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# "REFRIGERATION SELECTION AND ITS PROPERTIES: A REVIEW"

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## ABSTRACT

**Refrigerant is a substance used in a heat cycle usually for enhancing efficiency, by a reversible phase transition from a liquid to a gas. Traditionally, fluorocarbons, especially chlorofluorocarbons, were used as refrigerants, but they are being phased out because of their ozone depletion effects. Other common refrigerants used in various applications are ammonia, sulphur dioxide, and non-halogenated hydrocarbons such as propane. R134a is an inert gas used primarily as a "high-temperature" refrigerant for domestic refrigeration and automobile air conditioners. Contact of R134a with flames or hot surfaces have toxic and hazardous effect on the humans and environment. In this paper, a review of available alternative refrigerants and their physical and chemical properties have been done. Selection of efficient, eco-friendly and safe refrigerant for future has been attempted in this paper through discussions.**

***Key Words:*** *ODP, GWP, COP, Vapour, Compression, Enthalpy, Entropy, Coefficient of Performance*

## I. INTRODUCTION

The primary test of Refrigeration is to expel heat from a low temperature source and dump it at a higher temperature sink. So to achieve this, it exploits that exceptionally compacted fluids at one temperature will in general get colder when they are permitted to extend. On the off chance that the pressure change is sufficiently high, at that point the compacted gas will be more sizzling than our wellspring of cooling (outside air, for example) and the extended gas will be cooler than our ideal cold temperature. For this situation, we can utilize it to cool at a low temperature and reject the heat to a high temperature.

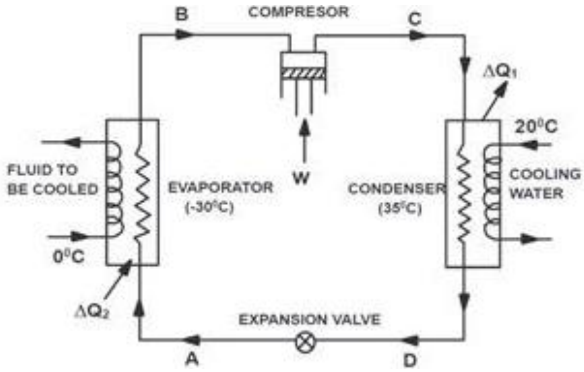


Fig.1 Vapour Compression Cycle

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Figure 1 portrays the schematic perspective on vapour compression refrigeration cycle. The cycle works between two pressure limits PC and PB and comprises of four phases under which refrigerant flows persistently .In the principal organize the low temperature, low pressure vapour at state B is compacted by a blower to high temperature and pressure vapour at state C, this is known as the compression arrange . In the following stage the compacted vapour is dense into high pressure vapour at state D in the condenser and after that goes through the extension valve, this is organize is known as the condensation arrange. Here, in the extension arrange the vapour is throttled down through a throttle valve to a low pressure fluid and passed on to an evapourator, where it absorbs heat from the surroundings from the circling fluid and vapourizes into low pressure vapour at state B. The fluid here is the refrigerant. The cycle at that point rehashes along these lines.

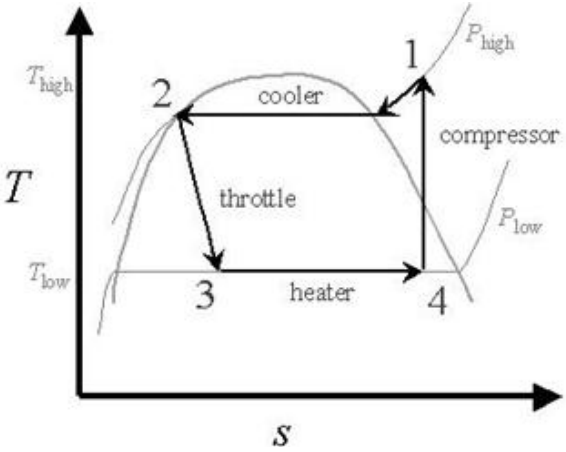

Fig.2. T-S diagram of vapour compression cycle

**Compression (Process 4-1):** Figure 2 portrays the T-s chart of vapour compression cycle, the refrigerant is packed by utilizing a blower and the pressure is expanded from low to high . Furthermore, it additionally raises the temperature of the refrigerant over the atmospheric temperature. At last it leaves the phase as a superheated vapour. Vitality is expected to control the blower that is the reason power is required to work a cooler.
**Condensation (Process 1-2):** In this stage the looped cylinders with aluminium blades disperse the heat of the refrigerant to the encompassing. This gadget is especially like the evaporator, yet may have diverse measurements. As the hot vapour courses through the condenser, the outside air evacuates vitality and the refrigerant turns into a soaked fluid. Now the smallest drop in pressure will start evaporation, which is the reason for the third phase of the procedure.
**Expansion (Process 2-3):** This procedure is the way to the whole cycle, since this was the issue that we begin with. Here the dense vapour is throttled through a throttle or expansion valve bringing about an abrupt drop in pressure which eventually causes the bringing down of temperature. This is accomplished by using the auto-refrigeration impact. This chilly fluid vapour blend presently goes into the last phase of the cycle. Evaporation (Process 3-4): During this stage, the refrigerant goes through a gadget called an evaporator that has a huge surface zone and regularly comprises of a curled cylinder encompassed by aluminium blades. The cool fluid is a blend of fluid and vapour refrigerant .the refrigerant while coursing through the evaporator absorbs heat from the encased space (low temperature area) and all the fluid get evaporated the vitality absorbed is utilized to change the condition of the refrigerant from fluid to vapour. The vitality absorbed by the refrigerant is the proportion of its refrigeration impact. This brings down the temperature of the space, alongside whatever sustenance or refreshments are put away in it. The refrigerant leaves this phase as a soaked vapour and goes into the blower stage to rehash the cycle.

## II. LITERATURE REVIEW

**B.O. Bolaji et al** researched tentatively the exhibitions of three ozone cordial Hydrofluorocarbon (HFC) refrigerants R12, R152a and R134a. R152a refrigerant found as a drop in substitution for R134a in vapour compression framework. They also talked about the way toward choosing ecological amicable refrigerants that have zero ozone exhaustion potential and low a dangerous atmospheric devation potential. R23 and R32 from methane subordinates and R152a, R143a, R134a and R125 from ethane subsidiaries are the developing refrigerants that are nontoxic, have low

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combustibility and ecological well disposed. These refrigerants need hypothetical and exploratory examination to research their execution in the framework.

**S. Wongwises et al** found that 6/4 blend of R290 and R600 is the most suitable refrigerant to supplant HFC134a in a residential cooler. Researchers also researched the exergy execution of R12 and its substitute (R134a and R 152a) in the household cooler. R152a performed superior to R134a as far as COP, exergetic efficiency and efficiency imperfection as R12 substitute in household refrigeration framework.

**Miguel Padilla et al** found that R413A (blend of 88% R134a, 9%R218, 3%R600a) can supplant R12 and R134a in household icebox. Molina and Rowlands (1974) have been ventured into a thorough and complex hypothesis accentuation around 200 responses that CFCs are essentially crushed by UV radiation in the stratosphere. In the year 1987 Hoffman anticipated 3 % worldwide ozone exhaustion with contact of CFCs emanations of 700 thousand tone/year.

**A.S. Dalkilic et al** considered the execution investigation of option new refrigerant blends as substitute for R12, R134a and R 22. Refrigerant mix of R290/R 600a (40/60 by wt. %) and R 290/R1270 (20/80 by wt. %) are observed to be the most reasonable option among refrigerants tried for R12 and R22.

**Abhishek Tiwari et al** distributed a survey paper on late improvement on residential refrigeration.

**A. S. Dalkilic S. Wongwises** An exhibition examination of vapour-compression refrigeration framework utilizing different elective refrigerants A hypothetical act contemplate on a conventional vapour-compression refrigeration framework with refrigerant blends dependent on HFC134a, HFC152a, HFC32, HC290, HC1270, HC600, and HC600a was accomplished for different proportions and their outcomes are contrasted and CFC12, CFC22, and HFC134a as conceivable elective substitutions.

**K. Senthil Kumar et al** considered the conduct of HCFC (Hydrochloroflurocarbon)- 123/HC-290 refrigerant blend computationally just as tentatively and found that refrigerant blend 7/3 as a promising option to R12 framework.

**R. Cabello et al** examined the impact of the evapourating pressure, gathering pressure and superheating level of the vapour on the exergetic execution of a refrigeration plant utilizing three diverse working fluids R134a, R407c, R22.

## Refrigerant Generation

Since 1830-1930 was the original of refrigerants. It depended on the accessibility. These refrigerants were all the more exceedingly harmful, combustible and some all around exceptionally responsive in nature. Models incorporate Ethers, CO and so on. Since 1930-1990 was the second era of refrigerants, was centered around diminishing poisonous quality and combustibility. Model: CFCs, HCFCs, HFCs, NH3, HO and so on. Since 1990-2010 was the third era of refrigerants, was centred around ensuring the ozone layer. Precedent - HCFCs, HFCs, HCs, NH3, H2O, CO2 and so on. Since 2010 to onwards be the fourth era is being concentrating on refrigerants that don't add to a dangerous atmospheric deviation, ozone layer consumption, proficient, non-combustible and non-lethal with great solidness. Be that as it may, the standpoint for revelation or blend of these perfect refrigerants is amazingly improbable.

## Environmental concern

There are two noteworthy concern identified with condition:

1) The primary significant concern is exhaustion of ozone layer. Ozone layer is a layer which shields the earth from bright beams. Ozone consumption potential is assessed on a scale that utilizes CFC-11 as a benchmark. The various parts depend on how harming to the ozone they are in connection to CFC-11.

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2) The second significant concern is an unnatural weather change. An unnatural weather change is the expansion in worldwide earth surface temperature because of the ingestion of infrared emanation from earth surface. A dangerous atmospheric depletion potential is assessed on a scale that utilizes CO2 as the seat mark for example CO2 is doled out an esteem and different parts are contrasted with CO2.

### Option to R134A

In CFCs and HCHCs present the chlorine content which add to the consumption of ozone layer. However, the elective refrigerant of CFCs and HCFCs is Hydroflrocarbon HFCs (R134a, R152a, and R32) as there are no substance of chlorine. R134a is the main swap for local coolers. In spite of the fact that the ODP of R134a is zero, the GWP is generally high.

### Alternative Refrigerant: HFO-1234yf

Another new refrigerant that is being considered is HFO-1234yf. Grown together by Honeywell and DuPont, it is being advanced as a conceivable drop-in substitution for R-134a in both new vehicles and more established vehicles, should that become fundamental later on. HFO-1234yf has warm attributes that are fundamentally the same as R-134a, so no real alterations to the A/C framework are vital. Even better, HFO-1234yf has an Earth-wide temperature boost capability of just 4, contrasted with 1200 for R-134a, enabling it to meet the European necessities for a GWP of under 150.

### Alternative Refrigerant: Ammonia

Smelling salts is created in a characteristic manner by people and creatures; 17 grams/day for people. Its ODP and GWP both are zero and have incredible thermodynamic qualities: little atomic mass, huge inactive heat, huge vapour thickness and amazing heat exchange attributes .Its smell makes spills be recognized and fixed before achieving risky focus likewise accessible at generally low cost. The main downside of NH3 is that it is dangerous, combustible and not perfect with copper.

### Alternative Refrigerant: Super freeze 134a

Super-Freeze 134a a HC-based refrigerant from is a mix of ecologically safe hydrocarbon fluids planned as an immediate substitution and retrofit refrigerant alternative for supplanting R123a and R12 refrigerants in car cooling and refrigeration frameworks outside of the United States. Super-solidify 134a works at lower head pressures and offers improved cooling properties and execution versus R134a and R12.

## III. CONCLUSION

In the consequence of the Montreal protocol HFC's have overwhelmingly supplanted CFC's and HCFC's in RAC gear. Because of their high GWP, HFC's are not a decent substitution arrangement. Kyoto protocol goes for the eliminating of HFCs sooner rather than later the arrangement are the characteristic refrigerants: Ammonia, Hydrocarbons and Carbon dioxide that may prompt zero ODP and negligible GWP. For making the refrigerant increasingly productive framework need low TEWI factor. Later on, the advancement specialists will additionally grow more refrigerants which won't just make the work framework increasingly effective yet in addition having the eco-accommodating nature, prompting the achievement of the refrigeration objectives and improving the prosperity and safety of the worker.

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