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Theoretical analysis of a wet cooling tower coupled with a desalination plant for fresh water yield

P. Sellamuthu[a], C. Manoharan[b], R. Senthil Kumar[c,*]

[a]*Mechanical Engineering Department, V.M.K.V. Engineering College, Salem – 636308, India, Tel. +919940982025, email: selsrikanth29@gmail.com*
[b]*Sapthagiri College of Engineering, Dharmapuri – 635205, India, Tel. +919443412157, email: c_m_66@yahoo.co.in*
[c]*Consultant and Professor, Heating Ventilating Air-conditioning (HVAC) Systems, Tamil Nadu 636502, India, Tel. +919597397115, email: senthilkumariit@yahoo.com*

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ABSTRACT

The scarcity of clean water resources and the need for supplementary water supplies is already significant in many arid regions of the world and will be increasingly vital in the future. Many arid areas simply do not have fresh water resources in the form of surface water such as lakes, ponds and rivers. They may have only limited underground water resources; some are becoming more briny as extraction of water from the aquifers continues. It is estimated that some 35% of the world's irrigated areas suffer from salinity problems and remediation is seen to be extremely costly. A desalination plant is coupled with wet-cooling tower to utilize the water vapour (plume) from the top of cooling tower for the fresh water yield by a designed water cooled condenser. From the cooling towers, lot of plume carries heat energy is wasted and an idea behind this research focuses on diverting the plume to a condenser through the ducts. The water vapour is condensed by the condenser,and then the fresh water is pumped out with help of a positive displacement pump. A theoretical analysis is made by mass, energy equations considering desalination system with the cooling tower to get fresh water yield. The important parameters which affect the performance of the plant such as condenser flow rate, condenser temperature, water vapour flow rate, water vapour temperature, cooling load, mass flowrate of water and air, range and effectiveness through the tower have been considered to find out the maximum fresh water yield (lps). The theoretical results have been validated with the experimental results available in literatures. In this paper, a detailed design of a condenser and a theoretical analysis of the desalination plant coupled with cooling tower to get fresh water is presented. With help of the results from analysis, the power plant having cooling towers with the capacity 330 MW and 840 MW coupled with desalination plant were analyzed.

Keywords: Cooling load; Cooling tower; Condenser; Desalination; Fresh water; Optimum condition; Power plant; Yield

*Corresponding author.

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