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SHELL AND TUBE TYPE HEAT EXCHANGER CONSIDERING FOULING

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Abstract:-

In this type of heat exchanger one of fluid flows through a bundle of tubes enclosed by shell this type of equipment used in chemical processes and process industries. By performing this experiment on live working model, we came to know how practical analysis of a heat exchanger can be performed with anexperimental model role of steady state and flow of fluid in two different flows(counter and parallel).A practical data would be calculated which proves that counter flow is better than parallel flow if mass flow rates are kept approximately equal. The effect on fouling can be observed by keeping tubes under RO (Reverse Osmosis) exit water for 10 days getting lower value of effectiveness. It isan experimental model which is anew introductory practical for our heat and mass transfer lab.

Keywords: Shell and Copper tube, LMTD, Fouling Factor etc.

1. INTRODUCTION

A heat exchanger is thermodynamic equipment which transfers the energy from hot fluid to a cold fluid with a maximum rate and a minimum cost .They are commonly used in practice in a wide range of application,from heating and air conditioning systems in a household,to chemical processing and power production in large plants.

Heat transfer in a heat exchanger usually involves convection in each fluid and conduction through the wall separating the two fluids in the analysis of heat exchanger it is convenient to work with overall heat transfer coefficient “U”.

We have used shell and tube type heat exchanger because this is the most widespread and commonly used basic heat exchanger in the process industries it provides a comparatively large ratio of heat transfer area to volume and weight,it provides this surface in a form which is relatively easy to construct in awide range of sizes.In our setup both flows can be performed and can be compared.

Better concurrence can be reasonably easily cleaned and those components like tubes can be replaced examples are intercooler, condenser and regenerator.

2. LITERATURE REVIEW

EBIETO,C.E AND EKE G.B, “Performance analysis of shell and tube type heat exchanger .A case study on journal of emerging trends and applied science,2012 (5) PP 899-903.

Indian standard (IS:4503-1967):Specification for shell and tube type heat exchanger

BIS 2007 NEW DELHI:"SHELL side numerical analysis of a shell and tube heat exchanger considering several fluid flow.

R.K SINNOT COULSON &RICHARDSON "CHEMICAL ENGINEERING:Thermal analysis of shell side flow of shell and tube type heat exchangerusing theoretical and experimental methods.

A.O ADELJA S.J OJOLO and M.G SOBAMOWO:Heat transfer principle and thermal analysis with different materials vol.367 (2012trans tech publication Switzerland.

3. METHODOLOGY

Here we will compare the theoretical heat transfer rate with the actual heat transfer rate

- We will analyze the effect of different mass flow rate in heat exchanger.
- For this LMTD assumptions will be taken,number of tubes will be calculated.
- One time hot fluid will pass through the tube and coldfluid from outside this will be our first case.
- Second case will be reverse hot fluid will flow outside and cold fluid will flow inside,to know the effect of fouling by keeping tubes under RO exit water for 10 days
- By comparingboth cases we can say in which case heat transfer will be better practically and our study can be done.

PARAMETER	VALUE
shell diameter	75 mm
shell Length	100cm
Tube diameter	10mm
Tube effective length	9.6mm
Mass flow rate of hot fluid	.033 Kg/sec
Mass flow rate of cold fluid	.018 Kg/sec
Temperature of hot fluidat inlet	54°C
Temperature of cold fluid at inlet	29°C
Temperature of hot fluid at outlet	45°C
Temperature of cold fluid at outlet	40°C
Overall heat transfer coefficient "U"	850-1170 W/m^2 °C
Temperature of hot fluid at outlet considering fouling	47°C
Temperature of cold fluid at outlet considering fouling	38°C

Table1: counter flow heat exchange

PARAMETER	VALUE
Mass flow rate of hot fluid	.0330 Kg/sec
Mass flow rate of cold fluid	.0191
Temperature of hot fluid at inlet	55°C

Temperature of cold fluid at inlet	27°C
Temperature of hot fluid at outlet	45°C
Temperature of cold fluid at outlet	36C
Temperature of hot fluid at outlet considering fouling	48°C
Temperature of cold fluid at outlet considering fouling	34°C

Table 2: Parallel flow heat exchange

CONCLUSION

In this type of heat exchanger one of fluid flows through a bundle of tubes enclosed by shell this type of equipment used in chemical processes and process industries. By performing this experiment on live working model we came to know practical analysis of a heat exchanger can be performed with anexperimental model role of steady state and flow of fluid in two different flows.A practical data which proves that counter flow is better than parallel flow if mass flow rates are kept approximately equal.An effect on fouling can be observed by keeping tubes under RO exit water for 10 days getting lower value of effectiveness.It is anexperimental model which is anew introductory practical for our heat and mass transfer lab.

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