

COMPARATIVE STUDY OF AUTO CASCADE REFRIGERATION SYSTEM PERFORMANCE USING ALTERNATIVE MIXED REFRIGERANTS

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Abstract

A comparison study to investigate the performance of one ton refrigeration capacity auto-cascade system using mixed refrigerant of propane R-290 and isobutene R-600a is presented. Mixed refrigerant of R-290/R-600a with four mass ratios (70/30, 60/40, 50/50 and 40/60) was used to investigate the performance of the system and compared with R-134a. An exergy analysis was performed to investigate the total exergy destruction and overall exergy efficiency of the auto cascade system. Numerical results were determined using process simulation software PROII and EES software based on mathematical models of auto-cascade system components. Results analysis showed that, the mixed refrigerant with mass fraction 60/40 displayed a higher performance comparing with other mass fractions and R-134a. mixed refrigerant with mass fraction (60/40) resulted, 29% and 26% increase in COP and refrigeration effect respectively, 25% decrease in total exergy destruction of the system and the higher value in overall exergy efficiency was 75% comparing with other mass ratios. System performance comparison between mixed refrigerant at mass ratio 60/40 and R-134a showed that, the enhancement in COP was 9%, percentage decrease in total exergy destruction was in range of 53% and the overall exergy efficiency of the system was 75% for mixed refrigerant comparing with 55% for R-134a.

Keywords: Auto-Cascade refrigeration system, Hydrocarbon refrigerant, Coefficient of performance, Exergy analysis.