Thermodynamic study of a combined power and refrigeration cycle by applying different working fluids

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Abstract

In this paper, a combined power and refrigeration cycle, including Organic Rankine and ejector refrigeration cycles, have been studied. Physical and thermodynamic properties of seven working fluids, including dry fluids (R227ea, R236fa, R245fa, R601a, RC318) and isentropic fluids (R124،R142b) have been investigated and their operations have been compared. By assuming fixed power to refrigeration ratio, the effects of different working conditions including turbine inlet temperature, evaporator temperature and expansion ratio of turbine have been studied. Exergy efficiency of the cycle increased, by decreasing evaporator temperature and increasing expansion ratio. When the expansion ratio of the cycle increases, the thermal efficiency of the cycle increases, too. Increase of inlet turbine temperature, causes to the increase of the total exergy destruction. According to the results, R124 possesses the best operation among the studied working fluids because by increasing temperature and expansion ratio and evaporator temperature, it has the maximum exergy efficiency.

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