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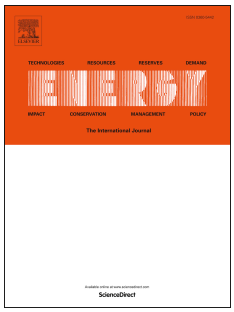

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Exergy, Exergo-Economic, and Exergy-Pinch Analyses (EXPA) of the Kalina Power-Cooling Cycle with an Ejector

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Abstract

This paper intends to optimize a new power and cooling cogeneration system, Kalina power-cooling with an ejector cycle (KPCE). The cycle combines the Kalina power cycle and the ejector absorption refrigeration cycle, with an ammonia-water mixture as the working fluid. To this aim, given the thermodynamic model, the potential improvements to the KPCE components are identified by performing exergy and exergo-economic analyses. Then, the system is optimized through a combination of exergy and pinch analyses (EXPA) to find out the direction of improvement and modifications of the system. This system operates with a thermal efficiency of 12.9% and power-cooling efficiency of 25%, providing 459 kW of power and 439.5 kW of cooling. KPCE showed a total exergy efficiency and exergy destruction of 69.8% and 1076 kW, respectively. Components with the highest exergy destruction and lowest exergy efficiency and unit cost rate are identified. According to EXPA, the system achieved a 5% lower overall cost rate and higher cooling generation, which resulted in higher thermodynamic efficiencies. The modified KPCE showed increases of 32%, 36%, and 32% in thermal, power-cooling, and exergy efficiencies, respectively. Compared with other Kalina power-cooling cycles, the optimized KPCE is introduced as a high-performance power-cooling cogeneration system.

Keywords: Absorption, Ejector, Exergy, Kalina cycle, Pinch, Power and cooling cogeneration.