Solar assisted Vapor Adsorption Refrigeration System Analysis

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Abstract: - In general, conventional cooling technologies are based on the electrically driven cooling system. Solar adsorption cooling is an alternative for overcoming standard cooling system disadvantages**.** This paper as a whole focus on the overall performance and analysis of India's tropical wet and dry climate Solar assisted Vapor Adsorption Refrigeration System Analysis. The factors which can be relevant to the depth of solar radiation together with nearby latitude, angle of inclination of the receiving floor, climate conditions etc. The system proposed consist of a glass tube having sorption mattress, condenser and an evaporator. The running pair of fluid used is low grade charcoal and methanol. For the successful operation of this gadget the factors together with adsorbent-adsorbate pair, gadget layout and arrangement of the subsystems had been selected with fantastic care.

Keywords: Adsorption system, refrigeration device, solar adsorption, sorption mattress, adsorbent-adsorbate pair

I. INTRODUCTION

Worldwide, most cooling and refrigeration systems are powered by electricity. Due to growing cooling and refrigeration demand, peak-load problems in the electricity grid in countries with high cooling load are forever increasing [1]. Thermally driven cooling technologies represent promising alternatives and are set to play a key role in the efficient conversion of energy in the field of building air-conditioning and refrigeration. Today, these technologies are used mainly combined with waste heat, district heat or cogeneration plants. But thermally driven cooling cycles can also run with solar thermal energy. In climates where cooling is not required all year round, solar thermal driven cooling systems can also be used for space heating or domestic hot water preparation during periods without cooling demand [2].

Absorption systems are widely studied as they are a green alternative to conventional compression chillers. The electricity enter is waste heat or a renewable heat source, including non-traditional sun or geothermal warmth. some other gain is that absorption gadgets operate with environmentally friendly working fluids. with the aid of combining the 2 stated advantages over mechanical compression cooling structures, you may reap a reduction of the bad impact on the surroundings [3]. an in-depth country of the artwork overview of solar absorption refrigeration structures changed into published with the aid of exclusive analyses and numerical simulations were finished through researchers in the sector, leading to improved hobby. emphasised in their study that among all set up worldwide sun thermal assisted cooling structures, sixty-nine% are absorption cycle-based totally. most of the published works on solar cooling structures are targeting absorption cycle systems running with LiBr-H2O solution and flat plate solar collectors [5]. As Duffie and Beckman emphasised, the temperature limitations of flat plate collectors imposed the use of LiBr-H2O primarily based structures. Ammonia-water based systems require higher temperature heat sources and therefore are much less used with flat plate creditors. The capability of the ammonia–water absorption refrigeration system in Dhahran, Saudi Arabia, became evaluated by using for a cooling ability of 10 kW pushed by way of a 116 m2 of evacuated tube solar collector. The gadget became coupled with twin storages of ice and chilled water used as a substitute feature on solar strength availability and according with the cooling demands of a 132 m3 room [6].

II. PROPOSED METHODOLOGY

System components are designed thermally with the assist of heat switch evaluation alongside thermodynamic standards. the 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.

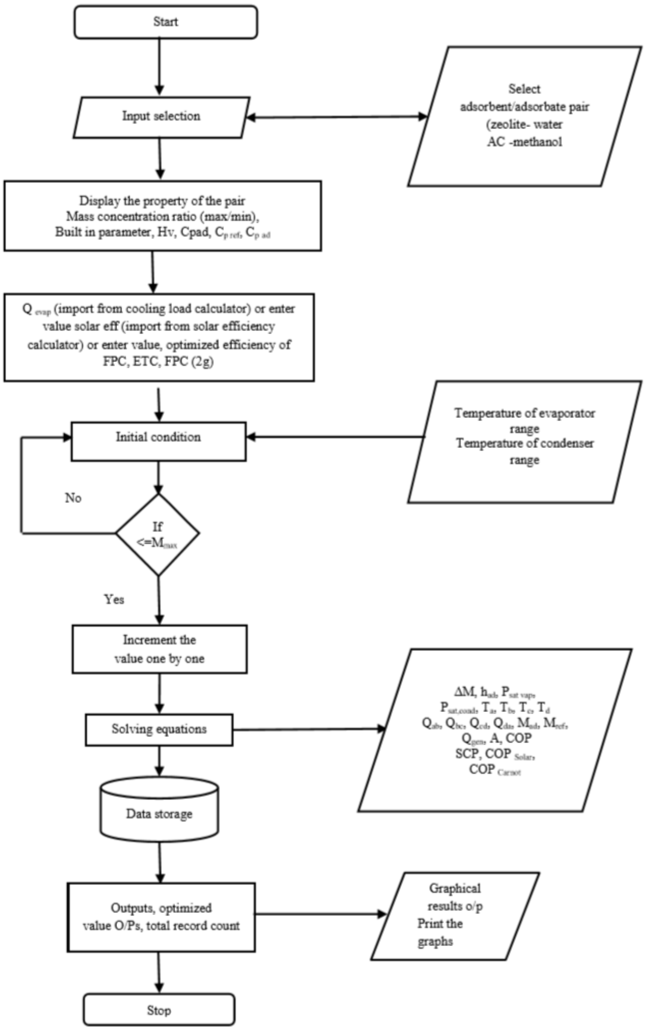

Figure 1: Algorithm of SAARS optimiser

The figure 1 shows the Algorithm of SAARS optimiser.

Design of adsorption bed:

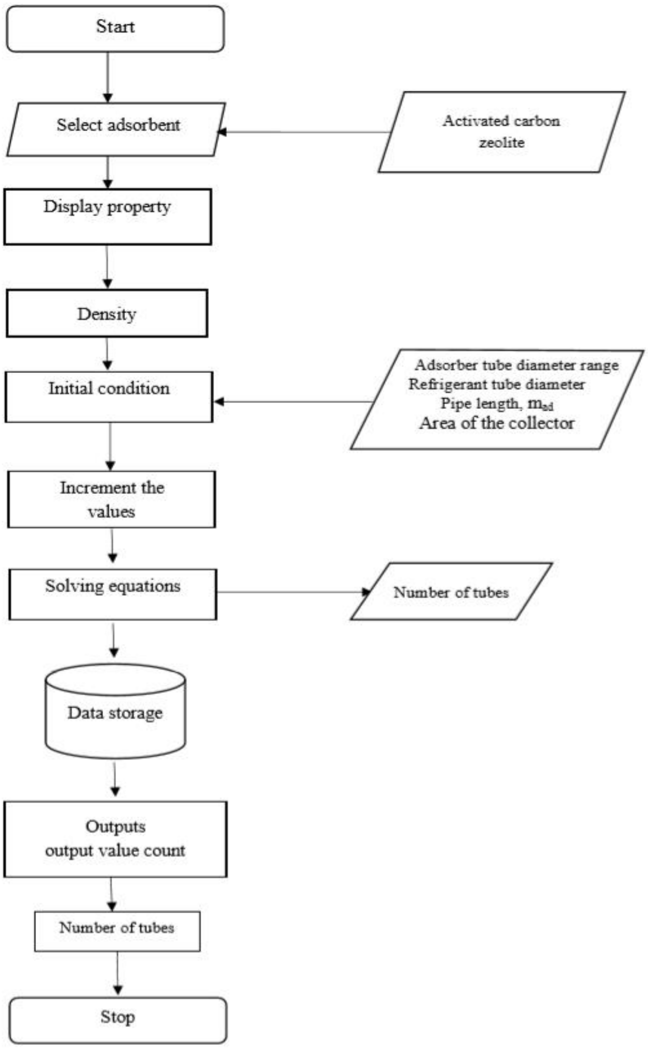

Figure 2: Algorithm of adsorption bed designer

The above figure 2 shows the Algorithm of adsorption bed designer.

Design of evaporator:

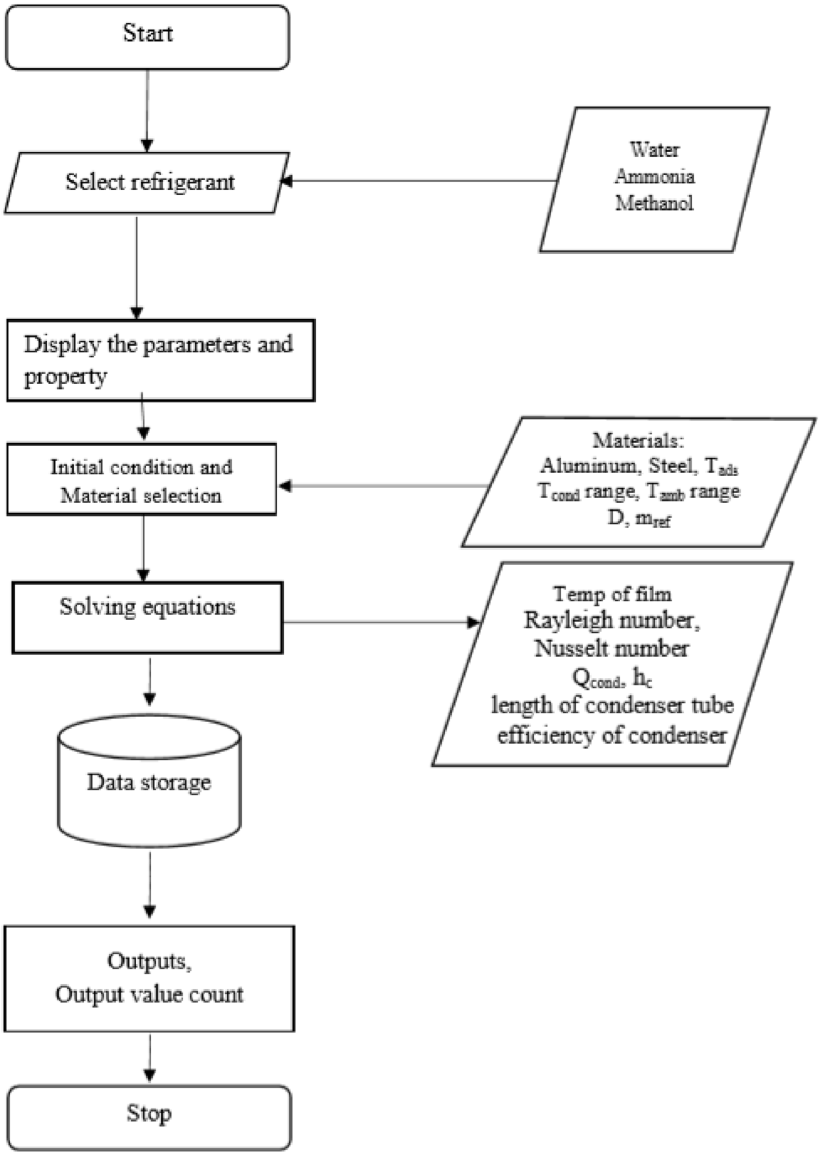

Figure 3: Algorithm of evaporator designer

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.

III. RESULT

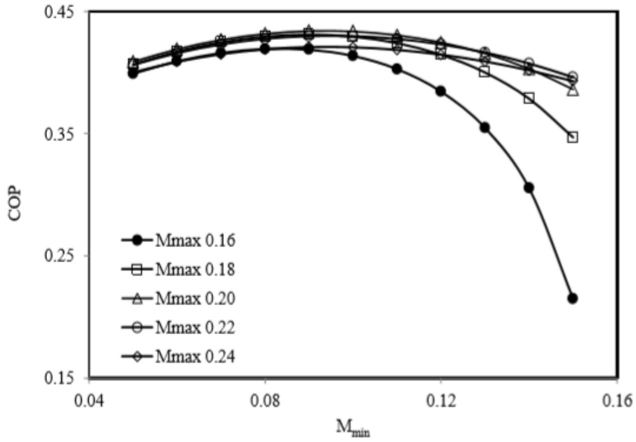

Figure 4: Influence of minimum mass concentration ratio on COP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr for zeolite-water

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

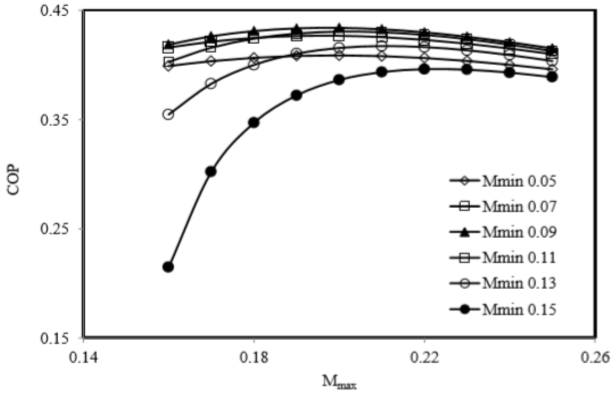

Figure 5: Influence of maximum mass concentration ratio on COP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr for zeolite-water

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.

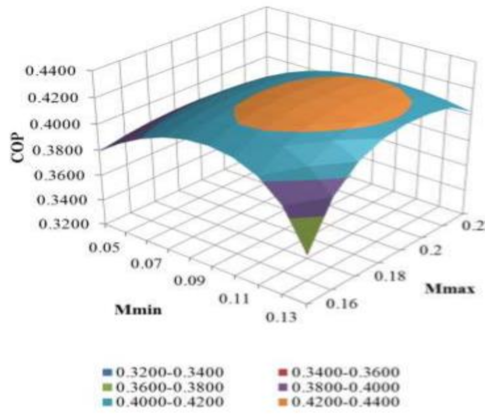

Figure 6: Influence of mass concentration ratios on COP for zeolite-water

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

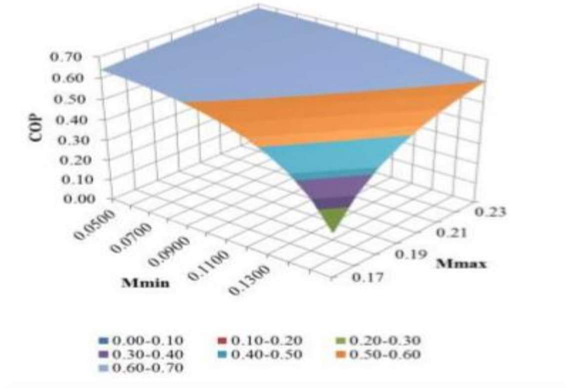

Figure 7: Influence of mass concentration ratios on COP for AC-methanol

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

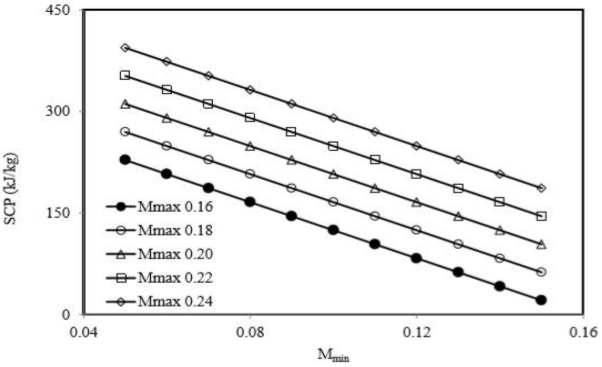

Figure 8: Influence of minimum mass concentration ratio on SCP at Tevap=274 K, Tcond=298 K, Qevap =1000 kJ/hr for Zeolite-water

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

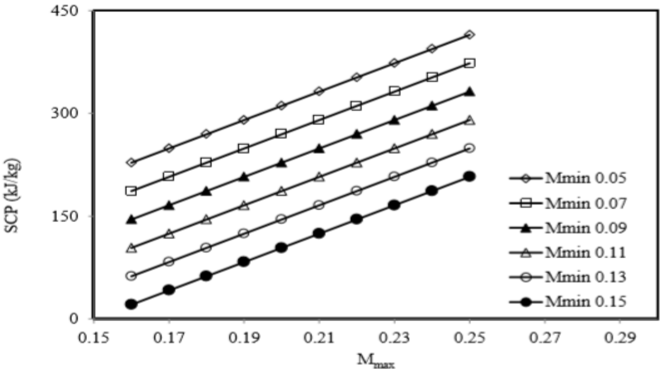

Figure 9: Influence of maximum mass concentration ratio on SCP at Tevap = 274 K Tcond = 298 K Qevap = 1000 kJ/hr for Zeolite-water

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.

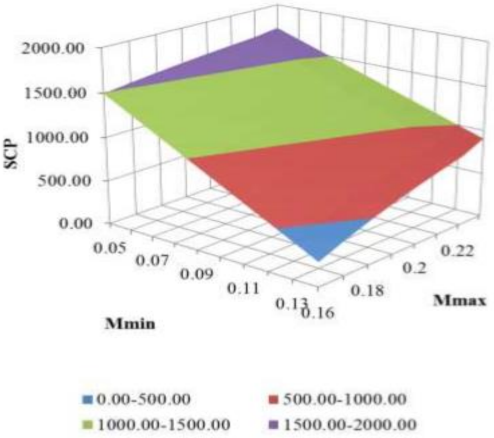

Figure 10: Influence of mass concentration ratios on SCP for Zeolite-water

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

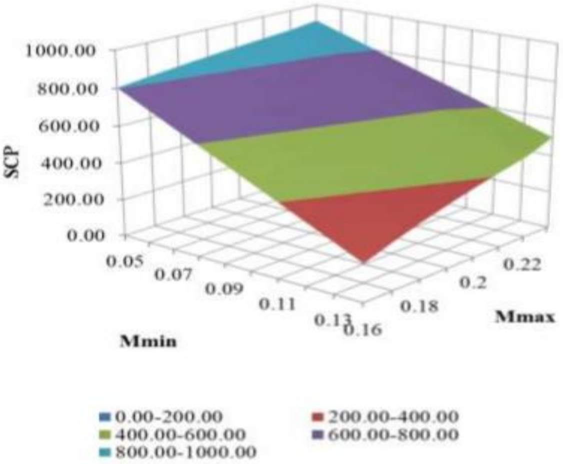

Figure 11: Influence of mass concentration ratios on SCP for AC-methanol

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

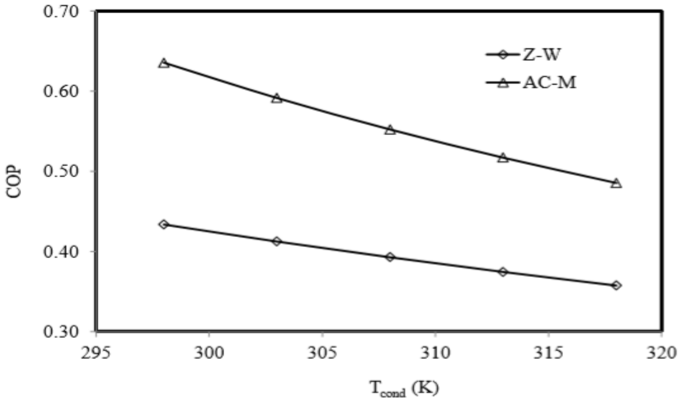

Figure 12: Effect of condenser temperature on COP for two different adsorption pairs for Tevap = 274 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

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

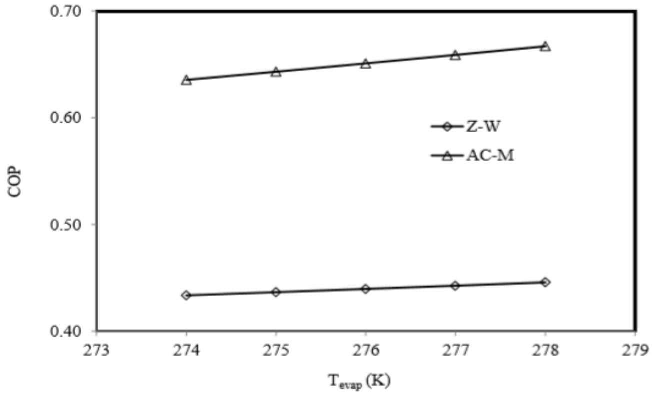

Figure 13: Effect of evaporator temperature on COP for different adsorption pairs. Tcond = 298 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

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

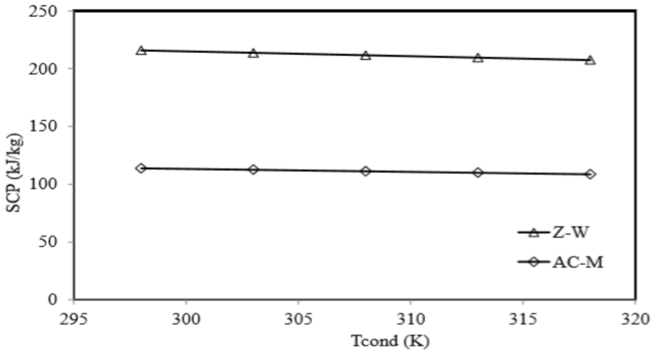

Figure 14: Effect of condenser temperature on SCP of different adsorption pairs. Tevap = 274 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

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

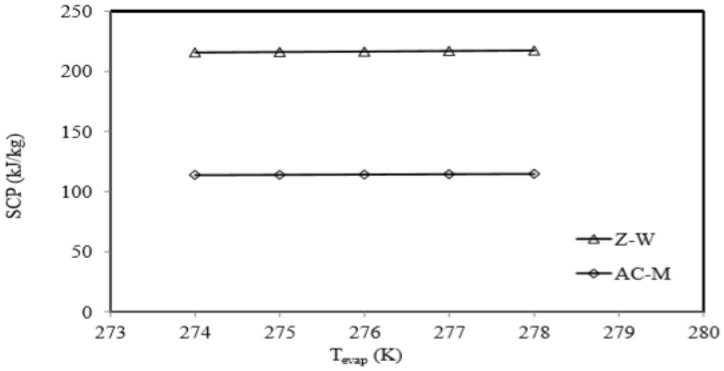

Figure 16: Effect of evaporator temperature on SCP for different adsorption pairs. Tcond = 298 K, Mmax = 0.2, Mmin = 0.1, Qevap = 1000 kJ/hr

The figure 16 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

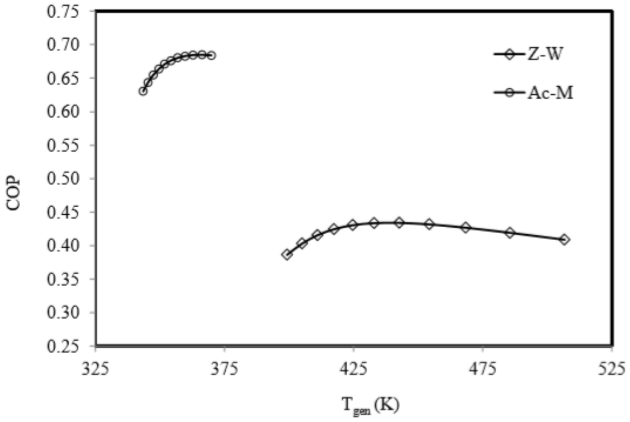

Figure 17: Effect of generation temperature on COP for different adsorption pairs. Tevap = 274 K, Tcond= 298 K, Mmax = 0.2, Qevap = 1000 kJ/hr

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

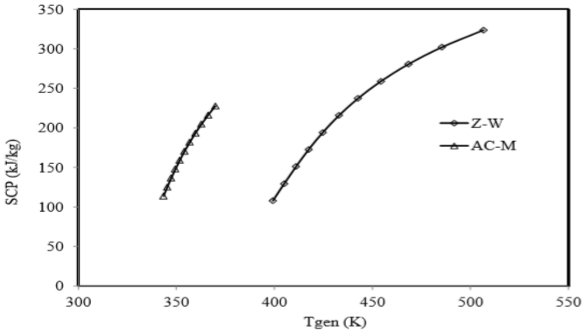

Figure 18: Effect of generation temperature on SCP for different adsorption pairs. Tevap = 274 K, Tcond= 298 K, Mmax = 0.2, Qevap = 1000 kJ/hr

The figure 18 shows the Effect of generation temperature on SCP for different adsorption pairs. Tevap = 274 K, Tcond= 298 K, Mmax = 0.2, Qevap = 1000 kJ/hr

IV. CONCLUSION

Adsorption gadget for refrigeration is promising. An overall thermodynamic based contrast of adsorption machine suggests that the performance of machine relies upon distinctly on each the adsorption pairs and processes. The generation keeps to broaden and the price of manufacturing electricity with sun adsorption refrigeration is falling. This paper affords a typical assessment on essential understanding of appropriate homes of adsorbent adsorbate pairs and approaches involved in adsorption refrigeration cycle.

V. REFERENCES

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