

A Review Paper on Air-Conditioner Works on Exhaust Gas

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Abstract - Most of new automobile engines used all over the world, converts nearly 30 % of developed power into useful work. The rest is covered by the cooling and exhaust system etc. Conventional air conditioning system of automobile consumes 15 % of the total energy developed in the engine. Thus it affects the running cost of a vehicle, causes environment pollution and reduces overall efficiency of automobile. Our proposed designed is works on the vapour absorption cycle with automotive air conditioning system instead of vapour compression cycle. Here we use the exhaust waste heat as power source, thus improves efficiency, as it does not use engine power. On the refrigerant side, ammonia is used as a refrigerant. In turn reduce the environmental impact caused by HFC. Existing components other than the compressor can be used as usual with this modification. However an economical heat exchanger/generator should be introduced to proper functioning of the system. COP of a proposed system is very low when compared to vapor compression cycle. But this is compensated by increase in efficiency of vehicles.

Key Words: HFC, COP, compressor, Ammonia, exhaust.

1. INTRODUCTION

Vapour absorption refrigeration is a heat operated system. This is older than the vapour compression system. In the early 1900's, refrigeration with this system using kerosene burner was popular. When CFC's were introduced and electric power was cheap, compression system having better COP got popular. With increase in the electricity charges and the phase out of the CFC's, the absorption system is again becoming popular in large capacities. In both the system we have the evaporator and the condenser. The process of evaporation and condensation takes place at two different pressure levels in both the systems. They also differ in the manner in which the evaporator is circulated in the system. In contrast to the vapour compression system which utilises a mechanical compressor; the absorption type makes benefit from a 'absorber' and a 'generator'.

A solution called the absorbent that has a affinity for the refrigerant is used. The absorbent in the absorber draws or sucks the refrigerant vapour formed from the evaporator thus maintaining low pressure in the evaporator to enable the refrigerant to evaporate at low pressure. In the generator the absorbent is heated to release the refrigerant vapour as a high-pressure vapour, to be condensed in the condenser.

Absorption machines are thermally activated and for this reason, large amount of input mechanical power is not required. In this way, where power is expensive or unavailable, or where there is waste, gas, geothermal or solar heat available, absorption machines provide reliable and quiet cooling. A number of refrigerant- absorbent pairs are used, for which the most common ones are water-lithium bromide and ammonia-water. These two pairs offer good thermodynamic performance and they are environmentally benign. Lithium bromide-water chillers are available in two types, the single and the double effect. The single effect absorption chiller is mainly used for building cooling loads, where chilled water is required at 6-7°C. The coefficient of performance (COP) varies to a small extent (0.65-0.75) with the heat source and the cooling water temperatures. Single effect chillers can operate with hot water temperature ranging from about 80°C to 120°C when water is pressurized.

Absorption refrigeration systems have many fundamental advantages besides environmentally friendly refrigerants and electricity saving. Briefly, there are: simplicity, low maintenance, and high temperature heat input capability, low pump power, inherent flexibility in operation, with a system performance insensitive to ambient temperature. The absorption system has no rotating component or machined surface. Compared with vapour compression refrigeration systems, no solution pump is needed in absorption refrigeration systems in which there is no crystallization or rectification problem. So, absorption refrigeration systems are suitable for vibration, incline, and rotation occasion.

2. LITERATURE REVIEW

2.1. Yadav and bharatraj singh

The refrigeration units currently used in road transport vehicles are predominantly of the vapour compression refrigeration (VCR) type but this work represents study of air conditioning in automobile based on ammonia water vapour absorption system using hot exhaust gases as an energy source. This is new technique to be used in automobile air conditioning, industrial refrigeration and air conditioning system especially in food preservation. The heat required in generator can be saved up to 33% by using hot exhaust gases as an energy source. This kind of arrangement in an automobile as an air conditioner will utilize the waste heat of the engine to increase the thermal efficiency as well as overall efficiency of the engine

2.2. S.Abeygunasekara, S.K.Chandrasiri, E.I. A.Virantha

This designed is couple the vapor absorption cycle with automotive air conditioning system instead of vapor compression cycle. Here uses exhaust waste heat as power source and it may not consume engine developed power for run the air conditioner. On the other hand, in this design used ammonia as a refrigerant. However, an economical heat exchanger/generator should be introduced to proper functioning of the system. Proposed system has been saved considerable amount of power of engine as it replaces the engine driven compressor by absorber and generator with liquid pump which consumes very low power compared with compressor. This also helping to saving fuel and prevent using of engine power to drive the air conditioner. This system also can be introduced to commercial vehicles including which are involved in the transportation of perishable goods such as fruits, fish pharmaceuticals etc (refrigerated vehicles).

2.3. Atishey Mittal, Devesh Shukla, Karan Chauhan

Considering the environmental changes and the atmospheric deprecation, including the factors such as excessive energy loss and cost factors, the emission from the exhaust of a vehicle is emphasized on heavily. Out of all the available sources, the internal combustion engines are the major consumers of fossil fuel around the globe. The energy loss from the vehicle can be utilized to operate the Vapor Absorption Refrigeration System (VARs), hence reducing the excessive work done by the engine. The possibility to design a refrigeration unit inside an automobile using

2.4. Desale Dhananjay, Chouhan Rahul, Chavan Pallavi, Prof. F.U. Pathan.

With the quickly changing environmental and atmospheric consequence, the air conditioning of the moving vehicle has become a necessity in this paper, an exploration has been done to research the possibility of waste heat recovery and it's subsequently utilization in air conditioning system of a vehicle without increasing the component expenditure, weight, number of component and brings improvement in vehicle by making luxurious. The study of dissipate heat cooling method analysed in this article will be experimentally investigated and the data will be captured for additional analysis. This will be supported by a suitable mathematical model and a simulation tool

2.5. Isaac Mathew Pavoodath

The attempt to have a vapour absorption system on lithium bromide may prove to be an advantageous alternative. It will not require a power input from the car's engine as well. Instead the exhaust gas heat may be used to run the system. The high degree of heat contained in the exhaust is ample enough to run a decent capacity absorption system and maintain optimal temperature conditions in the vehicle. Such a system would vastly help take of the compressor load of the vehicle engine and would prove a great percentile of power saving for small capacity engines. The satisfaction of using vast amounts of energy earlier let out into the environment untapped is thus gained.

2.6. Sohail Bux, A.C. Tiwari.

This paper present a vapour Absorption air conditioning system is run by exhaust waste heat of internal combustion engine. A shell and tube counter flow type heat exchanger is used as a generator of both absorption refrigeration system and a container used as a absorber are divided into two part one part used for LiBr-H₂O solution another part for Aqua Ammonia solution used alternatively for experiment. This system is saved cost, reduce maintenance, weight of existing air-conditioning and used as natural refrigerant. Also reduce ozone depletion potential (ODP) and Global Warming Potential (GWP). This air

conditioning system is totally eco-friendly in nature or used only natural refrigerants as well as increases the mileage of automobile.

2.7. Satish K. Maurya, Saurabh Awasthi; Suhail A. Siddiqui.

As well-known thing about VAS that these machines required low grade energy for operation. Hence in such types of system, a physicochemical process replaces the mechanical process of the Vapour Compression Refrigerant System by using energy in the form of heat rather than mechanical work. This heat obtained from the exhaust of high power internal combustion engines. Environmental point of view this system is Eco-friendly as it involves the use of Ammonia as a refrigerant which is a natural gas and is not responsible for OZONE layer Depletion. The recovery and utilization of waste heat not only conserves fuel (fossil fuel) but also reduces the amount of waste heat and greenhouse gases dumped to environment. The study shows the availability and possibility of waste heat from internal combustion engine, also describe loss of exhaust gas energy of an internal combustion engine. Possible methods to recover the waste heat from internal combustion engine and performance and emissions of the internal combustion engine. Waste heat recovery system is the best way to recover waste heat and saving the fuel.

2.8. T Sanoj, Christy Mathew, Tedy Thomas

In a Vapour Absorption Refrigeration System, the mechanical process of the Vapour Compression Refrigeration System is replaced by a physicochemical process using heat energy rather than mechanical work. The heat required for running the Vapour Absorption Refrigeration System can be obtained from the exhaust gases which is wasted into the atmosphere from the engine. With all the components it is possible to install a vapour absorption refrigeration system utilizing the wasted heat energy of the vehicle's engine exhaust gases to produce refrigerating effect inside the automobile's cabin. Using a vapour absorption refrigeration system within an automobile as an air conditioner will not only reduce the fuel consumption of the vehicle but will also provide many other advantages like the efficiency of the engine is not decreased considerably

2.9. Christy V Vazhappilly, Trijo Tharayil, A.P.Nagarajan

The exhaust gases from the IC engine have been utilized to vaporize the ammonia refrigerant. The available heat in the exhaust gases has to be estimated based on actual I.C-Engine driving cycles. The frame plate type heat exchanger has to be modelled and flow analysis inside the heat exchanger has to be analysed. In addition, the recoverable energy of the exhaust gases is to be analysed for representative Internal Combustion Engine

2.10 viren bagadiya, kalpraisinh zala, mayur N. patel

Now a day the air conditioning system which is mainly used in automobile is vapor compression refrigeration system but here this work represents study of air conditioning system in automobile by vapor absorption refrigeration system using lithium bromide as an absorber and water as a refrigerant. The system can be easily adopted for heavy vehicles as more exhaust heat from the engine will be available. This is new technique to be used in automobile air conditioning, industrial refrigeration and air conditioning system especially in food preservation. Either the decrease in the temperature of evaporator or the increase in temperature of Generator, the COP of the system decrease respectively. The minimum condenser temperature to increase the refrigerating effect of the automobile air conditioning system

3. CONCLUSIONS

Diesel engines can be considered as a potential energy sources for absorption refrigeration systems, because of the energy wasted through the exhaust gas. The absorption refrigeration system may be able to take advantage of the exhaust gas power availability and provide the cooling capacity required for automotive air conditioning. The waste heat energy available in exhaust gas is directly proportional to the engine speed and exhaust gas flow rates. The coefficient of performance found to be between 0.85 and 1.045 which has a good agreement with data reported in literature. Reducing the fresh air intake and sealing the automobile body can result in a saving in cooling requirements such as door sealing and tinting the glass.

In the exhaust gases of motor vehicles, there is enough heat energy that can be utilised to power an air-conditioning system. Therefore, if air-conditioning is achieved without using the engine's mechanical output, there will be a net reduction in fuel consumption and emissions. Once a secondary fluid such as water or glycol is used, the aqua-ammonia combination appears to

be a good candidate as a working fluid for an absorption car air-conditioning system. This minimises any potential hazard to the passengers

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