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Evaluation of Plate Heat Exchanger over Shell and Tube Heat Exchanger.

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ABSTRACT

The heat exchangers find enormous application in heat exchanging processes and engineering application. This research paper covers comparison of plate heat exchanger with shell and tube heat exchanger and allows us to understand how PHE's can replace shell and tube heat exchanger in small Ice plant. In small ice plant where there is scarcity of working space it is very in appropriate to use shell and tube heat exchanger. And how and also how efficient is plate heat exchanger in terms of thermal efficiency, cost reduction and other problems which are faced in shell and tube heat exchanger.

Keywords— Plat Heat Exchanger, Shell and Tube Heat Exchanger.

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I. INTRODUCTION

The heat exchangers are devices which are used in where specific operation or processes require heat exchange between two fluids of different temperatures has to be carried out. Heat Exchangers have got number of engineering applications. But in this research paper we are going to take look at application of heat exchanger for small Ice plants.

In this paper we are going to see comparison of P.H.E. and shell and tube heat exchanger, which one suits a small Ice plant on the basis of following points mentioned below:

1. On the basis of heat transfer .
2. On the basis of installation of heat exchanger.
3. On the basis of maintenance.
4. Leakage problems.
5. Temperature difference between fluids.

Fig.1 Schematic diagram of plate heat exchanger.

II. LITERATURE REVIEW

[1] Daniël Walravenc, Ben Laenen, William D'haeseleer used PHE AND SHELL TYPE HEAT EXCHANGER to run on organic rankine cycle as working cycle to determine best system optimization to be used for production of electricity from low temperature heat source. he compared number of different configurations of O.R.C's with both P.H.E's as well as shell and tube heat exchangers. And used these models in single-phase flow, condensation and evaporating processes. The experiment showed better performance with P.H.E's as compared to shell and tube heat exchanger with equal no of passes. The only disadvantage was found out that due to identical geometry on both sides of plate the heat exchanging was ineffective when strongly different channels geometry were needed.

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[2] Sreejith K., Basil Varghese, Deepak Das, Delvin Devassy, Harikrishnan K.,Sharath G. K., they calculated overall hear transfer coefficient and cost optimization. Also calculation of minimum no of plates is also done. Along with cost optimization they found out a considerable drop in cost. While determining considerable difference of maintenance cost installation cost they found out that the surface of the plate has fewer tendencies to foul. The greater the tendency to foul the fluid flowing. The design of the frame and plate offered easier heat transfer access and higher tendency to self cleaning also higher turbulence added to the self cleaning property.

The only disadvantage was highlighted that the high pressure application required shell and tube type heat exchangers because the tendency of leakage at gasket in P.H.E. if in near future the gasket leakage issue will be solved then the P.H.E. will be a high advantage over shell and tube heat exchanger in all fields.

Also ample working space is left for utilization. This ample space provides the plant to increase production. Thus adding increase productivity of ice plant.

[3]Qi Li, Gilles Flamantb, Xigang Yuana, Pierre Neveub,c, Lingai Luod the authors in this paper have discussed plate heat exchangers as compact heat exchanger along with other heat exchangers like plate-fin heat exchanger, printed circuit heat exchanger spiral heat exchanger and ceramic heat exchanger. They have mentioned about air density which is ratio of heat transfer surface to heat exchanger volume. The plate heat exchanger has area density over 400m^2 /m^3 in comparison to 100 m^2/m^3 shell and tube heat exchanger when fluid is used in operation of heat exchanging. They also mentioned that plate heat exchangers have strong interaction between flow inside the channel and relatively small hydraulic diameter causes. (a) Advection of fluid from the centre of the channel to the near-wall region along with increased turbulence (b) The boundary layer and its new formation and reattachment they are also responsible for the breakup and separation of boundary region. (c) There is also decrease of fouling is 10-25 % as compared to shell and tube heat exchanger. They concluded the following result that the available data for these compact heat exchangers are into its primary stage which cannot be used into consideration as a concrete proof if its advantages over shell type heat exchangers. Various enhancing technologies for heat transfer are compared to cope with its capabilities in given operating conditions and thermo-hydraulic performance compared with heat transfer factor and friction factor. The results proposed that new generation fusion bound heat exchangers along with micro channel and ceramic heat exchanger will be a mile-stone in new generation of solar receiver. The main emphasis of their paper was that they introduced the structures and various mechanisms which can be used in specific compact heat exchanger that will enhance heat transfer rate in those heat exchangers which are finding their applications in various industries, engineering application, and still being studied in the laboratory.

[4] Simarpreet Singh, Sanjeev Jakhar The authors in this paper discussed a case study and deduced the following conclusions that the thermal resistance increase with increase in fouling on surface of plate heat exchanger causing reduction on heat transfer rate. Also the overall heat transfer coefficient and overall efficiency decrease due to heat exchange between clean and dirty heat exchanging surfaces. The decrease in cleanliness factor also decreases the efficiency of heat exchanger. Based on experiment we can find out number of days by predicting cleanliness factor of 0.65 and it almost remain same for next cleaning of plate heat exchanger.

[5] Jyoti K Javanjal and Madan Parande, discussed in their introduction of their research paper that they have mentioned gasket plate heat exchanger is suitable for heat recovery of heat from river, sea and air which is uneconomic for conventional heat exchanger. Because of the reason of close temperature approach relatively low pumping power its efficiency is high. They also mentioned 85 to 90% of heat recovery of milk and beer in pasteurization process.

They studied different concentration of ethylene glycol and also varied gasket thickness. The reduced thickness of gasket showed tremendous improvement of heat transfer coefficient on higher temperature side also it is compensated by increased pressure drop due to reduced gasket thickness

III. OBJECTIVE

Our objective of this research paper is to show how plate heat exchanger is more efficient than shell and tube heat exchanger.

And not only shell and tube heat exchanger but Plate Heat Exchanger is more effective than other conventional heat exchanger in terms of cost, working area, thermal efficiency etc. We are going to compare plate heat exchanger on following points:

1. The work area required for both heat exchanger.
2. Cost required for installation and operation cost.
3. Heat exchanging factor.
4. Leakage problem in both heat exchangers.

IV. METHODOLOGY

We will try to take reading from a shell and tube heat exchanger which is currently is in running condition. We will try to look into some important parameters such as heat transfer coefficient, area required for installation, and also try to detect other problems which also includes maintenance problem working problems etc.

V. CONCLUSION

After studying the above research paper we have concluded that plate heat exchangers are more efficient than conventional shell and tube heat exchanger if various terms such as thermal efficiency, cost effectiveness, low fouling factor, etc.

The few disadvantages which we learnt that Plate Heat Exchanger require more initial investment, maintenance is a bit more complicated etc. But still these disadvantages can be ignored for its higher efficiency.

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VI. FUTURE SCOPE

Plate heat exchanger or other compact heat exchangers can be used as an alternative to shell and tube heat exchanger. But there is enormous research to be done in the fields of materials, design parameters, cost reduction, etc.

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