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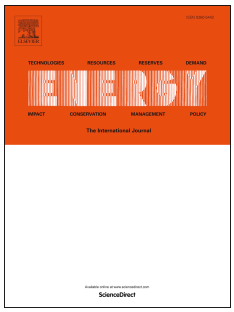

Improvement on the energy performance of a refrigeration system adapting a plate-type heat exchanger and low-GWP refrigerants as alternatives to R134a

Atilla G. Devecioğlu, Vedat Oruç

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Improvement on the energy performance of a refrigeration system adapting a plate-type heat exchanger and low-GWP refrigerants as alternatives to R134a

Atilla G. Devecioğlu*, Vedat Oruç

Department of Mechanical Engineering, Dicle University, Diyarbakır, Turkey

*Corresponding author, E-mail: voruc@dicle.edu.tr

Tel: +904122411000/3601

Abstract

This study is directed to propose a method for enhancing the energy parameters of the refrigeration systems operating with R134a which generally presents low performance of the units. Hence, R134a was experimentally compared with HFO-based refrigerants of R1234yf and R1234ze(E) having low-GWP. Additionally, plate-type liquid to suction heat exchanger (LSHX) was utilized in order to determine its effect on the system's energy performances. The evaporation temperatures were -9, -4.5 and 0°C while the condenser temperatures were 40, 45, and 50°C in the experimental work. The cooling capacity and power consumption of R1234ze(E) were noticed lower, however its COP was higher compared to R1234yf. It was also figured out that COP of the system with LSHX using R1234ze(E) was better about by 3% than that without LSHX which operated with R134a. The results of the present study indicated that the presence of LSHX caused improved COP and lower power consumption of the refrigeration system.

Keywords: R134a; R1234yf; R1234ze(E); COP; IHX

Nomenclature

COP	coefficient of performance
$C_{p,l}$	specific heat of refrigerant (liquid), kJ/kg·K
$C_{p,v}$	specific heat of refrigerant (vapour), kJ/kg·K
E	error in measured or evaluated parameter
GWP	global warming potential
h	enthalpy, kJ/kg
$\dot{m}$	mass flow rate of refrigerant, kg/s
$\dot{n}$	rotational speed for the compressor, rpm