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Refrigeration: Ice making using Solar Energy
冷凍：太陽エネルギーを使った製氷

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Abstract: Today's major problem is on how to avoid pollution caused by fuel in the world. The world has been encountered some different kinds of major calamities. The world is now heading towards a major environmental disaster that will seriously affects our future's wellbeing. In this research, by focusing how to use our renewable energy, conservation of energy, this is the most efficient and effective manner in helping our environment at risk. Energy conservation can be necessity if the energy will be utilized in the most favorable manner. Using solar energy, the air will become cleaner and help turn earth's climate change that is in part caused by man. This research is trying to produce ice using solar energy in an ice plant. Since ice plant are operated by using compressors which produced a large amount of diesel and electric energy, another method of operations to use for refrigeration system which is generator. In working on this method of refrigeration system by using solar energy, a lot of money can be saved.

1. Introduction

This research can possibly be operated by the solar energy. Today solar energy is highly important in the world because it has the benefit in all aspects. This is pollution free and makes it very useful and efective for refrigeration system. Many countries now are using solar energy as an alternative in using conventional fuels since the demand of fuels is getting higher. The fuels become more expensive and supply is difficult to find. Some tropical countries needs a lot of energy just to produce ice for their comfort usage. Focusing on this research, the type of collector to be used is evacuated solar collector as it will give us the temperature of water around 86 [°C]. Due to the collector efficiency and storage efficiency, the net amount of heat produced is more than that required in the generator [1].

2. Principle of Operation

Vapour absorption refrigeration (VAR) system replace the compressor with a generator and an absorber [2]. In refrigeration method, VAR is the most effective method since absorption systems are based on two combinations, refrigerant and an absorbent. The working fluid in the system is an ammonia and water solution. It has a strong chemical affinity with each other. Less in maintenance because almost all parts are steady and there is only one that is moving. Compressors consumes more power rather than the pump and not dependent on the increase or decrease in evaporator pressure because that can easily be adjusted. The quality of refrigerant from the evaporator in vapour compression refrigeration (VCR) system is more important as compressor cannot compress the liquid while it is not important in VAR system as absorber is there. If VCR is used solar energy may passes many conversion and loss may increases while VAR has only one conversion may pass.

VCR:

Solar Energy-Heat Energy-Electrical Energy-Mechanical Energy

VAR:

Solar Energy-Heat Energy [1]

3. Ammonia-Water System

Ammonia is used as refrigerant while water used as an absorbent. Ammonia-water occur in a variety of industries because it can be operated down to a very low temperature. Therefore the compressor from the VCR is replaced to generator, pump, absorber and liquid throttle valve [1]. Figure 1 shows, the high pressure and high temperature ammonia from the rectifier is condensed by rejecting heat to the atmosphere. It may be further sub-cooled before expanding in a throttle valve [3]. At some point the ammonia has lower boiling point than water, a very high fraction of ammonia and a very small amount fraction of water are boiled off in the boiler. The vapour is cooled down as it rises in the rectifier as it is happening in the flow of the strong ammonia-water solution from the absorber and

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therefore some moisture is condensed. The weak ammonia-water solution from the boiler goes through a reducing pressure valve (2 ➔3) to the absorber. Where absorber also absorbs the ammonia vapor from the evaporator. The low-pressure and low temperature ammonia from the throttle valve (8 ➔9) provides refrigeration in the evaporator. The vapor from the evaporator is combined with the weak ammonia solution in the absorber. The operating pressures are primarily controlled by the ambient air temperature for an air cooled condenser, the evaporator temperature, and the concentration of the ammonia solution in the absorber. Thermodynamics analysis of an ammonia-water absorption cooling system will become clear [3].

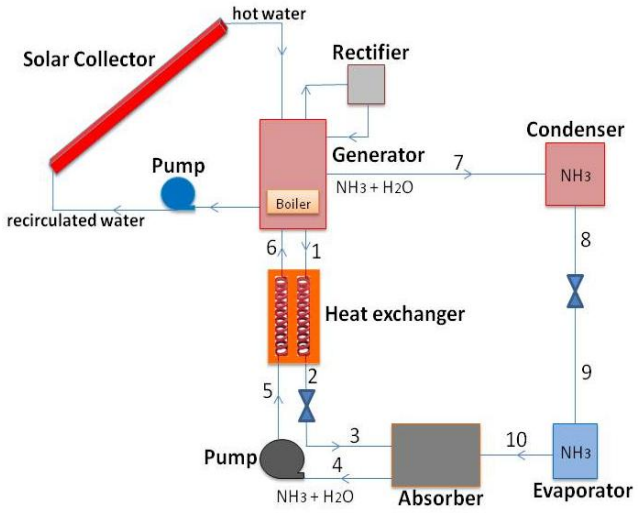

Figure 1. Schematic of an Ammonia-Water Absorption Refrigeration Cycle

4. The use of Solar Energy

A lot of people actually want to know how to get power from solar energy to electric power generation. Solar energy can be used in many ways like water heating, space cooling, space heating, electric conversion, power generation distillation etc [1]. As an example, a closed window can be viewed as a solar collector, the light that passes through the window is absorbed by the room and heat is trapped. In figure 2, the sun that passes through and strike the solar collector. Solar collector can get very hot, exceeding the boiling point of fluid and vaporizes the heat pipe fluid, and the vapour then rises to the heat exchanger at the end of the pipe. There, the vapour condenses, and transfers heat to the heat carrier of the solar cycle, water with antifreeze agent. The condensed fluid flows back to the bottom of the heat pipe. In the circulation system the water is pumped to the solar collector to fill with water when the collector where the sun begins heating it up again. The system works on principle that there is fluid in the collector when pump is operating [3].

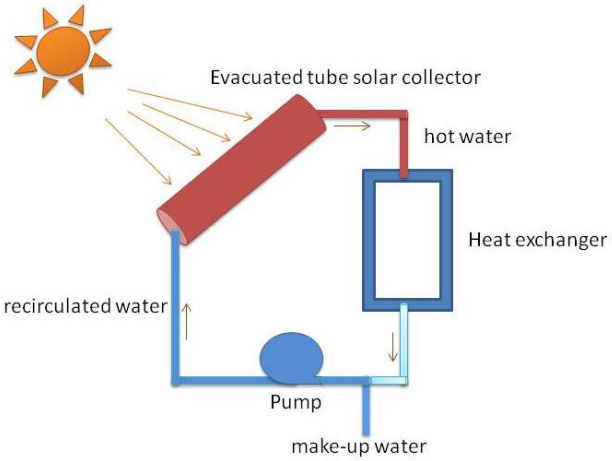

Figure 2. Schematic diagram of Solar Collector

5. Conclusion

The result of this research is that solar energy is useful in producing ice especially to the tropical countries. Some would recommend using the renewable energy because nowadays the emissions that released from coal is extremely harmful to the environment. It is pollution free, saves a lot of money and in particular that we are concerned about the greenhouse gas emissions from other energy sources. The development of the usage of renewable energy takes advantage of emerging markets to enhance diversity in energy supply markets. Evacuated solar collector to be used because it can provide the temperature of water at 86 [°C]. VAR is not dependent on the increase and decrease in evaporator pressure because it can easily be adjusted in the generator temperature. The bigger the solar collector is made the bigger the energy it produces ice in an ice plant.

6. References

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