Solar Energy

Volume 91, May 2013, Pages 283–296

Evaluation of Adding Flash Tank to Solar Combined Ejector–Absorption Refrigeration System

Abstract: Performance of the absorption cooling system is still a challenge due to the coefficient of performance (COP) that is generally poor when compared with the conventional vapor compression cycle. High solar radiation in hot climates is usually associated with high ambient temperature and consequently peak cooling demand. Absorption cooling cycles can be powered by solar but the performance is limited by heat source temperature (solar collector) and high ambient temperature that can affect the condensation process. Efficiency enhancement of the system components is essential to increase the COP of the system. A modification in the combined absorption–ejector cooling system is adopted. Adding a removable flash tank between the condenser and evaporator could improve entrainment ratio of the ejector, along with improving the cooling effect inside the evaporator. A computer simulation program is developed to evaluate the performance of the modified combined cycle using aqua-ammonia (NH_3–H_2O) refrigerant. The performance of the proposed combined cooling cycle is compared with basic absorption, and combined absorption–ejector cooling cycles. Results showed a significant improvement in the COP of the modified cycle at different operating conditions. Cooling effect and capacity of the evaporator is enhanced due to the reduction of flash gas delivered to the evaporator. Furthermore, the flash tank optimized the ejector entertainment ratio and consequently increasing the condenser pressure. This optimization will enable the system to perform well in hot climates where the condenser efficiency is limited by ambient temperature.

Keywords: Combined absorption–ejector cycle; Adding flash tank; Enhancement of components efficiency; Mathematical performance of the modified cycle

http://dx.doi.org/10.1016/j.solener.2013.01.018