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Review on Solar Powered Absorption Chiller

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Abstract: Sun powered warming and cooling (SHC) frameworks are presently under quick improvement and arrangement because of their capability to lessen petroleum product use and to ease ozone depleting substance discharges in the structure division – a part which is in charge of ~40% of the world vitality use. The accessible advances available for thermally determined cooling frameworks are absorption and adsorption chillers, strong and fluid desiccant cooling frameworks, and ejector refrigeration cycles. Of these, absorption chillers are considered as the most attractive strategy for tackling sun based warm vitality because of their relative development, unwavering quality, and higher proficiency. Likewise, assimilation chillers can exploit economies of scale in substantial structures to acquire a generally decent levelized cost of cooling when contrasted with other thermally-determined cooling frameworks. Most of sun oriented retention chillers introduced and a significant part of the examination around the globe depends on single-impact chillers and low-temperature sun oriented warm gatherers, while less accentuation has been put on the blend of high-temperature sunlight based warm authorities and multi-impact ingestion chillers, particularly tripleeffect chillers. In districts with low direct typical frequency sunlight based assets (for example the greater part of Europe), sun oriented multi-impact chillers are moderately wasteful, so single-impact chiller-based sun based cooling frameworks are the best techno-monetary decision in such districts. In any case, as of now accessible innovation, SHC ingestion chillers are not ready to financially rival ordinary cooling without government appropriations and motivators. Subsequently, improving the monetary execution of these frameworks is basic.
Keywords: Absorption chiller, single effect, multi effect.

I. INTRODUCTION

Air conditioning demand is increasing rapidly whole around the world. The now a days used vapour compression cycle uses electricity produced from fossil fuels. This leads to excessive depletion of fossil fuel sources. Hence there is a need of clean alternative for fossil fuels.Vapour absorption eliminates compressor and utilizes waste heat for its functioning. Solar heater can be used to heat the water given to vapour absorption cycle for its running. Absorption Chiller can be installed on large scale with less running cost than Vapour compression cycle. Single effect, double effect and triple effect chiller are available at commercial market. Most of the solar powered chiller are single effect chiller, very few review are available regarding solar powered multi effect chiller.As the economic growth of country takes place, energy demand increases which increases the use of conventional source of energies. Exploiting natural resources damages eco system which disturbs natural balance and tracking and use of solar energy has no adverse effect on environment. IT has been indicated that natural resources may deplete completely by 2300, hence research on solar alternatives is increasing. Hence Solar absorption chiller must be implemented in industrial or commercial thus reducing load on natural resources and utilizing freely available solar energy. The main drawback of Single effect Chiller is its low COP, and so it requires large collector area to provide energy demands. This increased cost of collector may restrict the use of this system. Also it cannot be used in buildings with less roof area available for Solar collectors.Use of multi effect chiller and solar energy yield high COP and can be a solution for problem of Single effect chiller. This system require high driving temperature which require expensive pipe work and collectors. Concentrating solar collectors can be used and also Evacuated solar tube collector and Parabolic trough solar collector can be used.

II. LITERATURE REVIEW

A nitty gritty writing audit of the ongoing advances on sun based fueled retention chillers for cooling applications. A wide scope of subjects including the foundation hypothesis, framework course of action, control structures, framework demonstrating and reproduction, exploratory examinations, vigorous monetary ecological (3E) appraisals and framework enhancement were secured. The survey demonstrated that most of sunlight based ingestion chillers introduced the world over are based on single-impact chillers and low-temperature sun based warm gatherers, while less accentuation has been set on the mix of high-temperature sun powered warm authorities and multi-impact ingestion chillers, particularly triple-impact chillers. It is closed while solar powered retention chillers can be promising in alleviating ecological impressions, their monetary execution needs to improve fundamentally to infiltrate the market effectively. Also, a great part of the writing to date has concentrated on the chiller and authority execution, be that as it may, the following phase of improvement will probably require more accentuation on other framework parts and plan, upkeep, and activity issues. In this way, the test for the sun powered industry is to diminish the entirety lifetime cost of sun oriented fueled ingestion chiller frameworks so as to improve the financial practicality of this innovation, intending to inevitably be aggressive without appropriations : Despite the fact that the sun oriented division related with every arrangement for the most part increments as the authority region increments, further expanding the gatherer territory for a high sun powered division plant leads to consistent losses, as the plant vitality request is restricted by the cooling and warming heap of the structure. Moreover, expanding the span of the sun oriented field marginally affects the yearly authority productivity of the proposed designs. On the off chance that the capacity tank is well-protected, the sun oriented single-impact chiller configuration requires around 70 L/m2 stockpiling limit with respect to powerful utilization of sun oriented yield from the sunlight based field, while a capacity volume of 40– 50 L/m2 is adequate for the sun oriented multi-impact chiller plans. The ideal stockpiling tank volume will be lower assuming high heat misfortunes are normal as well as if the structure isn't involved in the night. The capacity tank could be a noteworthy wellspring of warmth misfortune in the plant. On the off chance that the hot stockpiling tank needs adequate protection, this will result in considerable vitality misfortune, particularly amid activity at high temperatures. Thusly, it is firmly proposed that all parasitic misfortunes ought to be considered when structuring such frameworks. Else, they can totally counterbalanced any favorable position picked up from the sun oriented field.solar energy for future world comprising of fundamental of photovoltaic technology world's energy scenario, driving forces and development trends, highlight of remarkable research work done in solar power generation, PV/T collectors, solar heaters, design improvements and sizing, materials for efficient light absorption to upgrade solar industry, and its potential applications and barriers to solar industry is presented briefly. This brief representation is very useful for solar system manufacturers, academics, researchers and decision makers to give significant contribution to this sector to make future world energy wise efficient.

III.METHODOLOGY

1) *Vapour Absorption Cycle:* The Compressor, condenser, expansion valve and evaporator are four main stages of a refrigeration cycle. In vapour absorption cycle use of compressor is eliminated by using generator, absorber and heat exchangers Components of Li-Br absorption cycle : Water is used as an refrigerant and lithium bromide salt is used as absorbent in this system. When combined the water and lithium bromide solution has a very low vapour pressure and water evaporates at a low temperature. Whereas lithium bromide salt has a great affinity towards water solution.
2) *Absorber*: The Li-Br salt absorbs the water vapour due to its affinity creating vacuum in evaporator shell. Now a weak solution of Li-Br salt and water is created.

The absorbent must have following properties:

a) It should have great affinity towards refrigerant
b) It must have low surface tension
c) It should maintain its state throughout the cycle
d) It should have low viscosity
e) It should have low vapour pressure
f) It should have low specific heat

3) *Generator*: The weak solution is pumped to the generator through pump. Heat is received from hot water supplied to generator through solar heater. Water evaporates gaining latent heat and enters into condenser unit.The strong solution of water and Li-Br is pumped back to absorber.
4) *Condensor*: Water vapour condenses in condenser absorbing heat from water provided externally. This condensed water is expanded and sent to evaporator unit.
5) *Evaporato*r: The external water to be cooled and used for refrigeration purpose absorbs heat from water coming from condenser. Now the chilled water can be used for refrigeration purpose by blowing air through it and cycle completes.
6) *Solar-Powered Absorption Chillers*: The The incident solar radiation absorbed by solar thermal collectors increases the temperature of a storage medium (thermal storage) through a heat transfer fluid circulated by a pump in the solar loop. The absorption chiller then converts the collected solar-derived thermal heat into useful cooling, which is delivered from the chiller as chilled water into cooling coils to cover the building cooling load. The driving heat to the chiller and the building thermal load are rejected through a cooling water loop to the ambient. Since solar energy is not always available (or in phase with building load), the plant is usually equipped with an auxiliary heater and thermal storage unit, thereby decoupling the intermittent availability of solar heat from the variable cooling demand of the building.
7) *Arabolic Trough Collector* (PTC): A parabolic trough collector consists of an evacuated receiver tube positioned along the focal line of a parabola-shaped reflector .The tube is fixed to the mirror structure and used to transfer solar irradiation reflected

by the linear concentrator to the heat transfer fluid (e.g. water or oil) passing through the tube. . To ensure the incoming sunlight strikes the tube, the reflect and tube assembly needs to be equipped with a tracking system. Unlike FPCs and ETCs, PTCs can only utilize the beam component of global solar irradiance and must be spaced farther apart to avoid shading, leading to a lower solar gain per unit area

8) *Evacuated Tube Collector:* It is a type of non concentrating collector. It consists of parallel rows of vacuum-sealed glass tubes that are placed into the horizontal manifold. It is at the topside of collector. Each tube contains a copper heat pipe and a dark absorber coating which transfers solar-derived heat into a heat transfer fluid (e.g. purified water) inside the heat pipe. As this fluid receives heat, it evaporates and rises to the top of the heat pipe, where the collected heat is transferred to a cold water/oil stream flowing through the manifold. As this process takes place, the vapour inside the heat pipe condenses and turns back into liquid returning to the bottom of the heat pipe. The losses in this type of thermal collector are less and hence can be used to drive the single effect absorption chiller
9) *Flat Plate Collector (FPC)*: Flat plate collectors are the simplest and probably cheapest way to harvest solar energy and produce thermal heat. A flat plate collector mainly consists of a transparent cover that allows solar irradiation in, a dark, selective absorber plate that converts the incoming radiation to heat and transfers it to the tubing system attached to it, and a heat-insulating structure on the backside to minimize heat losses FPCs are usually employed for low-temperature applications such as providing domestic hot water and space heating, while some types of flat-plate collectors, such as double-glazed collectors (operating at 80–120 °C), could be used to drive single-effect absorption chillers. Heat losses associated with these collectors are prohibitively high at higher operating temperatures. This factor affects the amount of useful heat gain and thus the thermal efficiency of the collector.
10) *Single Effect Absorption Chiller*: Single-effect chillers are the simplest configuration of absorption chillers. A single-effect chiller consists of an evaporator, an absorber, a solution heat exchanger, solution pump, a generator, a condenser and two expansion valves. The main function of the solution heat exchanger is to preheat the weak absorbent solution before entering the generator by receiving heat from the strong absorbent solution returning from the generator, leading to an enhanced COP of the chiller. Single-effect chillers operate in the driving temperature range of 80 °C to 100 °C, achieving thermal COPs of around 0.7–0.8
11) *Double-effect Absorption Chiller*: Double effect absorption chiller has 2 generators. One is low temperature generator and other is high temp generator. The double effect cycle contains two generators: the main generator (G) and secondary generator (G2), where the refrigerant vapour get generated in both. After receiving heat by solar heater, the LiBr-H2O solution in the main generator boils, releasing refrigerant vapour that enters the condenser (C3) and condenses. The remaining strong solution from G then goes to G2. The generator G2 is operated by the heat of condensation from the condenser C3. The refrigerant vapour now generated in G2 goes to the main condenser (C) and the remaining stronger solution (shown in violet color) flows to the absorber. The refrigerant condensate from the C3 and refrigerant vapour from G2 then reach to the main condenser, where the refrigerant condenses and becomes saturated liquid. Then it finally goes to the evaporator for cooling. The pre-heaters are used to improve the performance of the cycle while the throttle valves are used to decrease the pressure/temperature of the working fluid as per the requirement.
12) *Triple effect Absorption Chiller*: The triple effect cycle consists of three generators, G, G3 and G2 at three pressure levels, respectively. Thus the refrigerant vapor here gets generated thrice. The main generator G is operated through the external heat source, while the other two generators G3 and G2 are operated by the heat released through the condensers C4 and C3, respectively. The triple effect cycle operate at four pressure levels; the lowest pressure is in the evaporator and absorber, and the highest is in the main generator and condenser C4. The main condenser and the generator G2 are operated at the second pressure level while the condenser C3 and the generator G3 are at the third pressure level.

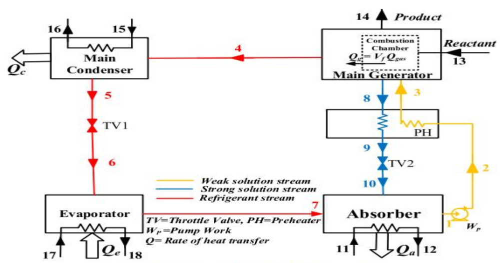

Fig. 1. Layout of single effect vapour absorption refrigeration cycle.

Fig 1.1 Layout of single effect vapour absorption refrigeration cycle.

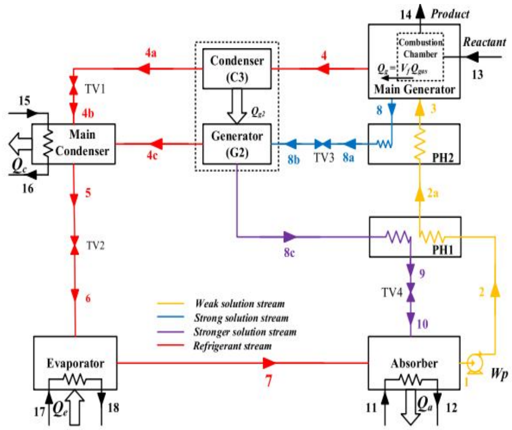

Fig. 2. Layout of double effect vapour absorption refrigeration cycle.

Fig .1.2 Layout of double effect vapour absorption refrigeration cycle

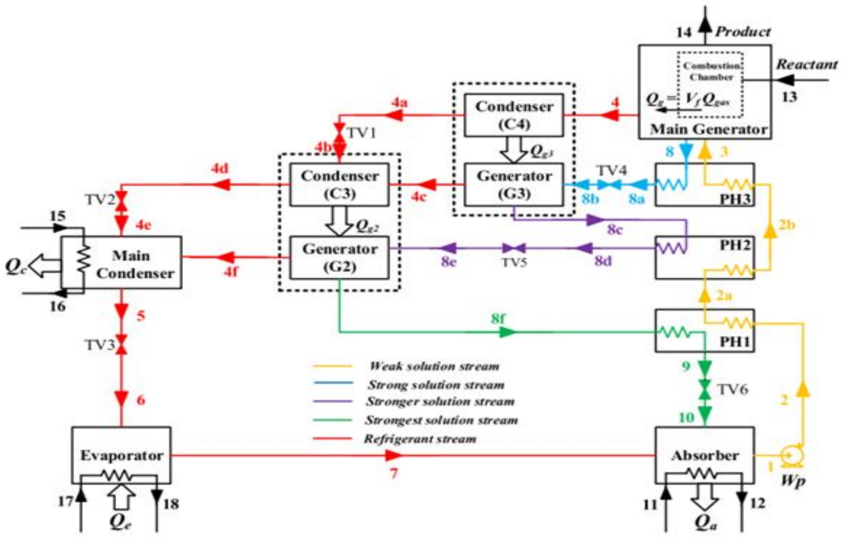

Fig .3.5 Layout of double triple vapour absorption refrigeration cycle

IV. CONCLUSIONS

Heat A point by point writing audit of the ongoing advances on sun powered controlled absorption chillers for cooling applications. The survey demonstrated that most of sun based absorption chillers introduced the world over depend on single-impact chillers and low-temperature sun oriented warm authorities, while less accentuation has been set on the mix of high-temperature sun powered warm authorities and multi-impact absorption chillers, particularly triple-impact chillers. It is closed while solarpowered ingestion chillers can be promising in relieving ecological impressions, their financial execution needs to improve altogether to enter the market effectively. Likewise, a great part of the writing to date has concentrated on the chiller and gatherer execution, however, the following phase of advancement will probably require more accentuation on other framework segments and structure, upkeep, and task issues. Along these lines, the test for the sunlight based industry is to diminish the entirety lifetime cost of sunlight based controlled assimilation chiller frameworks so as to
improve the monetary suitability of this innovation, planning to in the long run be focused without endowments.

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