

Heat Transfer Characteristics of Double Pipe Heat Exchanger with Plain Twisted Tape Insert using Titanium Oxide



T.Mohankumar, K.Rajan, P.Naveenchandran, K.Sivakumar

Abstract: In an effort to improve efficiency of heat exchanging device by means of induced tape inserts using titanium oxide Nanofluids is provided. The experimental study evaluated the fluid flow and heat transfer features of the turbulent water-based Nanofluids with a concentration of 0.6 per cent. Titanium oxide of nanoparticles with a diameter of 25 nm was used in this job. The information showed that the nano-fluid heat flow coefficient was slightly greater with base water a comparable mass flow and comparable temperature. A heat flow coefficient nano fluid rises by means of augment flow rate and amount of Reynolds rises with an rise in the heat transfer coefficient. The experiment performed heat double pipe Data were produced with distinct mass flow rates for both water and nano liquids. The amount of Reynolds ranges from 110000 to 135460. The increase in heat transfer was boosted with an increase in the amount of Reynolds. The heat transfer rate was increased by 12 per cent of nano-liquids compared to simple water.

Keywords : Titanium oxide, Nanofluid, heat transfer, Friction factor

I. INTRODUCTION

Various technical methods, such as passive, active and compound techniques, has been used to augment heat flow by many industrial purpose. In addition, to develop efficiency of heat flow by inserting warped strip inserts. Bhandari [1] has been evaluated for the characterization of nano liquids with sophisticated heat transfer apps. Hwang KS [2] examined the assessment of the thermal transfer features with Al₂O₃ nano liquids under laminar flow conditions with a twisted tape insert. Sami et al.[3] researched the use of Quadrant warped strip inserts in the CFD heat transfer assessment. Amin[4] explored improvement by means of a rotary warped strip place in. Saha[5] are investing in a rotating twisted tape heat transfer enhancement insert. Salam[6] addressed the improvement of heat transfer using a warped strip insert. Bodius salam [7] researched thermal transfer using a rectangular warped strip insert. Warkhedkar[8] approached for heat transfer by means of Elliptical warped strip Inserts.

Choi J[9] was discussed with the numerical simulation of the thermal transfer features by means of water-based nano fluid in the return bend pipe. The outcome of the Wongeharee[10] thermal transfer improvement was achieved by the use of the copper oxide and fluid with twisted tape.. Hwang[11] calculated MWCNT nano fluids, copper oxide & silicon dioxide detached a number of heat transfer fluids, such as water, EG and mineral oil. Xie & Chen[12] proposed a typical two-step method for the preparation of EG nanofluids based on CNT, which incorporated disentangling of nanotube embarrassment through introduction practical assembly on the nano tube shell.

II. EXPERIMENTAL METHODS

A geometry design tube with a width (t) of 0.075 cm, distance end to end (L) of 200 cm was utilized for investigational examination. In heat exchanging device, the primary part of the heat transfer experiment is used, which is insulated to decrease heat losses in the vicinity. It comprises of two pipes in warm water flowing from side to side of the inner tube and cold water flowing through the exterior tube. A external tube is completed CI with an inside and an outside diameter of 27 mm and 37 mm correspondingly. The inside pipe is made of aluminum with 20 mm and 18 mm inside and outside diameters, correspondingly.

The experimental arrangement

Geysler
Indicator with pressure gauge
High temperature gauge
Display unit
Hot water line
Cold water line

The standard correlation of the PTT Nusselt number

$$Nu = 0.813 Re^{0.4656} \pi^{0.33} Y^{-0.3792}$$

Standard correlation of the PTT friction factor

$$f = 2.732 Re^{-0.4267} Y^{-0.4962}$$

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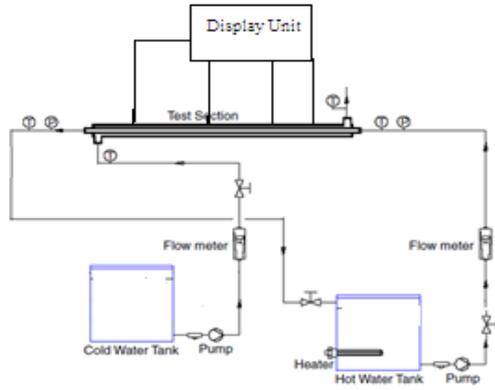


Figure 1 Experimental setup

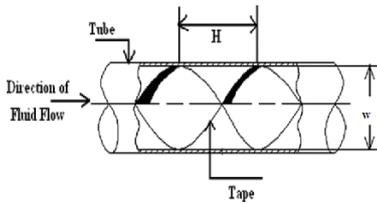


Figure 2 Twisted tapes

III. RESULT AND DISCUSSION

An experimental value of heat flow character of PTT with plain water was composed and these data then used to evaluate the experimental arrangement PTT, Nano fluid tape inserts and the range of Re 110000 to 135466 by capacity technique. evaluation of the amount of Reynolds and the amount of Nusselt experimental information is exposed in 3. Analyzed, Nu with Nano fluid inserts was given a higher value than the plain water insert. The amount of Nusselt increased with an rise in the amount of Reynolds. From an examination, the number of Nano fluids in Nusselt augment with an rise in the amount of Reynolds.

The ratio of Re and Nu with Al₂O₃ was better from 1.4 to 1.39 match up to plain water and error were originate the series of $\pm 4\%$ to $\pm 6\%$. Fig 4 setup distinction in the amount of Reynolds and the coefficient of heat transfer, at the sum Nano heat transfer fluid, is higher than before with an rise in the amount of Reynolds and provides higher values water insert. Because swirl generated through the warped strip, it was responsible for reduction heat boundary layer and widening the mixing between the core and the pipe wall streams; The value heat flow coefficient Nano fluid was augmented by 1.3 to 1.6 times improved than the plain water.

The fig 5 shows Analysis of Re & h, experimental results of consequence of Nano fluid disclosed that the amount of Reynolds increased with an rise in the speed of heat transfer. The Nano liquid thermal transfer speed is better at 20% compared to the conventional flat water insert in the double tube thermal exchanger. The increase in the heat transfer in the nano-liquid, due to the nano-particle, gives uniform motion to roughly the pipe. In order to increase the heat transfer rate, assess with the water fluid. The greater amount of Reynolds gives the highest rate of heat transfer.

The figure 6 analyse evaluation the Re and Friction. The friction value reduces with an rise in the amount of Reynolds. The nano fluid and the water of the friction factor give the highest value with the reduced Reynolds number, and the greater Reynolds number

provides the reduced friction factor as shown in the figure. The experimental value of nano liquids is better than the simple water used.

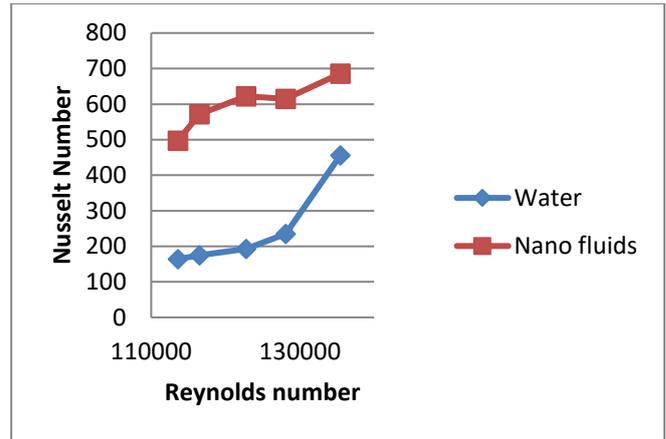


Figure 3 shows the Reynolds number and Nusselt number

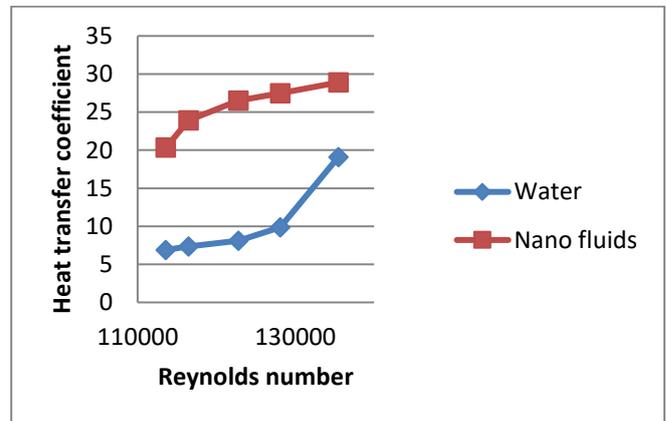


Figure 4 comparisons of the Re and heat transfer coefficient

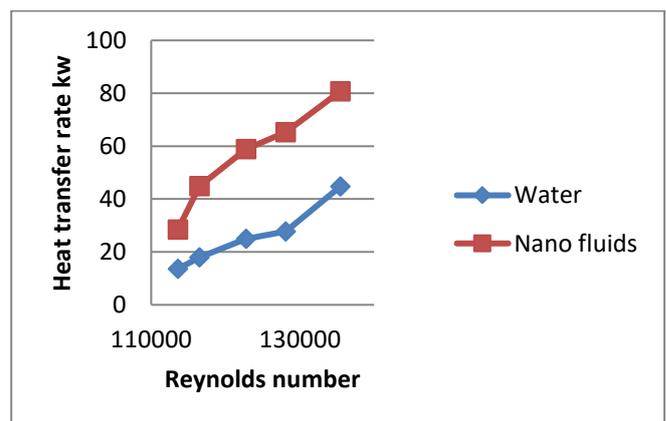


Figure 5 comparison of the Re and heat transfer

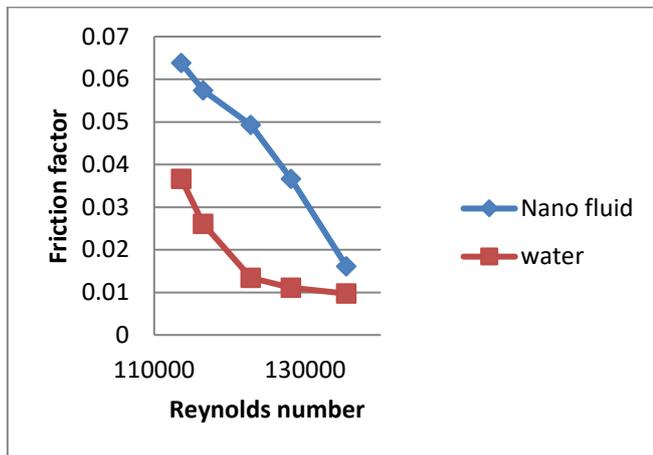


Figure 6 Re vs friction factor

IV. CONCLUSION

The experimental test was approved plain warped tape evaluate the heat transfer rate. The value Nu and heat flow rate for the nano-fluid plain twisted tape pipe were noticeably greater than the values PTT with water inserts. An impact of deliberation and the Re nano fluid heat transfer concert and flow behavior has been determined. Spreading nanoparticle addicted to the purify water improves the conductivity and viscosity nanofluid and reduces the concentration of the particles. The general coefficient of thermal nanofluid is 37% higher of air. As for the Nusselt number volume concentration is 545 and 354 for water, this resources the Nusselt nanofluid number is 42.6 per cent higher by water. From the above execution, the experimental result of the nano fluid with a warped strip insert gives utmost effect of heat flow of the base fluid of the water.

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