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Heat Transfer and Friction Factor Characteristics of Heat Exchanger using Aluminium Oxide and Titanium Oxide

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Abstract A heat flow and fluid flow investigation of double tube heat exchanger by means of warped tape insert under the mixing water based nano fluids. In this article Aluminium oxide and Titanium oxide was used to get better performance heat exchanging device. A different mass flow rate of fluids used to conduct the experiment and gathered various surface temperature for analyses the heat flow augmentation. A heat flow rate Nano fluids 10 to 12% was enhanced compare with the plain base water. A heat flow with liquid flow Aluminum oxide was enhanced with +8% compare with the plain base water. A heat transfer characteristics titanium oxide were augment with raise of Re and 12% was augmented compare with the plain water. However heat flow and liquid flow heat exchanging device was increasing with volume of Nano fluids increased and leading to friction factor.

***Keywords* : Titanium oxide, Aluminium oxide, Heat flow rate, Nano fluid, factor**

I. INTRODUCTION

Many industries to develop performance with heat exchanging device is utilized many techniques. One commonly used method is passive techniques, because this method is very simple heat transfer enhancement techniques. Ayub et al [1] was examined that heat flow uniqueness inserts horizontal pipe. Zimparov [2] was investigating warped strip insert with heat flow analyses grouping three create spirally ridged tube. Rahimia et al [3] has been observed that experimental with CFD examination of characteristics with warped. Saha [4] has been investigating experimental pressure fall individuality laminar built-in by means of frequently spaced warped strip inserts. Ray [5] have been examined experimental analysis heat flow with fluid analysis through a open area duct by means of inserts. Manglik [6] examined heat flow and distinctiveness of force go down of isothermal pipe. Jaisankar [7] was deliberate about the analysis on planetary water system fixed by means of warped strip inserts. Thianpong [8] calculated the enhancement heat flow characteristics in round pipe fixed by means of warped strip inserts. Wongwises [9] has been discussed with heat transfer augmentation by means of TiO2 and water based nano fluids through warped strip inserts counter exchanger. Zamzamian et al [10] observed heat convey improvement with warped strip inserts along by means of nanofluid mixing Al2O3 based on water. Sivakumar et al [11] results revealed heat flow and friction characteristics the double tube heat exchanging by means of triangular cut warped strip inserts.

II. EXPERIMENTAL INVESTIGATION

The experiment was conducted circular tube fitted by means of warped strip inserts. A test section heat exchanger protect from the atmosphere to improve heat move as of boiling fluid to cool fluid. It comprises two tubes with external and internal tubes. The internal tubes made up of Aluminium material by means of interior and surface diameters are 20mm & 18mm correspondingly. An external tubes made up of CI material with inner and outer diameters 27mm and 37mm respectively. The experimental was conducted with plain water and Nano fluids of Aluminium oxide and titanium oxide. A temperature dimension classification creek and exit of the interior and surface tube in that order. The hot stream stream from side to side the inside tube and nano fluid. every flow round comprise a impel by means of flow indicator, tank get around control device to continue the compulsory flow rate.

Fig1 Exp. arrangement of heat exchanger

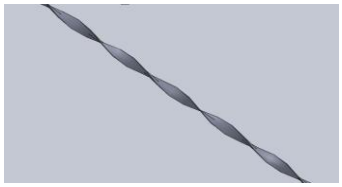

Fig 2 PTT model

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Performance of heat transfer was calculated below

Heat transfer $Q = h A [T_2 - T_1]$

$Nu = h D / K$

$Re = UD/ v$

III. RESULT AND DISCUSSION

An experimental statistics was collected as of double tube heat exchanging device by means of plain twisted tape insert with different nano fluids was used to calculate heat remove and resistance characteristics. A Reynolds various from 110000 - 140000 by means of dimension method. Fig 3 explain the assessment of Re and Nu with Aluminium oxide and Titanium oxide was used to analyses heat rate and Nu. It will be make out the Nu of Aluminium oxide and Titanium oxide was increases through augment the Re and enhanced compare with the plain water used. The Nu was augmented with 6 to 9% Nusselt enhanced compare with base water. As figure 4 was examined the experimental data heat flow rate with Re, a results revealed that Reynolds increases simultaneously heat transfer rate also increased as exposed figure. heat flow rate Aluminium oxide and titanium oxide was augmented with 10 to 12 % compare than the plain water. Because due to the concentration of nano fluids was very high compared to the water, that is the reason nano fluids heat transfer rate enhanced than the pure water.In addition that while inserting the twisted tape supplementary contact region involving fluid with surface wall. An induced generates the swirl flow motion between the wall and fluid. The assessment of the Re with heat flow coefficient as exposed in fig 5. The heat rate was augmented through increase Re and velocity of fluid increases, the heat coefficient also enlarged. The heat flow coefficient Nano fluids was augmented 1.2 to 1.47 times compare that than the pure water. It was understandable the thin ratio give way the more heat coefficient and gives superior values pure water. A variation analysis Re and friction characteristics of Nano fluids as indicated in figure 6. The friction factor value decreases by way of augment of Re and advanced Reynolds number gives lower friction factor. A lower Reynolds number gives the higher friction factor. It will be experimental friction were diminish through 1.34 to 0.79 times PTT inserts with pure water.

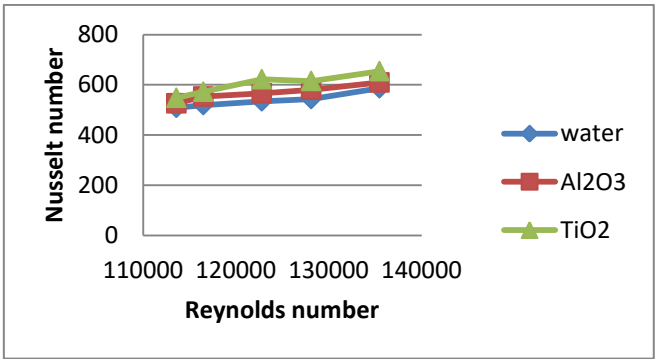

Figure 3 shown the evaluation of Re and Nu

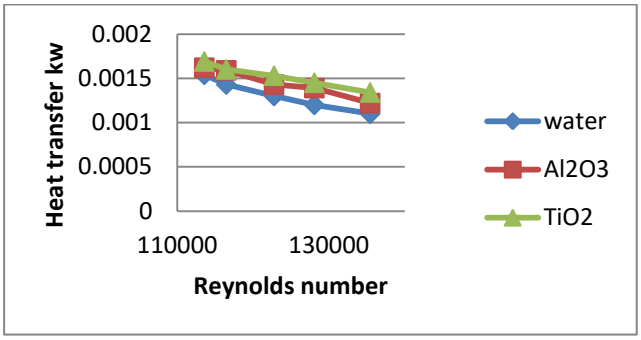

Figure 4 deviation of Re with Q

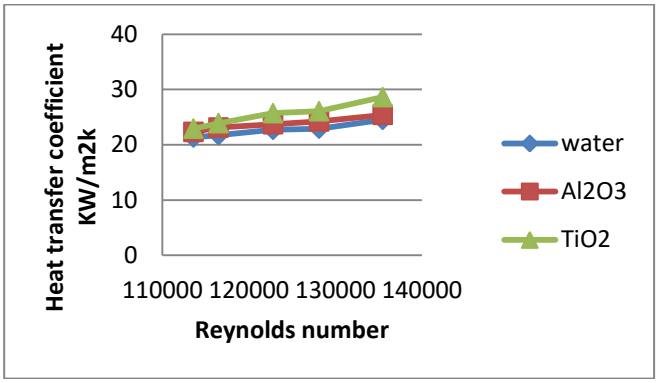

Fig 5 Analysis of Re with h

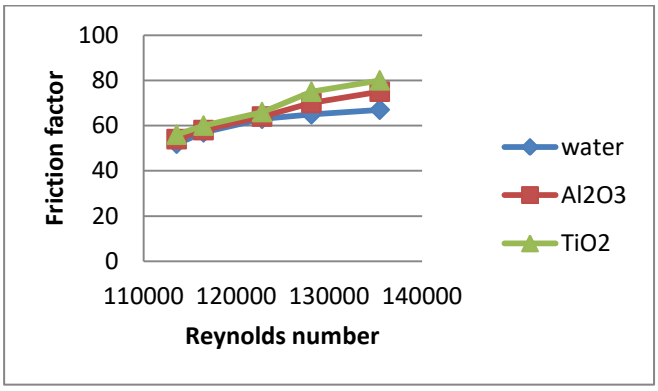

Figure 6 Relation between the Re with f

IV. CONCLUSION

As experimental results of the heat exchanger with pure water and Nano fluids was conducted and gathered the experimental data; theses data were used to attain the presentation heat transfer by means inserts. Performances of heat exchanger are carried with heat flow rate, Nu and friction was considered. A heat flow rate of Al2O3 & Titanium oxide 10 to 12% was enhanced than the pure water. An experimental value the Nu was augmented by means of 7 to 10% was increased than that the pure water. The Nusselt number enhancement was due to the fluid mixing and contact area between the surface wall. A heat flow coefficient is augmented by means of 1.2 to 1.47% compare with the pure water, the reason due to the velocity of the flow between the fluids. However the heat transfer rate od Nano fluids was increased and augmented compare with the plain pure water under the normal Reynolds number variations with plain twisted tape inserts.

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