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Review: Analysis of Shell & Coil Heat Exchanger at Different Mass Flow Rate by Using Carbon Nano Tube Nanofluid

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Abstract: *For many years, large-scale commercial enterprises have been interested in the treatment of waste heat. This recovery not only makes an operation more environmentally friendly, but it also allows for cost savings. Furthermore, it may lower the amount of resources required to power a facility. Many industries have implemented one-of-a-kind waste warmth recovery solutions. A warmness exchanger is a common option. This work describes the investigation of carbon nanotubenanofluids in shell and helical coil heat exchangers at different mass flow rate. In this present paper, attempts are made to recall how the nanofluid will supply strain decrease in hot and cold fluid by evaluating the results/ researched by various authors.*

Key Word: *Shell and Helical Coil, Nano-fluid, Heat Exchanger, CFD, Pressure Drop, Temperature Distribution.*

I.INTRODUCTION

Because of its compact construction and excellent heat transfer coefficient, shell and helical coil heat exchangers are widely used in commercial applications such as power generation, nuclear industry, system vegetation, heat recuperation systems, refrigeration, food industry, and so on. Due to their ease of manufacture, helical coils with circular move phases were widely employed in a variety of package styles. Because of the existence of centrifugal forces, floating in a curved tube differs from floating in a straight tube. These centrifugal forces form a secondary flow parallel to the primary direction of flow, with circulatory results that raise both the friction factor and the fee of heat switch. The amount of secondary drift advanced within the tube is proportional to the tube diameter (d) and coil diameter (D). Because of the more desirable warmth switch in shell and helical coiled configurations, the investigation of flow and warmth switch characteristics in the curved tube is critical. Creating fluid-to-fluid helical warmth exchangers (fluid is available on both sides of the tube wall) necessitates a thorough understanding of the warmth switch mechanism on both sides of the tube wall. Despite extensive research on the warmness transmission coefficients within coiled tubes, little work has been documented on the outside warmness transfer coefficients. One of the severe problems is warmth switch fluid, which disrupts the scale and value of warmth exchanger structures. Traditional fluids such as oil and water have partial heat switch potential. It is our first priority to produce unique types of fluids in order to reduce fees and fulfil the growing demand of industry and commerce. Through threat, advances in nanotechnology make it possible to achieve improved performance and cost savings in heat transmission technologies. Nano particles are occupied as the dazzling establishment of materials with potential applications in the warmth transfer place.

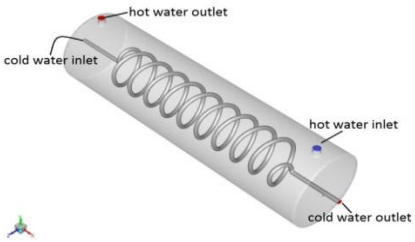

Figure 1 Shell & Coil Heat Exchanger

Nano Fluid

Nano fluid is nothing more than a fluid debris with a diameter of less than a micron (9-10 times smaller) and a highly reactive and gifted cloth that can be utilised to increase features like rate of response, heat conductivity of any metal or fabric and they are that much reactive and robust.

While the nano fluid circulates the nano debris, the following benefits are anticipated: [3]

i. Heat conduction is higher
ii. Stability
iii. Choking not occurs in Micro passage cooling
iv. Probabilities of erosion reduced
v. Pumping power is reducing

II.LITERATURE REVIEW

PranitaBichkar et.al. [1]has completed his research in Shell and Tube Warmness Exchangers with the effects of various baffles. This work presents numerical simulations of several baffles, including single segmental, double segmental, and helical baffles. This implies that baffles have an effect on stress decrease in shell and tube heat exchangers. Single segmental baffles exhibit the establishment of dead zones wherein the warmth switch cannot take place effectively. When compared to single segmental baffles, double segmental baffles reduce vibrational damage. The use of helical baffles results in a lower strain drop due to the elimination of unnecessary zones. The fewer dead zones result in more heat transmission. The smaller stress drop leads in lower pumping electricity, which boosts overall system performance. The comparison results demonstrate that helical baffles are more advantageous than different two baffles.

Lei et al. [2] finished a numerical study of various baffle inclination angles on fluid float and heat switch of non-prevent helical shell and tube warmth exchangers using a periodic model. Based on the outcomes, it was determined that the overall overall performance happens around 45° helix mind-set standard overall performance of heat exchanger also depends on strain drop. Leakage can reduce pressure drop, which is consistent with the compartment average heat switch coefficient.

Vidula Vishnu Suryawanshi et.al. [3] He completed his examination in format and assessment of heat exchanger. In this article, CFD evaluation has been performed by way of several exceptional diameter one-of-a-kind material. Future efforts wanted for better development of helical warmth exchanger are: CFD evaluation and optimization of the curvature ratio. The usage of the Dean range and the Colburn component for boundary circumstances with constant wall temperature and constant wall warm temperature flux for both laminar and turbulent flow. To investigate the results and adjust the heat transfer charge by varying the pitch of the helical coil.

Vishal Momale et.al. [4]Examine the usual overall performance of a conical helical tube heat exchanger with right away and conical shell using cfd. Computational fluid dynamics is used to evaluate the conical helical tube warmth exchanger. Heat transfer can progress significantly because the larger shell fluid comes into contact with the tube fluid even when we employ a conical shell rather than a helical shell. With a conical shell configuration, the stress drop will increase. However, if we utilise baffles, we will increase the warmth switch.

The Mohamed Ali et.al. [5] The experimental study of natural convection was carried out to investigate, regular type natural convection was received from turbulence herbal convection to water. The experiment was carried out with a four coil diameter to tube diameter ratio for five and ten coil tubes, as well as a five pitch outer diameter ratio. He linked Rayleigh range for two exceptional coil units, and the heat transfer coefficient falls with coil period for tube diameter do =.012m but increases with coil period for do=.008m. Important D/d0 is obtained for a maximum warmness transfer coefficient for a tube diameter of 0.012 m with either five or ten coil turns.

R. Patil et.al. [6] recommended design approach for helical coil heat exchanger. The internal coil diameter hi is used to determine the heat transfer coefficient, which is based entirely on one of the Sieder-Tate equations or a plot of the Colburn aspect, JH versus Re. The outer heat transfer coefficient is derived using correlation for a wide range of Reynolds numbers. Helical coil heat exchangers are preferred when space is limited and low flow charges or laminar flow conditions exist.

III. PROBLEM FORMULATION

There is less work has been done on heat transfer rate of shell and helical coil heat exchanger. In my work I am trying to showing the CFD analysis of Carbon NanoTubenano fluid for hot and cold fluid in shell and helical coil heat exchanger at different mass flow rate by keeping in mind that Nano fluid should produce maximum heat transfer rate with minimum power consummation. Because some times in the process of improving the heat transfer coefficient we consume more power without knowing the economic cost. Consider a 3D design of CAD model of helical coil of tube outer diameter (d_o**)** 16 mm, inner diameter of helical coil (d_i) 12 mm, pitch of 26.3mm, pitch coil dia. 86 mm, tube length of 235 mm, shell diameter is 110 mm and shell length is 215 mm, is generated by using ANSYS fluent 18.2.In my research I am using Carbon Nano TubeNano fluid.

IV.CONCLUSION

The different boundary conditions are taken for shell and helical coil heat exchanger for the numerical simulations. The numerical study considers the effect of Nano fluid Carbon Nano tube on the flow and heat transfer characteristics of tube. The thermal properties of fluid are lesser as compared to Nano fluid. We will made a shell and helical coil in which, helical coil of tube outer diameter (d_o**)** 16 mm, inner diameter of helical coil (d_i) 12 mm, pitch of 26.3mm, pitch coil dia. 86 mm, tube length of 235 mm, shell diameter is 110 mm and shell length is 215 mm, is generated by using ANSYS fluent.

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