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# Experimental investigation on split type window Air conditioner using HFC and HC mixture as ecofriendly refrigerant alternate to HCFC-22

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**Abstract.** This paper reports on an experimental study evaluating a window air conditioner's performance when R152a/R290/R600/R600a refrigerant mixture (by various mass percentages) is used as a possible alternative to R-22. Alternative refrigerants are local, cheap, and environmentally friendly. Unmodified R-22 window AC was charged with R152a/R290/R600/R600a. During the experiment, parameters such as coefficient of performance, refrigeration effect, pressure ratio, compressor discharge temperature, refrigerant mass flow rate, and compressor power are analyzed. The present work shows that R152a-15%/R290-15%/R600-35%/R600a-35% is the best-performing alternative refrigerant. Proposed blends and R22's performance were compared.

## 1 Introduction

In the current scenario, as chlorine contributes to ozone depletion, refrigeration and air-conditioning industries are switching to chlorine-free refrigerants. Developed countries must phase out HCFC 22 by 2030 and developing countries by 2040.To solve the ill-effects of traditional refrigerants like ozone layer depletion, researchers around the world are identifying alternative refrigerant mixtures for window Air conditioner. Research journals list many R-22 alternatives. The suggested alternatives are HFC and HC refrigerants, each with benefits and drawbacks. To meet the Montreal and Kyoto protocols, it is essential to find environmentally-friendly refrigerants. Hydrocarbon (HC) refrigerants are eco-friendly, but their flammability is dangerous. so, safety standards in many countries prohibit charging air conditioners above a certain level. Hydrocarbons require constant safety attention, such as preventing system leakage. Hydrofluorocarbons are incompatible with mineral oil, so they're used with polyolester (POE) oil. This polyolester oil is highly hygroscopic, causing moisture-related problems.

## 2 Literature review

The search for suitable alternatives to R22 and other toxic refrigerants with eco-friendly properties and comparable performance began in the early days. In the 1920s, 'Carrier and Water Fills' researched improved chiller refrigerants to replace R22. Donald et al. (1994) studied R-407C to replace R-22 in heat pumps and air conditioners. Kim et al. (1994) tested heat pumps with azeotropic R-134a/HC-290 and R-134a/R-600a mixtures. Macline & Leonardi (1997) measured refrigerant performance and suggested that zeotropic blends could reduce the high energy consumption of HC and HFC air-conditioning appliances. Purkayastha and Bansal (1998) studied HC290+LPG to replace R-22. Yang et al. (1999) studied R-32 / R-290, R-125 / R-290, R-32 / R-125 / R-152a, and R-32 / R-125 / R-290 to find a replacement for R-22. Motoshi (1999) studied lubricants for use with HFCs and compressor lubrication. Samuel and Daniel tested R-404A, R-407C, R-408A, R-410A, and R-507 to replace R-22 (2000). Jabaraj et al. investigated the performance of R407C/R290/R600a refrigerant mixtures without changing the mineral oil (2006). Oruc et al. conducted experiments with newly proposed HFCs such as R417A, R422A, R422D, and R424A to investigate their performance for use as drop-in replacements for the existing R22 (2016).

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