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Performance Evaluation of Double Pipe Heat Exchanger by using Nano Fluid

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Abstract: *Heat exchangers have extensive applications across various industries for cooling purposes or heat recovery. The current project involves making model parallel and counter flow heat exchangers to analyse the performance of the Parallel and Counter Flow Heat Exchanger under varying temperature conditions of water and Nano fluid (Al_2O_3), consisting of water and different volume concentrations. (1%, 3.75% and 5.65%) fluid and temperature to temperature by researching various papers. Additionally, we have computed LMTD and effectiveness by adjusting the flow rate and temperature of hot water and cold fluid. The project involves comparing the performance of parallel and counter flow heat exchangers, and evaluating their performance under different operating conditions.*

Keywords: Heat Exchanger, Nano Fluid, LMTD.

I. INTRODUCTION

Heat exchangers are built to exchange heat between two fluids with varying temperatures that are separated by a solid wall. The transfer of heat is facilitated by the temperature gradient or the difference in temperature. Three main mechanisms enable the transfer of heat: radiation, conduction,and convection. Although radiation plays a role in the use of heat exchangers, its contribution is not significant in comparison to conduction and convection. Conduction occurs when heat from the higher temperature fluid passes through the solid wall. In this we have used Nano Fluid(Al_2O_3) wit volume concentration (1%,3.75%, 5.65%)

II. PROBLEM STATEMENT

"Examine the efficacy and efficiency of employing nanofluid in a dual-tube heat exchanger, with the objective of assessing its effects on heat transfer rates and the overall performance of the system.".

III. LITERATURE REVIEW

Heat pump performance enhancement by using a nanofluids (experimental study) Zaid A. Shaalan, Ayad S. Abedalh, Mustafa W. Hamadall (2021) The findings of the investigation demonstrated that substituting traditional pure water with 0.5% CuO in the heat pump condenser led to noteworthy outcomes

[**2**]. Performance evaluation of Al2O3 nanofluid as an enhanced heat transfer Seungro Lee

The experimental results revealed that the introduction of Al2O3 nanofluids had a significant impact on the system performance. Notably, the utilization of these nanofluids led to a considerable rise of around 13% in pressure drop, primarily due to their higher viscosity. Conversely, the heat transfer coefficient experienced a notable increase of approximately 19% as the volumetric concentration of nanofluids increased, attributed to their enhanced thermal conductivity

[**3**] An updated review of nanofuids in various heat transfer devices Eric C. Okonk

The objective of this review is to provide readers with up-to-date information on the latest advancements in nanofluids and their potential as an advanced heat transfer fluid. Furthermore, the review aims to discuss the future prospects of nanofluids. The review concludes by presenting the advantages and disadvantages of nanofluids and proposes future research directions to support their widespread commercialization.

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IV. METHODOLOGY

Study Properties and Application of Nano Fluid(Al_2O_3)
Properties Thermal Conductivity Specific Resistivity Viscosity and its Usage in heat exchanger for industrial Purpose

Market Survey and Collection Of Nano Fluid (Al_2O_3)
Searched for nano fluid Al_2O_3 different volume concentration and collected it (1%, 3.75%, 5.65%)

Completion Of Setup
Firstly done the market survey for components required for setup and collected and assembled in setup(Pump, Flow meter, Temperature Indicator, Tank and Thermocouple

Readings and Calculation
Taken readings of different volume concentration at different flow rates and Calculated heat transfer rate

Result and Conclusion
After all readings and calculation higher the volume concentration i.e. 5.65% higher heat transfer rate

V. PROJECT DESIGN

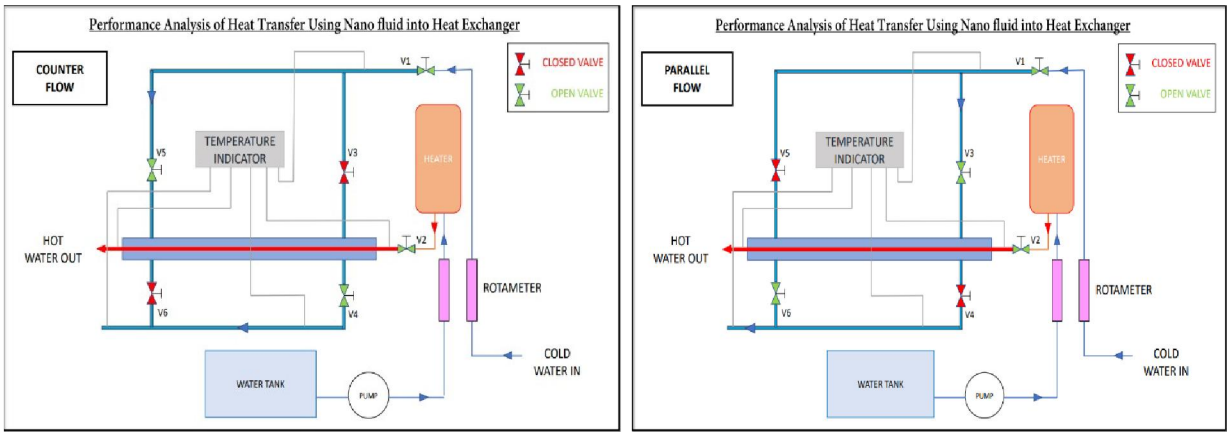

Figure 1: Parallel And Counter flow Arrangement

VI. WORKING

The equipment comprises of a concentric tube heat exchanger with a tube in tube structure. The inner tube is used to carry the hot fluid, which is hot water from an electric geyser, while the annulus is used to carry the cold fluid, which is cold water. The flow rate of the hot water is regulated by valves, and it always flows in onedirection. The cold water can be introduced at either end of the exchanger, allowing It to operate in a parallel or counter-flow configuration, depending on the valve setting. This process is illustrated in the figure.

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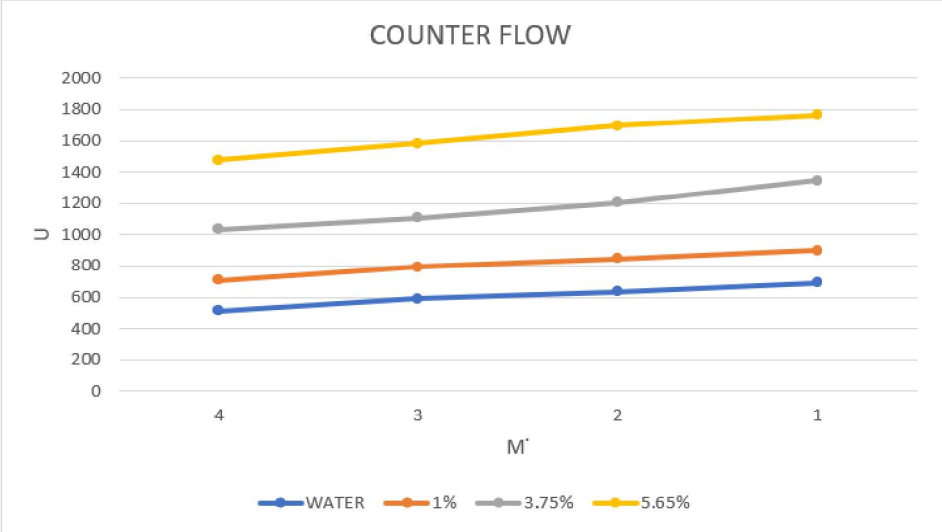
VII. RESULT



	4	3	2	1
2	550	590	621	680
3	710.98	780.11	828.82	870.61
4	937.36	1011.2	1105.1	1190.6
5	1115.6	1210.11	1312.3	1401.63

DESCRIPTION - Above Graph is of Mass flow Rate and heat transfer rate in which there are water readings as well as nano Fluid Readings with different volume concentrations. As we can see heat transfer rate for water is minimum as compared to Nano Fluid readings And this graph tells us that Higher the volume concentration higher will be the heat transfer rate

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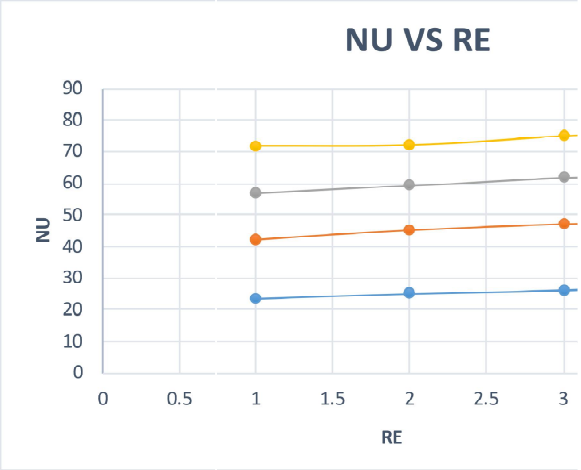

RE	WATER NU	1% NU	3.75%NU	5.65% NU
1	23.71	25.16	26.2	27.72
2	42.14	45.17	47.18	48.16
3	57.1	59.44	61.81	62.55
4	71.88	72.13	74.91	77.63

DESCRIPTION - The above graph is of Reynolds number to Nusselt number according to graph as we can see there is minor difference in Nusselt number but it also indicated as Reynolds number increases Nusselt number also increases and it is maximum at higher Reynolds no and higher volume concentration

VIII. CONCLUSION

- Counter flow arrangement has higher heat transfer rate as compared to Parallel flow arrangement
- Nano Fluid al2o3 results in reduction in operating temperature
- Higher volume concentration Al2o3 i.e. (5%) higher heat transfer rate

IX. FUTURE SCOPE

- Nanofluid Concentration Optimization: Further investigation can be conducted to determine the optimal nanofluid concentration that maximizes heat transfer efficiency while minimizing pressure drop.
- Exploration of Alternative Nanoparticles: Research the performance of the double pipe heat exchanger using different types of nanoparticles to analyse their impact on heat transfer characteristics and overall system performance.

REFERENCES

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