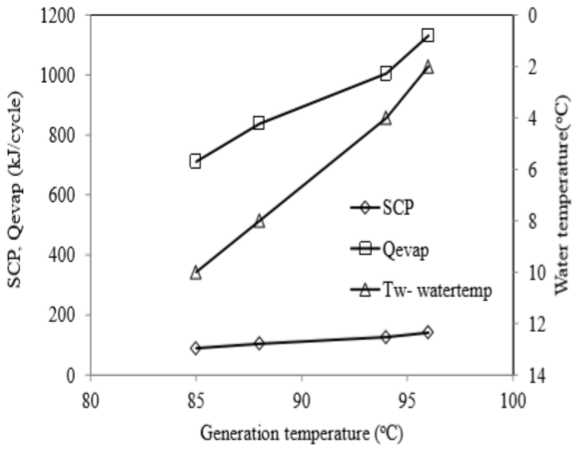

Figure 20: Variation of SCP, Qevap and Tw with generation temperature

The figure 20 shows Variation of SCP, Qevap and Tw with generation temperature

Conclusion: -

The design of the refrigeration adsorption gadget is promising. A general thermodynamic-based adsorption machine comparison indicates that the machine's efficiency depends on each of the pairs and procedures of adsorption. The generation continues to expand and the cost of sun adsorption refrigeration energy production is dropping. This article provides a typical evaluation of important knowledge of suitable housing of adsorbent pairs and methods engaged in the refrigeration cycle of adsorption. The proportion of temperatures, pressures and concentration was calculated at exclusive points. Furthermore, there were countless generation and absorber temperatures to determine the most effective temperatures.

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