A REVIEW- INVESTIGATION OF DIFFERENT PROCESS PARAMETERS OF HEAT EXCHANGE HAVING HELICAL BAFFLES TO INCREASE TURBULENCE INSIDE THE TUBE

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***Abstract*: This paper features a broad discussion on the application of enhanced heat transfer surfaces to compact heat exchangers. The motivation for heat transfer enhancement is discussed, and the principles behind compact heat exchangers are summarized. Next, various methods for evaluating and comparing different types of heat transfer enhancement devices using first and/or second law analysis are presented. The study of heat exchangers is a thrust area as it is an eco-design model. The concept of heat exchangers plays a major role in the refrigeration and air conditioning system. An attempt is made in this paper to review the literature related to the heat exchangers and modifications made to improve the efficiencies.**

***Keywords*- heat exchanger, turbulators, heat transfer, flow behavior**

1. Introduction

A heat exchanger is a device used to transfer heat between a solid object and a fluid, or between two or more fluids. The fluids may be separated by a solid wall to prevent mixing or they may be in direct contact. They are widely used in space heating, refrigeration, air conditioning, power stations, chemical plants, petrochemical plants, petroleum refineries, natural-gas processing, and sewage treatment. The classic example of a heat exchanger is found in an internal combustion engine in which a circulating fluid known as engine coolant flows through radiator coils and air flows past the coils, which cools the coolant and heats the incoming air. Another example is the heat sink, which is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant.

1.1 Types of heat exchanger

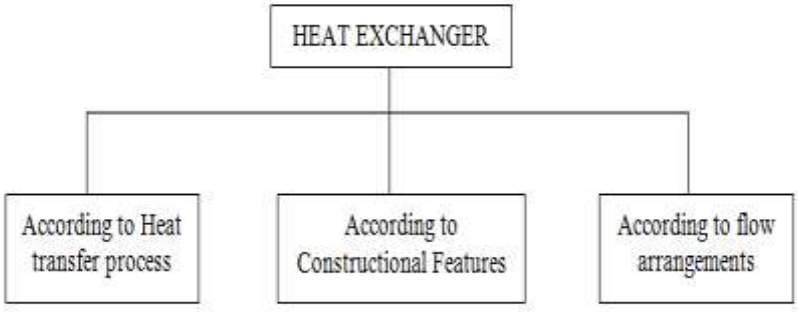

Figure.1 Schematic diagram showing the type of heat exchanger

2. According to Heat transfer process

2.1 Direct contact type heat exchanger-

Here in this exchanger two immiscible fluids are directly mixed with each other to exchange heat between two fluids. The two streams must also be at the same pressure in a direct contactor, which could lead to additional costs.

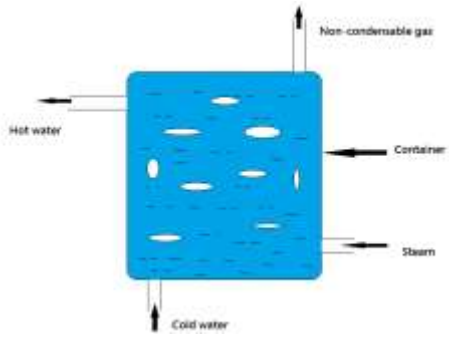

Figure.1 Schematic diagram showing direct contact heat exchanger

2.2 Transfer type heat exchanger-

In transfer type or recuperate type of heat exchanger two fluid flows concurrently through two tubes separated by walls. a recuperator is a special purpose counter flow energy recovery heat exchanger positioned within the supply and exhaust air streams of an air handling system, or in the exhaust gases of an industrial process, in order to recover the waste heat.

2.3 Regenerator type heat exchanger-

In Regenerator type heat exchanger the cold fluid flow and hot fluid flow alternatively on same surface. During the hot fluid transfer the surface wall of heat exchanger get heated and when the cold fluid flows through it, wall heat get transferred to the cold fluid and heat exchanges so that the temperature of cold fluid increases. The common example of these type heat exchangers is pre-heaters for blast furnace, steam power plant etc.

3. Existing Research work

To enhance the performance of heat exchanger many researchers have worked for optimizing the different parameters on which the performance of heat exchanger depends. Some of the research work related to the enhancement of heat transfer due to the use of different baffles inside the heat exchanger is mention in the below section.

1. **Vahidifar et.al (2015)** it carried out the analysis of characteristics of heat transfer and the drop in pressure of a horizontal double pipe heat exchanger with wire coil enclosures. The magnification of coefficient of heat transfer in the heat exchanger decreases the weight, size and heat exchanger cost. When an article is engaged in a boundary layer, it disturbs the flow pattern and changes the velocity as well as temperature contours. The change is influenced by the development of jets and stirs in the boundary layer as it varies transfer and coefficients of friction on the wall.

2. **Roslim et.al (2015)** The object of this work informs about the inquiry on the things of porous twisted plate as enclosure to improve performance of heat transfer and flow parameter for a single fixed tube. The real fixed tube of the boiler is utilized and implanted with simple and porous twisted plates. The accumulating outcome is associated with the simple tube without any supplement. The final consequences describe that formation of holes changed the flow pattern and then creating secondary flow and forthcoming to turbulence flow. The temperature variation and characteristic of heat transfer of the porous surface twisted plate as inserts in fitted tube are presented in this article.

3. **Freidoonimehr et.al (2015)** The main objectives of this analysis is to represent double the value for the difficulty in magneto hydrodynamic Jeffery Hamel Nano-fluid flow in other than parallel walls. To get it, we occupy a new logical method, Predictor Homotopy analysis method. This active method is an adept to determine all outlets of the multiple solutions all together. Additionally, comparison of the Predictor Homotopy analysis method results with mathematical outcomes gained by the shooting method attached with a Runge-Kutta integration method exemplifies the high precision for this method.

4. **Jassim et.al (2015)** The analysis gives a fresh design for inactive cooling system by utilizing wind catcher of an earth to air heat exchanger. Rise in space of wind-catcher and supply natural lighting, executes part of wind-catcher into the earth. After we start that wind-catcher which are utilized in conventional construction for long times are missing in modern housing after the appearance of automated freshening and due to the quantity of air given are few that do not meet the restrictions of thermal relief necessities of the modern person.
5. **Sheikholeslami et.al (2015)** it investigates the economic reasons material and energy saving leads to make efforts for making more efficient heat exchange. The heat transfer improvement methods are extensively utilized in various applications in just like the heating procedure to make probable deduction in weight as well as size or improve the heat exchangers performance. These methods are categorized as active and inactive methods. The active method uses exterior power whereas the inactive method does not require any exterior source.
6. **Vermahmoudi et.al (2014)** According o this analysis, the coefficient of overall heat transfer of water based iron oxide Nano fluid in a dense air-cooled heat exchanger are calculated practically under laminar flow settings. The air-cooled heat exchanger is comprised of 33 vertical tubes with arena shaped cross section as well as air makes a cross flow through the tube bank with moveable flow rates. The coefficient of overall heat transfer of Fe2O3 or water Nano fluid in a compact air-cooled heat exchanger has been calculated practically according to the logarithmic mean temperature difference methods under laminar flow system.

7. **Huertas et.al (2014)** during the analysis it investigate that, exploration represents a practical analysis of the heat transfer and drop in pressure features of a solar collector of flat plate with two dissimilar shape of helical wire coil supplements. This gives us by recognizing the distinct flow systems that each wire coil endorses, and helps as a base for the analysis of the outcomes of heat transfer. Two wire coil enclosures with changed geometry are considered practically to read the liberated influence of tube side improvement of heat transfer on the temperature dissemination of the absorber plate in a heat transfer rig for the analysis of flat plate liquid solar collectors.
8. **Matani et.al (2013)** In this research work, the effects of twisted tapes and wire coil on drop in pressure, friction factor f, heat transfer as well as thermal improvement index are practically resolute. The twisted tapes are utilized as whirl flow generators also like double twisted tapes that are act as counter whirl generator whereas wire coil with the twisted tapes utilized as co-whirl flow generators in an assessment unit. The analysis by means of the twisted tape and with wire coil achieved beneath same process assessment surroundings, for evaluation.
9. **Lahiri et.al (2013)** Due to complete numbers of heat exchanger with shell and tube in any natural process firm, small development in their analytical policies deals high saving chances. Conventional design tactics are established on iterative processes that progressively vary with the design as well as mathematical functions until given heat duty and geometric series and working limits are contented. While well confirmed type of method is time taking and are not discover the exact answer of space to be fully examined.

10. **Patel et.al (2013)** in a double pipe heat exchanger where one of the easiest kind of heat exchanger, usually utilized for the function of sensible heating or cooling. In present work heat exchanger of double pipe is practically investigated at industry and collected necessary data like rate of mass flow, inlet-outlet temperatures, and dimensions of heat exchanger with double pipe. Heat exchanger running at industry is with fix rate of mass flow and aim of present work to advance the properties of heat exchanger. So analysis with changed discharge is necessary.
11. **gheorghian et.al (2013)** here in this work, heat transfer in forced convection in circular tubes are analyzed by having an initial point in the entropy generation equation per unit volume. The entropy generation equation having a contour which is estimated by supposing Poiseuille flow environments and considering velocity as well as temperature contours. It been shown that this may be stated as a function of two terms that is heat transfer across finite temperature differences and viscos flow inside the tubes. A non-dimensional type of entropy generation system is established for conveying the local entropy generation number per unit volume.
12. **Jamra et.al (2013)** in this work they analysis, transfer of heat in a horizontal circular tube heat exchanger where air as the base fluid that are raised by means of rectangular implantations. In the practical set up, cold air at atmospheric state is accepted within the internal pipe where as hot water is moving within outer tube. The Reynolds number of air changes from 16000 to 120000. The outcomes are associated with the simple tube with zero supplements.
13. **Johir et.al (2012)** here it analyzed the influence of isolating wires standing as turbulators only, with circular cross section diameter, and creating a coil of another pitches on the rates of heat transfer are practically examined. The analysis is achieved for the flow of turbulent water in a double pipe heat exchanger for both parallel as well as counter flows in contrast with cold water in the side of the shell. The practical's are achieved for flows with Reynolds numbers from 5,000 to 15,000.
14. **Martín et.al (2012)** The heat transfer improvement methods are employed to flat plate liquid solar collectors in the direction of more solid and effective analysis. For the distinctive functional mass flow rates in flat plate solar collectors, as furthermost appropriate method is implanted as an equipment. Based on earlier research from the researchers, wire coils are taken for heat transfer improvement. This type of implanted manoeuvre offers improved outcomes in laminar, transitional as well as lower turbulence flow of fluid systems.
15. **Hussein et.al (2012)** during this analysis it analyzed the transfer of Heat and features of friction are mathematically inspected, by using oblique tube to rise the rate of heat transfer with a lessening the rise of drop in pressure. FLUENT software is utilized to evaluate the leading calculation of computational fluid dynamics like continuity, momentum and energy by means of a finite volume method. The computational fluid dynamics with mathematical outcomes specify that the oblique tube that can improve transfer of heat as well as friction factor by almost 10% to 7% than the circular tube correspondingly.

5. Conclusion

In this review paper, the discussion had been done about the various configurations for the heat transfer enhancement. A review on the compact heat exchangers had been also done to extract some useful facts regarding heat transfer. The conclusions drawn from literature review are listed below:

- The achievement of the thermal comfort conditions optimizes the size of the heat exchangers.
- The provision of baffles in the heat exchangers causes huge pressure drop of the heat transfer fluid. This limitations can be overcome by using dimples, fins, full length twisted tapes and vortex generators.
- The increase in Nusselt number increases the heat transfer rateThe proper designs for the fluid flow in compact heat exchangers are essential. The axial heat conduction affecting parameters are Reynolds number (Re), thickness of separating wall (ts) and thermal conductivity ratio (Kr).

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