

Abstract

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COMPUTATIONAL ANALYSIS FOR THE EFFECT OF THE TAPER ANGLE and HELICAL PITCH ON THE HEAT TRANSFER CHARACTERISTICS OF THE HELICAL CONE COILS

This numerical research is devoted to introducing the concept of helical cone coils; comparing the performance of helical cone coils as heat exchangers to the ordinary helical coils. Helical; spiral coils are known to have better heat; mass transfer than straight tubes, which is attributed to the generation of a vortex at the helical coil. This vortex, known as the Dean Vortex, is a secondary flow superimposed on the primary flow. The Dean number, which is a dimensionless number used in describing the Dean Vortex, is a function of Reynolds Number; the square root of the curvature ratio, so varying the curvature ratio for the same coil would vary the Dean Number. Numerical investigation based on the commercial CFD software fluent is used to study the effect of changing the structural parameters (taper angle of the helical coil, pitch; the base radius of curvature changes while the height is kept constant) on the Nusselt Number, heat transfer coefficient; coil outlet temperature. Six main coils having pipe diameters of 10; 12.5 mm; base radius of curvature of 70, 80; 90 mm were used in the investigation. It was found that, as the taper angle increases, both Nusselt Number; the heat transfer coefficient increase, also the pitch at the various taper angles was found to have an influence on Nusselt Number; the heat transfer coefficient. A MATLAB code was built to calculate the Nusselt Number at each coil turn, then to calculate the average Nusselt number for all of the coil turns. The MATLAB code was based on empirical correlation of Manlapaz; Churchill for ordinary helical coils. The CFD simulation results were found acceptable when compared with the MATLAB results.