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| Thesis Title | Experimental investigations on a helically coiled finned tube heat exchanger |
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## Abstract

In the present study, the heat transfer characteristics and thermal performance of a helically coiled finned tube heat exchanger are experimentally investigated. The heat exchanger consists of 4 concentric helically coiled tubes of 7 layers of different diameters. Each tube is constructed by bending straight copper tube into a helical coil. Crimp spiral fins made from aluminum are placed helically around the tube. The water and air are used as working fluids. The test runs are done at the air mass flow rate in the range between 0.035-0.122 kg/s, and water mass flow rate in the range between 0.21-0.37 kg/s. The air temperature is around 32$^{o}$C. The water temperature is between 10 and 17.5$^{o}$C. The experiment consists of two steps. The first step is to determine the tube-side and air-side heat transfer coefficients and the second one is to obtain the data for verifying the simulation results. The mathematical models used to describe the heat transfer characteristics are developed from the conservation equations of energy and mass.

The results obtained from the experiments provide the tube-side heat transfer coefficients are presented in the term of the Nusselt numbers. Air-side heat transfer coefficients are presented in term of the Colburn j factors. The tube-side and air-side heat transfer coefficients obtained from experiments are fitted in to the forms of the presented correlations. The Nusselt numbers obtained from the correlations are correlated within $\pm 5\%$, while the Colburn j factors obtained from the correlations within $\pm 15\%$. The heat transfer characteristics and the relevant parameters of the helically coiled finned tube heat exchanger, namely, the effectiveness, the outlet- water and outlet-air temperatures, and the heat transfer rate obtained from the models are validated by comparing with the measured results obtained from the experiments. The results obtained from the models show reasonable agreement with the experimental data.


Keywords: Air- side heat transfer coefficient / Crimped spiral fin / Heat transfer characteristics / Helically coiled tube / Tube-side heat transfer coefficient