REVIEW ON ANALYSIS OF DOUBLE PIPE HEAT EXCHANGER WITH HELICAL FINS

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Abstract -*In this present day double pipe heat exchanger is the most common type of heat exchanger widely use in oil refinery and other large chemical processes because it suits high pressure application. To determine the performance of double pipe heat exchanger, the hot fluid has made to flow through inner tubes and cold fluid is flow through the outer tubes. The main objective is to design the DPHE with different angles of fins & to study the flow and temperature field inside the tubes.*

Key Words: Helical fins, overall heat transfer coefficient, heat transfer rate, mass flow rate, CFD.

1.INTRODUCTION

A heat exchanger is a device used to transfer heat from a hot fluid to cold fluid across an impermeable wall. Fundamental of heat exchanger principle is to facilitate an efficient heat flow from hot fluid to cold fluid. This heat flow is a direct function of the temperature difference between the two fluids, the area where heat is transferred, and the conductive/convective properties of the fluid and the flow state.

2. LITERATURE REVIEW

Sivalakshmi S. and Raja M.[1]In this work, the helical fins effect in the performance of a double pipe heat exchanger has been examined experimentally. The performance in terms of average heat transfer rate, heat transfer coefficient and effectiveness of heat exchanger in plain inner pipe is evaluated and compared with helical fins installed heat exchanger over inner pipe. In this experimental analysis, hot fluid flow rate is varied in range from 0.01 kg/s to 0.05 kg/s and hot fluid temperature at inlet is kept constant as 80 °C. The result shows the heat transfer coefficient is increased with introduction of fins. Average rate of heat transfer and effectiveness of heat exchanger are increased to 38.46% and 35% respectively at higher flow rate.

Balarama Kundu et al. [2] had experimentation on beneficial design of shell and tube heat exchangers for attachment of longitudinal fins with trapezoidal profile. In this experimentation, the rectangular and trapezoidal fin shapes longitudinally attached to the fin tubes. The results show that the heat transfer rate was lesser than the rectangular cross section keeping the outer shell diameter is a constant along with all other constraints of a heat exchanger. Also using trapezoidal fins the heat transfer rate is found to be increased in comparison to the rectangular cross section and pressure drop decreases .It shows that the trapezoidal fin has more effectiveness in heat transfer under a design constant.

Dong et al. [3] performed study to accomplish the influence of cribriform annular finned–tube on the convective heat transfer of annular finned–tube heat exchanger. The convective heat transfer coefficient was increment by 3.55% and 3.31% and increment in pressure drop by 0.68% and 2.08% for two- hole and four -hole cases respectively.

Iqbal et al. [4] investigated of the optimal longitudinal triangular fins (initial shape) close fitting to the outer surface of the inner pipe enclosed. Within a laminar, incompressible and fully- developed flow in the shell of two concentric circular pipes at regular heat flux. The fins are straight, non-porous, regularly distributed about the periphery of the inside pipe and are assumed to be made up of highly conductive material. The fin profile is showed by Piecewise Cubic Hermite Interpolating Polynomial (PCHIP). The results depict that the optimal shape is strongly dependent on the ratio of radii, the number of fins, and the number of control points and the characteristic length. The increment in the Nusselt number up to 138%, 263% and 312% over the traditional fins of trapezoidal, parabolic and triangular shapes for equipollent diameter however 212%, 90% and 59% respectively for hydraulic diameter.

Kanade Rahul H. et.al [5] performed CFD analysis of heat transfer enhancement in a double pipe heat exchanger. They investigated the effect of internal aluminum baffles on heat transfer enhancement and pressure drop. The baffles were taken in the form of semicircular and quarter-circular geometries arranged on inner pipe of DPHE. They resulted that the heat exchanger equipped with quarter-circular baffles offered more heat transfer rate than heat exchanger equipped with semicircular baffles as well as heat exchanger without baffles as they stimulate more consistent turbulence inside annulus.

Mayank Bhola et al. [6] investigated modeled and simulated for annular tube heat exchanger with and minus insert. Design process for heat exchanger and insert has been carried out in SOLIDWORKS, fluid domain is formed in ANSYS workbench for steel. Inlet temperature of warm water and cold air are (60 - 26) °C respectively. CFD computations were done for three various mass flow rate of air (0.0079, 0.018, and 0.036) kg/s and water (0.0216, 0.36091, and 0.6767) kg/s for both counter flow and parallel flow condition. The profile tape of insert is rectangular insert. The results have illustrative a good acceptable. The inside convective heat transfer coefficient for rectangular insert of this type is roughly 25% higher than for smooth tube. Counter flow configuration is high efficient than parallel flow. And depict increment in heat transfer coefficient of roughly 27%.

Mohsen Sheikholeslami et.al [7] investigated flow and heat transfer in a horizontal annular tube double pipe heat exchanger is experimentally. The inside tube is made from copper, while the outer tube is made from PVC. The temperature were measured with Stainless steel thermocouples. Pressure losses were determined by using U-manometers that were stuffed with water for the air side. The flow is designed as according to countercurrent flow and turbulent flow. Warm water was passed through the inside pipe, while cold air was flowing through the annulus duct. Water at various volumetric flow rates in the range of from 120 to 200 (Lit/h) flows through the inside tube and in the temperature of water range from 70 to 90 °C. The experimental Results depict that Nusselt number in water side increments with increments of temperature of the water and flow rate of water while opposite trend is observed for Nusselt number in air side. Friction factor increments with increment of inlet temperature and inlet velocity of water.

3. CONCLUSION

From this literature survey ,it will be concluded that the mass flow rate increases then overall heat transfer coefficient increases. The mass flow rate increases then overall heat transfer coefficient increases for different helix angle.

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