

Energy Analysis of Different Cascading Refrigeration Cycles with Jet Ejector

ABSTRACT

Without refrigeration, present-day life would be unimaginable. Around 10% of the world's power is utilized to drive refrigerating and cooling frameworks. This paper aims to improve the coefficient of performance (COP) of refrigeration systems to reduce the overall electrical load. In vapor compression cycle (VCC), reducing the throttling losses in the expansion valve, which increases system irreversibility, is one of the methods of improving system's performance. In light of this point, an ejector is utilized in the system rather than an expansion valve to recover a portion of the kinetic energy of the expansion procedure. With a constant-pressure mixing ejector, the performance characteristics of vapor compression with ejector cycle (VCEC) using R1234yf as a refrigerant have been investigated. A parametric study was carried out to compare: VCC with VCEC; cascading vapor compression cycles (CVCC) with cascading vapor compression with ejector cycles (CVCCE) and VCEC with CVCEC. By keeping condenser pressure, evaporator pressure, cooling load and subcooled temperature at 1200 kPa, 160 kPa, 1 kW and 5 °C respectively, the COPs calculated were 2.053 for VCC, 2.598 for VCEC, 2.793 for CVCC and 3.144 for CVCEC. The results showed that ejector increases the overall COP with maximum percentage improvement at low evaporator pressures and high condenser pressures. After detailed analysis, examination and consideration of limitations it was concluded that VCEC and CVCEC are the two best alternatives of conventional VCC.