Issue 9 vol 3 ISSN: 2321-8134

IJFEAT

INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

STUDY AND COMPARISON OF CROSS FLOW PATTER WITH COUNTER CURRENT FLOW PATTERN IN HEAT EXCHANGERS

Nitin B. Chavan [1], Shubham M. Kamble [2], Suryakant R. Patel [3], Vivek B. Rathod [4]

[1]*Nitin B. Chavan, Chemical Engg. Department, J.D.I.E.T Yavatmal, Maharashtra, India,**directcontactchavan@gmail.com***

[2]*Shubham M. Kamble, Chemical Engg. Department, J.D.I.E.T Yavatmal, Maharashtra, India, **sk412862@gmail.com***

[3]*Suryakant R. Patel, Chemical Engg. Department, J.D.I.E.T Yavatmal, Maharashtra, India,**suryakantpatel16@gmail.com***

[4]*Vivek B. Rathod, Chemical Engg. Department, J.D.I.E.T Yavatmal, Maharashtra,India , **balarathod1404@gmail.com***

Abstract

Shell and Tube heat exchangers are having special importance in boilers, oil coolers, condensers, pre-heaters. They are also widely used in process application as well as the refrigeration and air conditioning industry. The robustness and medium weighted shape of Shell and Tube heat exchangers make them well suited for high pressure operations. In this study the effect of liquid on Heat Transfer flow rate was studied using a lab scale shell and tube heat exchanger (length-39 cm, shell diameter 9 cm, Tube diameter 0.62 cm). Also the effect of cold and hot fluid on heat transfer rate, effect of mass concentration of fluid (liquid) was studied. This work deals with the experimental investigation of thermal conductivity and specific heat capacity of fluids as a function of a temperature and concentration of liquid with respect to water. Heat capacity and require less heat transfer areas as compared to those of their base on other liquids. The enhancement heat transfer of the heat transfer devices can be done by changing the fluid transport.

Key words: *Shell and Tube Heat Exchanger, Design parameter, Flow Pattern, Application etc.*

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1. HEAT EXCHANGER

A **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.Heat exchangers are devices that facilitate the exchange of heat between two fluids that are at different temperatures while keeping them from mixing with each other. Heat exchangers are commonly used in practice in a wide range of applications, from heating and air g conditioning systems in a household, to chemical processing and power.

1.1 Cross Flow Heat Exchanger

A cross-flow heat exchanger is used in a cooling and ventilation system that requires heat to be transferred from one airstream to another. A cross-flow heat exchanger is made of thin metal panels, normally aluminium. The thermal energy is exchanged via the panels. A traditional cross-flow heat exchanger has a square cross-section.

It has a thermal efficiency of 40–65%.

1.2 Counter Flow Heat Exchanger

A counter flow heat exchanger has the hot fluid entering at one end of the heat exchanger flow path and the cold fluid entering at the other end of flow path. It is most common type of liquid-liquid heat exchanger.

It is more efficient than cross flow heat exchanger.

2. EXPERIMENTAL SETUP

3. EXPERIMENTAL PROCEDURE

The inlet hot water and cold solution temperatures were adjusted to achieve the desired level by using electric heaters controlled by temperature controllers.The hot water and cold solution flow rate was increased thus we took reading on these different flow rate 10LPH, 20LPH, 35LPH, 50LPH. inlet cold solution and hot water temperatures were also varied.The water and tube wall temperatures at the inlet are measured by calibrated thermometers, and outlet sections are measured by digital thermocouples constant.

Table-1: Observation

Cold LPH	Hot LPH	Cold (In)	Cold (Out)	Hot (In)	Hot (Out)	LMTD
Counter Current						
25	10	18	28	70	53	38.33
50	20	20	26	63	55	35.99
Cross Current						
35	20	20	25	65	45	29.72
50	20	20	24	61	50	32.29

4.RESULT

In this project we have worked on a shell and tube heat exchanger. Hot fluid is passed in the shell side and cold fluid is passed through the tube side. When the concentration is increased, the LMTD also increases when the flow rate is kept constant and when concentration is increased LMTD also increases.

Thus for these solutions if LMTD is increased the heat transfer rate will also increases.

5. CONCLUSION

According to the theory of heat transfer counter flow is the best flow pattern as compared to co-current and counter current flow. A counter flow heat exchanger is the most efficient flow pattern. It requires less heat exchanger surface area because the log mean temperature drop is the highest for counter flow.

Hence, it is clear that for heat exchanger, counter current flow configuration has higher effectiveness. Overall heat transfer coefficient of counter current flow is greater that's why counter current flow configuration of heat exchanger is more preferred for practical application.

The experimental proof to the above theory is given by our experiment and we found both the values for counter and cross flow and we conclude that the efficiency of counter is greater than the cross flow.

ACKNOWLEDGEMENT

These research was supported by Prof. Nitin Chavan we thank our colleagues from J.D.I.E.T Yavatmal, Shubham Kamble, Suryakant Patel , Vivek Rathod.

We would also like to show our gratitude to Mr. Vipul Gandhi for sharing his pearls of wisdom with us during the course of research.

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