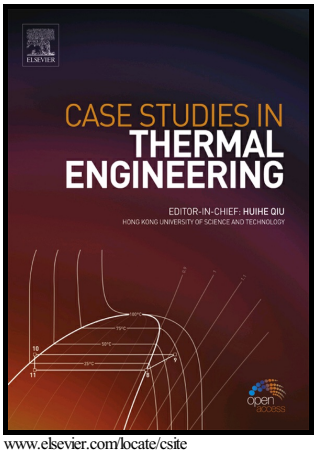

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Comparative performance analysis of ice plant test rig with TiO_2-R-134a nano refrigerant and evaporative cooled condenser

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Abstract

The nanoparticle is used in chillers for increasing system performance. The increasing concentration of nanoparticles (TiO_2) in refrigerant increases the performances of the system due decreasing compressor work done and enhance heat transfer rate. For hot and dry climate condition, performances of air-cooled condenser minimize, and C. O. P. decreases extensively in chillers due to heat transfer rate decreases in the condenser. In the condenser, nano-refrigerants are not cool at the desired level, and the system was faulty. These drawbacks of the nano-particles mixed refrigerator have promoted the research and improving heat rejection rate in the condenser. In this article, vapour compression refrigeration system coupled with evaporative cooling pad, and nano-refrigerant, for improving the performance of the system in hot & dry weather is proposed and compared experimentally. Combined evaporative cooling system and ice plant test rig have been proposed for the appropriate heat rejection offered in the condenser due to a faulty system run at high pressure. The experimental investigations revealed that the performance characteristics of the evaporatively-cooled condenser are significantly enhanced. Maximum C.O.P. increases by about 51% in the hot and dry climate condition than the normal system.

Keywords: Evaporative cooled chillers, C.O.P., Nano-particles mixed refrigerant, heat transfer rate

1. Introduction

The nano refrigerant is used to improve system performance, and it is decreased energy consumption of the system (viz. enhance heat transfer rate in cooling coil). If the nano-refrigerant does not cool at the desired level in the condenser, then the cooling coil does not cool the water to the saturated level. As seen, in hot and dry weather, performances of air-cooled condenser decrease, which is increased the energy consumption of the chiller. The heat rejection in the condenser is not offered in sufficient quantity; the nano refrigerants choked the chiller, in that case the system does not work properly. Therefore, some researchers are trying to reduce the consumption of electricity of chillers by using Nano Refrigerant and Evaporative Cooled Condenser; it is expressed as below:

Hady et al. [1] experimentally studied the performance of "chilled - water air conditioning unit using alumina nanofluids" for enhancement of Coefficient of Performance (C.O.P.) and energy saving. Majgaonkar [2] suggested nano refrigerant improve system performance, but its application is obstructed by many factors like poor long-term stability, high-pressure drop, high pumping power, low specific heat, particle settling, fouling and high production cost. Liu et al. [3], Wang et al. [4] experimentally investigated and compared the effect of the evaporatively-cooled condenser with an air-cooled condenser for the vapour compression refrigeration system. Whereas, the COP