PARAMETRIC & CFD ANALYSIS OF SHELL AND TUBE HEAT EXCHANGER BY VARYING BAFFLE GEOMETRY

M Tech Dissertation

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ABSTRACT

The heat exchanger is a device that used to transfer thermal energy between two or more fluids, in thermal contact and at different temperature. The Shell and Tube Heat Exchanger are most commonly used in current industrial production. In this study, the effect of baffle spacing on pressure drop and heat transfer coefficient are considered in a shell and tube heat exchanger with single segmental baffles and staggered tube layout. The effects of number of baffles are considered 4, 6, 8, 10, 12, and 14 and baffle spacing are considered 366.67, 220,157.14, 122.22, 100, and 84.61 respectively with 38% baffle cut are investigated to study the effect of pressure drop and heat transfer coefficient.

Shell and tube heat exchanger with single segmental baffles is designed with same input parameters using Kern's theoretical method and Bell-Delaware method. From the CFD simulation results, heat transfer coefficient and pressure drop values for varying tube layout are provided.Variation of number of baffles with shell side pressure drop heat transfer coefficient are shown. It is discussed that for both methods (analytical calculation and CFD result) pressure drops will be increases with increases number of baffles. K-ε Standard turbulence model with second order discretization and fine mesh is selected for CFD simulation considered.

The result are shown highly sensitive to tube layout orientation selection, it is observed for this heat exchanger geometry 30° tube layout arrangement gives slightly better results. The results are also sensitive to baffle spacing selection, the baffle spacing must be chosen very carefully. For this heat exchanger geometry 14 baffle gives better result. Hence it can be concluded that shell and tube heat exchanger with 30° tube layout orientation results better performance compares to 45° and 90° tube layout orientation and 14 baffle results give better performance compared to 4, 6, 8, 10, and 12 of baffles.