IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

EXPERMENTAL ANALYSIS OF TUBE IN TUBE TYPE HEAT EXCHANGER USING NANO FLUIDS

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Abstract: This paper investigates the enhancement of heat transfer coefficient of a nanofluid containing nanoparticles Al2O3 with a particle size of 20 nm. Effects of temperature and concentration of nanoparticles on heat transfer coefficient in a tube in tube type heat exchanger with parallel and counter flow are investigated. Experimental results show a considerable increase in heat transfer coefficient. Also, it has been observed that the heat transfer coefficient increases for counter flow as compare to parallel flow.

***Index Terms* - Heat exchanger, nanofluids, heat transfer coefficient.**

I. Introduction

Fluids have been applied in the cooling in the most important industries including microelectronics, manufacturing, metrology, etc. With increasing thermal loads that require advances in cooling the new higher power output devices with faster speeds and smaller feature, the conventional heat transfer fluids, such as water, engine oil, ethylene glycol, etc., demonstrate the relative low heat transfer performance. The use of solid particles as an additive suspended in the base fluid is a potential alternative technique for the heat transfer enhancement, i.e. thermal conductivity of metallic or nonmetallic solids might have two orders of magnitude higher than the conventional fluids.

Modern nanotechnology can produce materials with average particle sizes below 50 nm. All solid nanoparticles with high thermal conductivity can be used as additives of Nano fluids. These nanoparticles that have been usually used in the Nano fluids include: metallic particles (Cu, AL, Fe, Au, Ag, etc.) and nonmetallic particles (Al2O3, Cu, Fe3O4, TiO2, Sic, carbon nanotube, etc.).The base media of Nano fluids are usually water, oil, acetone, decent, ethylene glycol, etc. A 40% increase in thermal conductivity was found in the Cu oil-based Nano fluids with 0.3% volume concentration, while the Al2O3 water-based Nano fluids exhibited a 29% enhancement of thermal conductivity for the 5% volume concentration Nano fluids .

Nano fluids are a new class of solid-liquid composite materials consisting of solid nanoparticles, with sizes typically in the order of 1 - 100 nm, suspending in a heat transfer liquid. Nano fluids are expected to have superior properties compared to conventional heat transfer fluids. The much larger relative surface area of nanoparticles should not only significantly improve heat transfer capabilities, but also increase the stability of the suspensions. In addition, Nano fluids can improve abrasion-related properties as compared to the conventional solid/fluid mixtures. Successful applications of Nano fluids would support the current trend toward component miniaturization by enabling the design of smaller but higher-power heat exchanger systems. The thermal properties including thermal conductivity, viscosity, and surface tension have been investigated.

II. Selection of Nano Particle

2.1 Al2O3:-

Nano fluids are dilute liquid suspended Nano particles which have only one critical dimension smaller than~100nm. Much research work has been made in the past decade to this new type of material because of its high rated properties and behavior associated with heat transfer, mass transfer . The thermal behavior of Nano fluids could provide abases for an huge innovation for heat transfer, which is a major importance to number of industrial sectors including transportation, power generation, micro manufacturing, thermal therapy for cancer treatment, chemical and metallurgical sectors, as well as heating, cooling, ventilation and air- conditioning. Nano fluids are also important for the production of Nano structured materials , for the engineering of complex fluids , as well as for cleaning oil from surfaces due to their excellent wetting and spreading behavior

Al2O3 is the most commonly and widely used Nano particle by many researchers during their experimental works. Efforts have been made to study the thermal conductivity of Nano fluids. Usually, thermal conductivity of the Nano fluids increases with increasing fraction in volume of Nano particles; with decreasing particle size, the shape of such particles can also influence the thermal conductivity temperature of Nano fluids, Brownian motion of the particle, and with the additives.

2.2 Preparation of nanofluid

Two-step preparation process is used in the synthesis of Nano fluids by mixing base fluids with Al2O3 Nano powders obtained from different mechanical, physical and chemical routes such as milling, grinding, and sol-gel and vapor phase methods. The size of nano particles is 10-20nm and purity is 99.9%.. An ultrasonic vibrator is used to stir Nano powders with host fluid. Two samples are created, one with 2% of nano particles and second with 4% of nano particles.

Fig.2.1 Ultrasonic vibrator

3.3 **Experimental setup-**

The tube in tube type heat exchanger is used for experimentation as shown in figure. The hot water is flowing inside the tube and cold water is flowing outside the tube. Different sensors are used to measure the inlet and outlet temperatures of cold and waters.

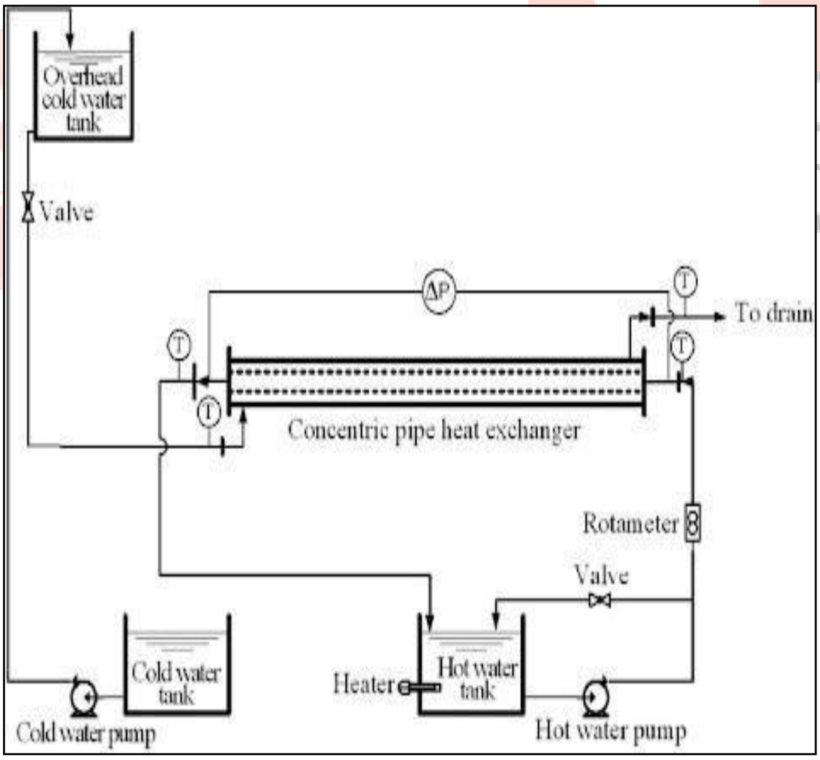

Fig. 2.2 Experimental set-up

III. RESULTS AND DISCUSSION

3.1 Parallel Flow Heat Exchanger

Table 3.1: Results of parallel flow heat exchanger

Sr. No	Parameter	Heat Transfer Rate
1	By conventional Fluids	2.3051 watts
2	By Using Nano Fluids a) 2% Concentration	2.7718 watts
	b) 4% Concentration	3.0681 watts

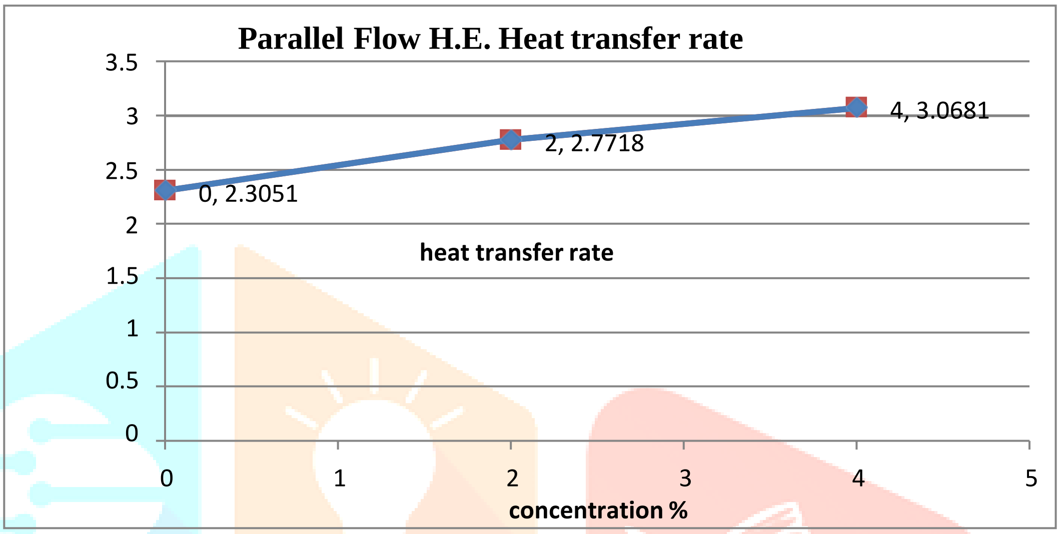

Fig. 3.1 Graph of Parallel flow heat transfer Vs. nanofluids

For Parallel flow heat exchanger without using nanofluids the heat transfer rate is 2.3051 watts. Using Nanofluids with 2% concentration the heat transfer rate is 2.7718 watts. Using nanofluids with 4% concentration the heat transfer rate is 3.0681 watts

3.2 Counter Flow Heat Exchanger

Table 3.1: Results of counter flow heat exchanger

Sr. No.	Parameter	Heat Transfer Rate
1	By conventional Fluids	2.9635watts
2	By Using Nano Fluids a) 2% Concentration	3.0457 watts
3	b) 4% Concentration	3.1078 watts

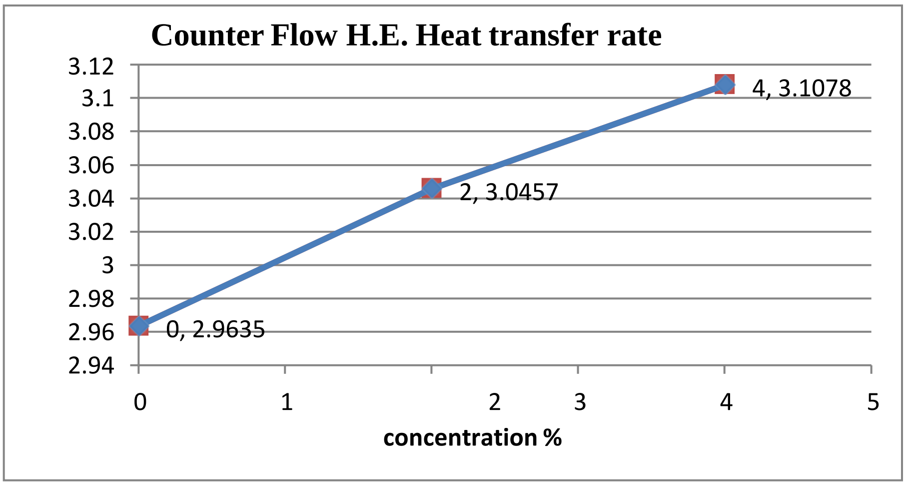

Fig. 3.2 Graph of Counter flow heat transfer Vs. nanofluids

For counter flow heat exchanger without using nanofluids the heat transfer rate is 2.9635 watts. Using nanofluids with 2% concentration, the heat transfer rate is 3.0457 watts. Using nanofluids with 4% concentration, the heat transfer rate is 3.1078 watts

From above, we can conclude that as concentration of nanofluids increased, the heat transfer rate and effectiveness also increased.

IV. CONCLUSION

For Parallel flow heat exchanger without using nanofluids the heat transfer rate is 2.3051 watts. In same fluid if nanoparticles added then heat transfer coefficient is increases. Heat transfer increases with increase in percentage of nanoparticles increases. For counter flow heat exchanger without using nanofluids the heat transfer rate is 2.9635 watts. In counter flow in nano particles are added then similar to parallel flow heat transfer rate is also increases.

From above, we can conclude that as concentration of nanofluids increased, the heat transfer rate and effectiveness also increased. Heat transfer rate is higher in counter flow as compared to parallel flow.

References

[1] Nandy Putra, Wilfried Roetzel, Sarite K. Das "Natural convection of Nano fluids". Heat and Mass transfer 39(2003) 772-784

[2] S. lee, S.U.S. Choi, S.li, J.A. Eastman, "Measuring Thermal Conductivity of Fluids containing oxide Nano particle" journal of heat transfer may1999 281-289

[3] Stephan U.S. Choi And Jeffrey A. Eastman "Enhancing Thermal Conductivity of Fluids with Nano particles" Energy technology division And material science division Argonne national Laboratory Argonne IL 60439 Oct 1995

[4] P.Sivashanmugum "Application of Nano fluids in heat transfer" CHP14 Intake 414- 440

[5] Sayantan Mukherjee, Somjeet Paria "Preparation And stability of Nano fluids" (Iosr- Jmce) volume9, issue2, Oct 2013 63-69

[6] Edieto, C.E. and Eke G.B. "performance analysis of shell and tube heat exchanger a case study" Journal of emerging trands in Engineering and applied sciences (JETEAS)3(5) :899 903

[7] Prof. Alpesh Mehta1*, Dinesh k Tantia , Nilesh M Jha , Nimit M Patel "heat exchanger using Nano fluid" International Journal of Advanced Engineering Technology

[8] Abbass A. hashim "smart nanoparticles technology" Janeza Trdine 9, 51000 Rijeka, Croatia

[9] Satoshi Horikoshi and Nick Serpone "Introduction to Nanoparticles" Microwaves in Nanoparticle Synthesis, First Edition.