ISSN Print: **2150-3621**
ISSN Online: **2150-363X**

International Journal of Energy for a Clean Environment

FORMERLY KNOWN AS CLEAN AIR: INTERNATIONAL JOURNAL ON ENERGY FOR A CLEAN ENVIRONMENT

DOI: 10.1615/InterJEnerCleanEnv.2016015644
pages 71-80

EXPERIMENTAL STUDY OF LPG AND R134a REFRIGERANTS IN VAPOR COMPRESSION REFRIGERATION

T. O. Babarinde
Mechanical Engineering Department, Covenant University, Ota, Nigeria
O. S. Ohunakin
Mechanical Engineering Department, Covenant University, Ota, Nigeria
D. S. Adelekan
Mechanical Engineering Department, Covenant University, Ota, Nigeria
S. A. Aasa
Mechanical Engineering Department, University of Pretoria, South Africa
Sunday Oyedepo
Mechanical Engineering Department, Covenant University, Ota, Nigeria

ABSTRACT

Natural refrigerants, such as hydrocarbons, have been renewed in recent

years as a result of the environmental problems associated with chlorofluorocarbon (CFC) and hydro-chlorofluorocarbon (HCFC) refrigerants. Due to the depletion of the ozone layer and global warming effects, synthetic refrigerants are being gradually phased out in accordance with the international protocols that aim to protect the environment. A refrigerator designed to work with R134a was used for this experiment, liquefied petroleum gas (LPG) which consists of 60% propane (R290) and 40% butane (R600) was compared with R134a refrigerant in a vapor compression refrigerator with a total volume of 62 L. The experiments were carried out using different charges of 40, 60, 80, and 100 g for R134a and LPG refrigerants, the charges were measured with a digital charging scale. The K-type thermocouples were used to measure the temperatures at the inlet and outlet of the four major components (evaporator, compressor, condenser, and expansion device) of the refrigeration system. The system was instrumented with two pressure gauges at the inlet and outlet of the compressor for measuring the suction and discharge pressures. The results obtained were used to determine the thermodynamic properties of the refrigerants using Refprop, version 9. The results obtained showed that the design temperature and pull-down time set by the International Standard Organisation (ISO) for a refrigerator were achieved with LPG earlier than with R134a. The coefficient of performance (COP) of the system increases by 9.5% and the power consumption is reduced by 12%, when compared with R134a. Therefore, LPG can successfully substitute R134a in domestic refrigerators.

KEY WORDS: experimental, domestic refrigerator, LPG, R134a