

Project- Scrap Shredding, Collecting and Remoulding of Acquired Plastics

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Abstract

In the present context need for drinking water during traveling in automobiles is high and passengers faces difficulty in finding trustworthy source of drinking water. The aim of the project is to create purified drinking water in automobiles from the evaporator in the AC unit, which is being drained out. The water being formed in the evaporator is collected in a collecting tray and pumped through water purifier to remove all the dirt and impurities and gets collected in a tank from where it is pumped into the bottles kept on the side of the door. The collected water in the bottle can also be cooled using the cool air coming from the AC unit. Excess water can also be collected into the windshield washer reservoir for further use.

Keywords: AC, Condenser

I. INTRODUCTION

The objective of this project is to design and develop an automobile air-conditioning prototype that is capable of stimulating the actual working of an AC unit in automobile. The project's aim is to create a system that will capable of producing portable water during travel. This will encourage the reduction in use of plastic bottles which is a threat to the environment

Drinking water helps to maintain the balance of body fluids. Our body is composed of about 60% water. The functions of these bodily fluids include digestion, absorption, circulation, creation of saliva, transportation of nutrients, and maintenance of body temperature, and thus water is very essential for travellers. During most of the journey, travellers buy drinking water in plastic bottles. Plastic bottles cause serious threat to the environment and the society.

Bottles are made of Polyethylene terephthalate (PET) plastics, but PETs don't biodegrade they photodegrade, which means they break down into smaller fragments over time. Those fragments absorb toxins that pollute our waterways, contaminate our soil, and sicken animals (which we then eat).The need for drinking water also increases the travelling cost. These days packaged drinking water are not healthy and have many problems causes health issues. Thus generation of purified water within automobiles could be very helpful in solving these problems. Independent water generation unit creates water independence for the passengers. Thus they act as secure water source from within the cabin of the vehicle. Also, the water generated can be used for automatically filling the windshield water reservoir.

II. LITERATURE REVIEW

The possibility of extracting water from air is an activity that has been studied recently, especially with the purpose of producing it for emergencies or exceptional events, when drinking water is not temporarily available. Water extraction can be done with different technologies, one of which is represented by cooling water below the dew point, to cause condensation of the vapour content of the air. The comparison is made between typical HVAC system and an integrated air conditioning system by Magrini A Et.al and found that the integrated system produces water and guarantees air conditioning with a global cost reduction for the HVAC system energy.

L. Magnania Et.al made study on water vapour condensation in the HVAC system chillier that can be employed to increase the sustainable use of resources by using the condensed water for domestic consumption. The study would demonstrate the competitiveness of the production of water from the air, by means of the comparison between a traditional and an optimized system, and would evaluate the production costs of drinking water.

Comparative evaluation of an automobile Air - Conditioning System Using R134a and Its Alternative Refrigerants is made by Jignesh K Vaghela Et.al and found that some of the alternative refrigerants cannot be substituted in AAC system due to high flammability issue and others have high saturation pressure compared to R134a.

Salem Algarni Et. al done a comprehensive review of HVAC condensate recovery and reuse by considering the present water crisis and quest for clean and sustainable energy resources and concluded that if planned at the design stage of buildings, it would be easier to collect, store and reuse the condensate in the most efficient way. Among the meteorological factors that influence condensate generation, humidity plays a major role. The values of conductivity, dissolved oxygen, turbidity, nitrates, chlorides and pH of condensate reported by various authors show considerable differences which might be attributed to the variations in geographical locations where the condensate was produced. Different locations give different atmospheric temperature, humidity and pollution level. Differences in the testing apparatus and HVAC components might be another reason for the discrepancy.

III. DESIGN AND WORKING

A. Design

The physical reliability and economic worth of the system to be proposed were studied. A structural skeleton is made to support the components. Specifications of components to be used are studied. All potentially useful specifications of the components were thoroughly examined at the beginning of the preliminary design phase. After building sufficient confidence, this approach was finalized. A complete set of assembly and detail drawings were prepared. A cost analysis was conducted. Then, the prototype was fabricated and tested.

B. Component Specifications

The objective of this project is to design and develop an automobile refrigeration system to stimulate the working in an actual automobile. Thereby collecting the amount of water formed on the surface of the evaporator and testing whether is satisfy the conditions for drinking.

To fulfil this objective, the following component specifications are established and met.

- Two layered evaporator is used for good heat transfer and maximum water generation.
- Three layered condenser is used since surface area for transfer of heat is greater than two layered condenser.
- Two 12V AC Cooling fan is used for increasing rate of air flow.
- Collecting tank of 15cm*14cm*12cm is used.
- 12V DC motor is used to pump the water from collecting tank
- Active carbon filter was used for purification purpose

C. Component Description

The major components involved in the design and the fabrication are

1) Body structure – MS Angle

The frame used is L-shaped structural steel. This is made of mild steel material. This structure supports the total weight of other parts. The whole parts are mounted on this frame structure with the suitable arrangement. This makes the prototype easy for transportation.

2) Compressor

Air conditioner compressor is used to remove the heat-laden vapour refrigerant from the evaporator of the air conditioning systems. In layman term, the compressor compresses or squeezes the vapour into a smaller volume at high temperature. The external-drive compressor has a crankshaft that is driven by a pulley and belt system.

An electric motor can also be used to drive it directly. The hermetic compressor has a motor which is sealed inside housing with the compressor, hence a crankshaft seal is not required. The motor rotor is located either at the top or bottom of the unit.

3) Evaporator

This is the part of the refrigeration system that is doing the actual cooling. Because its function is to absorb heat into the refrigeration system, the evaporator is placed in the area to be cooled. The refrigerant is let into and measured by a flow control device, and eventually released to the compressor. The evaporator consists of finned tubes, which absorbs heat from the air blown through a coil by a fan. Fins and tubes are made of metals with high thermal conductivity to maximize heat transfer. The refrigerant vaporizes from the heat it absorbs heat in the evaporator.

4) Condenser

The condenser removes heat given off during the liquefaction of vaporized refrigerant. Heat is given off as the temperature drops to condensation temperature. Then, more heat (specifically the latent heat of condensation) is released as the refrigerant liquefies. There are air-cooled and water-cooled condensers, named for their condensing medium. The more popular is the air-cooled condenser. The condensers consist of tubes with external fins. The refrigerant is forced through the condenser. In order to remove as much heat as possible, the tubes are arranged to maximize surface area. Fans are often used to increase air flow by forcing air over the surfaces, thus increasing the condenser capability to give off heat.

5) DC Motor

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming’s left-hand rule. A direct current (DC) motor is a fairly simple electric motor that uses electricity and a magnetic field to produce torque, which causes it to turn. At its most simple, it requires two magnets of opposite polarity and an electric coil, which acts as an electromagnet. The repellent and attractive electromagnetic forces of the magnets provide the torque that causes the motor to turn

6) Refrigerant Gas – R143a

A 1,1,1,2-Tetrafluoroethane is a non-flammable gas used primarily as a refrigerant for domestic refrigeration and automobile air conditioners. These devices began using 1,1,1,2-Tetrafluoroethane in the early 1990s as a replacement for the more environmentally harmful R-12 and retrofit kits are available to convert units that were originally R-12-equipped.

7) Filter

Carbon filtering is a method of filtering that uses a bed of activated carbon to remove contaminants and impurities, using chemical adsorption. Each particle, or granule, of carbon provides a large surface area, or pore structure, allowing contaminants the maximum possible exposure to the active sites within the filter media. One (pound 454 g) of activated carbon contains a surface area of approximately 100 acres (~40 Hectares).

Activated carbon works via a process called adsorption, whereby pollutant molecules in the fluid to be treated are trapped inside the pore structure of the carbon substrate. Carbon filtering is commonly used for water purification,



IV. RESULT AND DISCUSSION

The developed system can successfully collect the water from evaporator which is filtered using carbon filter. The generated water is tested for checking whether the water is potable or not. pH test, test to determine the amount of chlorine, and test to determine the hardness of the water are conducted. The results of the above mentioned tests are as follows (Table 4.1).

Table - 4.1
Test Results

Test Name	Quantity	Limit
PH Test	6.4	6 – 8.5
Chloride	62 mg/litre	250 mg/litre
Hardness	114 mg/litre	60 – 120 mg/litre

The developed system is run for one hour at different time. This is done so as to measure the amount of water collected at different humidity condition. The test is run for 4 times a day, 12am, 5am, 10am and 3pm.

The findings of the above mentioned test are as follows (Table 4.2):

Table 4.2: Amount of Water Collected

Time	Temperature	Humidity	Water Collected
12:00 AM	26°C	91%	350ml
5:00 AM	24°C	96%	360ml
10:00 AM	30°C	60%	282ml
03:00 PM	36°C	39%	130ml

V. CONCLUSION

The design and development of improved drinking water generation in automobiles is successfully completed, and found out different quantity of water that can be generated by this system, under different humidity condition. It is found that amount of water generated increases with increase in humidity. Also, potable test on the generated water is done and found that the water is safe for drinking purpose. Drinking water thus can be generated in automobiles efficiently utilizing the air conditioning system. Thereby providing safe drinking water in public transport vehicles as well as other automobiles.

The experiment was conducted under controlled condition, in real life situation unburned hydrocarbon and dust particles gets deposited on the collecting tray and obstruct the flow in the filter. The ice formed on the evaporator gets evaporated to outer atmosphere and amount of water collected gets decreased. The water generated can be used in windshield washer reservoir

Further study can be done in the designs and mounting of the collecting tray, and filter used.

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