IJFEAT
INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

A PAPER ON DESIGN AND FABRICATION LPG AS A REFRIGERANT USING DOMESTIC AIR CONDITIONING AND COOKING PURPOSE

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Abstract

The LPG is cheaper and possesses an environmental free in nature with no ozone depletion potential (ODP). Also LPG is available as a side product in local refineries. This work investigates the result of an experimental study carried out to determine the performance of domestic refrigerator when a propane-butane mixture is liquefied petroleum gas (LPG) which is available and comprises 56.4% butane, 24.4% propane, and 17.2% isobutene. An experimental investigation of Performance is carried out by the effect of changing capillary tube length, capillary tube inner diameter and capillary coil diameter on the mass flow rate of refrigerant in an adiabatic helical capillary tube. Large amount of electricity supply is not available easily in large part of under development country like India. The use of LPG for refrigeration purpose can be environment friendly since it has no ozone depletion potential (ODP). LPG is primarily used as a fuel for cooking food in houses, restaurants, hotels, etc,and the products of combustion of LPG are CO2 and H2O. LPG can produce refrigerating effect for a confined space which can be used for air conditioning with the help of blower. From experimental investigations, we have figure out that the COP of a refrigerator which uses LPG is higher than a domestic refrigerator.

Index Terms*: LPG ,cylinder capillary, evaporator blower burner etc.*

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1. INTRODUCTION

In developing country like India, most of the vapors compression based refrigeration, air conditioning and heat pump systems continue to run on halogenated refrigerants due to its excellent thermodynamic and thermo-physical properties apart from the low cost. However, the halogenated refrigerants have adverse environmental impacts such as ozone depletion potential (ODP) and global warming potential (GWP). Hence, it is necessary to look for alternative refrigerants to full fill the objectives of the international protocols (Montreal and Kyoto) and to satisfy the growing worldwide demand. In earlier days, ethyl chloride was used as a refrigerant which soon gave way to ammonia as early as in 1875. At about the same time, sulphur dioxide in 1874, methyl chloride in 1878 and carbon dioxide in 1881, found application as refrigerant. During 1910-30 many nerefrigerants, such as N2O3, CH4, C2H6, C2H4, C3H8 were however, found extremely inflammable. Dichloromethane,
Trichloroethylene and Monobromomethane were also used as a refrigerant for centrifugal machines. A great break through occurred in the field of refrigeration with the development of Freon's. Freon's are a series of fluorinated hydrocarbons, generally known as fluorocarbons, derived from methane, ethane, etc., as bases. With fluorine, chlorine sometimes bromine in their molecules, these form a series of refrigerant with wide range of normal boiling point to satisfy the varied requirements of different refrigerating machines. The presence of fluorine in the molecule makes the compound non-toxic and imparts other desirable physical and physiological characteristics. Plank has given individual treatment to some 50 inorganic and organic refrigerants. Among the most common inorganic refrigerant are ammonia, water, carbon dioxide. Presently, the most commonly used organic refrigerant is the chloro-fluoro derivatives of CH4 and C2H6. The fully halogenated ones

with chlorine in their molecule are chloro-fluorocarbons, referred to as CFCs.

The energy crisis persists all across the globe. We think of recovering the energy which is already spent but not being utilized further, to overcome this crisis with no huge investment. The climatic change and global warming demand accessible and affordable cooling systems in the form of refrigerators and air conditioners. Annually billions of dollars are spent in serving this purpose. Hence forth, we suggest NO COST Cooling Systems. Petroleum gas is stored in liquefied state before its utilization as fuel.

The energy spent for pressurizing and liquefying is not recovered afterwards. If it is expanded in an evaporator, it will get vaporized and absorb heat to produce cooling. This property has been used for refrigeration and air conditioning. So that the liquefied form of LPG can be used for cooling and the expanded gas (LPG) can be further used for cooking purpose.

2. WHY LPG USED AS A REFRIGERANT?

Refrigerant	R-12	R-22	R-134a	R600a
Class	CFC	HCFC	HFC	LPG
Ozone depletion potential	1.0	0.07	0	0
Global warming potential	7300	1500	1200	8

The table shows that the LPG refrigerant (R-600a) has zero ozone depletion potential and a near zero global warming potential. The above values combined with some of the other properties of LPG refrigerants make them an obvious choice as a refrigerant in future refrigeration. In fact, countries like Europe and Cuba are already using hydrocarbon refrigerants in their refrigerators since 1993 and have found no trouble whatsoever using them. Translating Table 1 to dollars and cents may help us appreciate the significance of CFC and HFC GWP's. An Australian proposal for a tax on emitted carbon dioxide of 1.25 $/tone was abandoned in January 1994. Partly because a tax which adds only 0.2 cents/kW hr to the price of coal fired electricity would not significantly reduce CO2 emissions. If the global warming contribution of R-134a was taxed at the same rate it would be 1.5$/kg R-134a which gives R-600a a 3.67$/kg price advantage.

3. LPG PROPERTIES

A good mixture: LPG is mainly Propane (C_3H_8), Butane (C_4H_{10}) or a mix of Propane and Butane. Since LPG has such a simple chemical structure, it is among the cleanest of any alternative fuels.

Boiling point: LPG's boiling point ranges from -42°C to 0°C depending on its mixture percentage of Propane and Butane.

Combustion: The combustion of LPG produces carbon dioxide (CO_2) and water vapor, but sufficient air must be available. Inadequate appliance flueing or ventilation can result in the production of carbon monoxide, which can be toxic.

Vapor pressure: LPG is stored as a liquid under pressure. It is almost colorless and its weight is approximately half that of an equivalent volume of water. The pressure inside a closed container in which LPG is stored is equal to the vapor pressure of the liquid and gaseous LPG in the container and corresponds to its temperature.

LPG vapor is denser than air: Butane is about twice as heavy as air and Propane about one-and-a-half times as heavy as air. Consequently, the vapors may flow along the ground and into drains, sinking to the lowest level of the surroundings and be ignited at a considerable distance from the source of leakage.

Ignition temperature: The temperature required to ignite LPG in the air is around 500°C.

Calorific value: The calorific value of LPG is about 2.5 times higher than that of main gas, so more heat is produced from the same volume of gas.

Toxicity: LPG is a colorless, odorless and non-toxic gas. It is supplied commercially with an added odorant to assist detection by smell. LPG is an excellent solvent of petroleum and rubber product and is generally non-corrosive to steel and copper alloys.

Safety: LPG is just as safe as any other fuel. In fact, it is safer than most fuels because neither LPG itself nor the end products that are produced by burning LPG in a suitable appliance are poisonous to inhale. Since LPG cannot burn without air, there can never be a 'flashback' into the cylinder.

You can feel safe with LPG as the most thorough precautions are taken to ensure your safety. All you have to do is to handle it correctly while adhering to the simple instructions provided.

4. PROPOSED WORK

In this project we are going to design and fabricate a system of Air conditioner which uses LPG as refrigerant. LPG is compressed in cylinders at high pressure. When this LPG having high pressure is passed through the capillary tube of small internal diameter, the pressure of LPG is dropped due to expansion and phase change of LPG occurs in an iso-enthalpic process. Due to phase change from liquid to gas latent heat is gained by the liquid refrigerant and the temperature drops. The LPG air conditioning is shown in the figure. We kept the thermo-coal sheet because the cold air cannot transfer from inside to outside of compartment And the evaporator is wrapped totally with aluminum tape. The schematically diagram of the LPG air conditioning system is shown in above diagram. The gas cylinder is connected to high pressure regulator which is connected to high pressure pipes. To the other end of the high pressure pipes pressure gauge is connected. To another end a copper tube is connected which is connected to the capillary tube. The capillary tube is fitted with evaporator. The evaporator coil end is connected to the stove by another high pressure pipe. One pressure gauge is put between capillary tube and cylinder and another is put at the end of the evaporator

5. METHODOLOGY

Firstly, in this project going to collecting all the apparatus. After that using LPG as a refrigerant in domestic ac by passing LPG refrigerant through cylinder gas pipe as well as capillary tubes for reducing the pressure. Then, low pressure and temperature refrigerant going in the evaporator. It helps to produce cooling effect. Later, outlet low pressure vapour from the evaporator is passing towards the burner.

6. WORKING PRINCIPLE

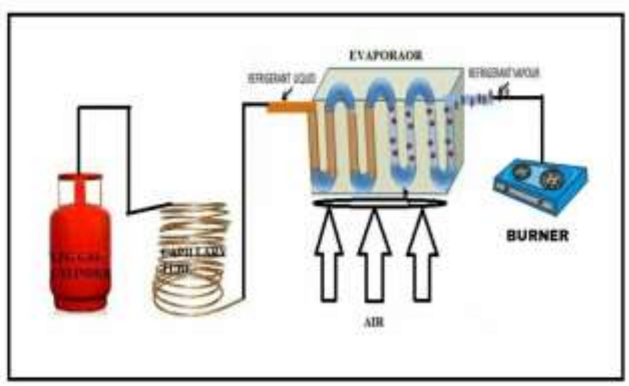

Fig (a): Schematic working

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7. ACTUAL SYSTEM SETUP

In this project we are going to fabricate and showing the simple mechanism of LPG using in the domestic air conditioning and the cooking purpose.

Fig (b): Actual working

In this we use pressurize refrigerant, we used 14kg cylinder in that present the pressurized LPG in liquid form the pressure of LPG which is stored in cylinder is about 80 psi and we used a regulator, it has help to flowing and controlling the LPG pressure, then the liquid high pressure refrigerant flow into the capillary tube. In this case we used to help the reducing the pressure and temperature of the LPG refrigerant. In this project we used the size of capillary tube is 0.031cm of diameter and 12feet of length. The capillary outlet we giving the low pressure and low temperature liquid refrigerant then the low temperature and low pressure refrigerant flow into the the evaporator coil in that the size of the evaporator coil is 8mm. in this evaporator we used the blower fan. The blower is used to take atmosphere air and exchange with cooling coil that obtained the latent heat. Thus room space becomes cool down.

Thus, we can get the refrigerating effect in air conditioning. After that the obtained low pressure vapors LPG gas. This low pressure vapors LPG passed to the burner through high pressure pipe and we can used this low pressure LPG for burning and further application in this project we used recompressed LPG cylinder instead of compressor. In this project we can achieve refrigerating effect and cookingpurpose from this system. After 15mins of experimentation we successfully reduce 8 degree Celsius room temperature.

8. CONCLUSION

According to lots of research papers it can be found that A system can be designed and manufactured for the purpose of human comfort based air conditioning system This system can be useful for human comfort for basic needs like air conditioning. LPG based air conditioning system will be helpful ,LPG can be further utilized for cooking food in domestic purpose , hotel and restaurant. Due to low cost and availability of LPG, operating cost of this system is low.

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