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NUMERICAL, EXPERIMENTAL AND THEORETICAL STUDY OF EVAPORATIVE COOLING USING SALINE WATER

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The present paper provides an overview and review on heat and mass transfer involved in evaporation of single saline water droplets as well as pure and saline water sprays for cooling purposes. Independent numerical, experimental and theoretical approaches were implemented. The aim is to demonstrate the advances towards the deployment of natural draft dry cooling towers with inlet air-precooling using saline water. Our experiments led to the development of a new theoretical model for evaporation of single solid containing droplet where the corresponding advantages are discussed. Moreover, a comparison between pure and saline water sprays is reported and performance correlations are compared. The new approaches to implement saline water injections in multiphase multiscale numerical simulation, involving the liquid, vapour (gas and air) and solid (formed by crystallization) phases, nozzle arrangement in a cooling tower reported in this work provides valuable tools for designing an efficient natural draft dry cooling tower on hot days hence minimizing the water consumption rate for such systems. This work shows that in addition to fresh water preservation and cost savings due to water purification, using saline water can also lead to cooling efficiency enhancement by up to 8% and build more compact, hence less expensive, cooling towers. Overall it has been shown that the use of saline water is a viable and promising concept that requires further exploration.