International Research Journal of Commerce and Law
Volume 5 Issue 10, October 2018 ISSN: 2349-705X Impact Factor: 4.616
Journal Homepage: http://ijmr.net.in, Email: irjmss@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal

A Bird view on Heat Transfer Enhancement in a Tube with Twisted Tape Insert

Prof. Karande Anurag Vishnupant Prof. Shitole Jagdish Sudhakar Prof. Valkunde Bapurao Rajaram Prof. Sodal Jeevankumar Anil

Dattakala Shikshan Sanstha "Dattakala Group of Institution" Swami-Chincholi, Daund, Pune, Maharashtra 413130. India.

Abstract **-**Different kinds of methods used to enhance heat transfer rate of heat exchanger without influencing overall performance of the heat exchanger referred as heat transfer enhancement techniques. This technique are categorized into three types i.e. active technique, passive technique, and compound technique Some of the application of heat exchanger which require enhancement in heat transfer are– Air conditioning equipments, radiators, refrigerators, thermal Power plants etc. The intention of enhanced heat transfer is to encourage high heat fluxes, this result in reduction in size of heat exchanger. The present paper is a review of research work in last decade onheat transfer enhancement in a Heat Exchanger.

Keywords:-*Heattransferenhancement,passivemethod,twistedtape,heattransfercoefficient*

*****

I. NTRODUCTION

At the present days, twisted-tape has been generally appliedfor enhancing the convective heat transfer in distinct industries, because of their effectiveness, low cost , Energy and material savingconsideration, aswell aseconomical,have led to produce more efficient heat-exchanger equipment. Therefore, theconservation ofthermal energyleadstopossible the economical handling of thermal energy through heat- exchanger. Theheat transfer techniques permitheat exchanger to operate at smaller velocity, but still accomplish the same or even higher coefficient of heat transfer. This means that a Decrementin pressuredrop withrespect toless operatingcost.

II. METHODSOFHEATTRANSFER ENHANCEMENT

Generally, heattransfer enhancementmethodsareclassifiedin three methods:

A] Activemethod: -Inthismethod,someexternalpowerinput used for the enhancement in heat

transfer. Examples of active methods are induced pulsation by cams and reciprocating plungers,, use of a magnetic field to disturb and seeded light tiny pieces in a flow, etc.

B] Passive method: - In these cases, external power is used to help the desired surface or geometrical modification and the improvement in the rate of heat transfer. For example, use of inserts, use of rough surfaces etc.

C] Compound method: - When any two or more techniquesare employed together to obtain enhancement in heat transfer that is greater than that produced by any one of them when usedindividuallyistermedascompoundenhancement.This technique included complex design and it has finite applications.

III. TWISTEDTAPE

To increasetherateof heat transfer, in theflowpassages some kind of insert is placed and they also reduce its hydraulic diameter. Heat transfer enhancement leads to flow blockages, partitioning of the flow and secondary flow. Flow blockages enhance the pressure drop and leads to viscous effects,because of a reduced free flow area. The selection of the twisted tape depends on performance and cost. Therefore this paper concentrates on the review of enhancing heat exchanger performance bytwisted tape, Fig1 shows geometryof twisted tape.

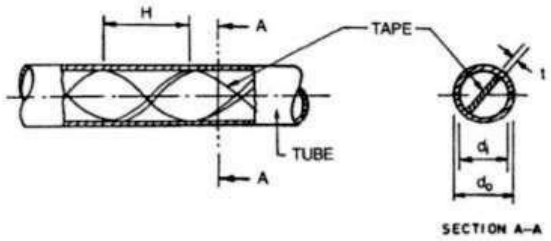

Figure 1. Schematic view of twisted-tape insert inside a tube

A literature review on heat transfer enhancement in laminar flow and turbulent flow using twisted tape is explained in following sections.

A] Twistedtapeinsertinlaminar flow-

Saha, S. K.andDutta,Saha(2001),S.K.andBhunia K(2000) Studied experimental data on a twisted tape generated laminar swirl flow friction factor and Nusselt number for a large Prandtl number (205- 518) and they observed that, If pumping power is constant then short-length twisted tape is a selected becauseinthiscaseswirlgeneratedbythetwistedtape

breaking downstream slowly which cause increases in the coefficient of heat transfer with minimum pressure drop, compared with a full-length twisted tape [1, 2, 3]. Suresh Kumar, P., Mahanta, P. and Dewan (2003) studied the thermo hydraulic twisted tape performance. The thermo hydraulic performance in laminar Flow with a twisted tape is better than the wire coil for

the same helix angle and thickness ratio [4]. Ray S. and Date A. W. (2003) studied a correlation for the Nusselt number and friction factor for a square duct from the forecasted data. Theycompared the correlation for the friction factor with experimental data and the deviation was found within +10 % [5]. Anil Yadav(2009) studiedinfluences ofthe half length twisted tape insertion on heat transfer & pressure drop characteristics in a U-bend double pipe heat exchanger, experimentally. The results obtained from theheat exchangers with twisted tape insert are compared with those without twistedtapei.e.Plainheatexchanger.Theexperimentalresults revealed that the increase in heat transfer rate of the twisted- tape inserts is found to be strongly influenced by tape-induced swirl or vortex motion. The heat transfer coefficient is foundto increase by 40% with half-length twisted tape inserts when compared with plain heat exchanger. It was found that on the basis of equal mass flowrate, theheat transfer performance of half-lengthtwisted tapeisbetter than plainheatexchanger[6].

P. Bharadwaj, A. D. Khondge, A. W. Date(2009) experimentally Studied pressure drop and heat transfer Characteristics of flow of water in a 75-start spirally grooved tubewith twistedtape.Thegrooves areclockwisewith respect to the direction of flow. Range of Reynolds numbers havebeen considered from Laminar to fully turbulent. The heat transfer enhancementduetospiralgroovesisfurther increased by inserting twisted tapes having twist ratios are

Y=10.15,7.95&3.4----------[7].

K. N. Sheeba, S. Jaisankar, and T. K. Radhakrishanan (2009) studied of friction factor, heat transfer and thermal performance of thermosyphon solar water heater system fitted with helical twisted tape having different twist ratios and Conclusions made from the results show that heat transfer enhancement in twisted tape collector is higher than the plain tube collector with minimum twist ratio and gradually decreases with increase in twist ratio [8].

B] Twistedtapeinsertinturbulent flow-

K. V. Sharma, L. Syam Sunder, P. K. Sharma (2009) Studied heat transfer coefficient and friction factor for transition range offlowwith Al203nanofluidina tube withtwisted tape.The results show that compared to flow with water, convectiveheat transfer has been enhanced with Al203 nanofluids [9].

S. Eiamsa-ard, K. Wongcharee, P. Eiamsa-ard, c. Thianpong (2009) Studied flow friction , heat transfer and thermal performance factor characteristics in a tube fitted with delta- winglet twisted tape, Influences of the oblique delta-winglet twistedtape(0-OWT)andstraightdelta-winglettwistedtape
(S-OWT)arrangementsarealsodescribed.Theexperiments

are carryout usingthetapes with three depth ofwing cutratios (DR = dlw = 0.11, 0.21 and 0.32) and three twist ratios (ylw = 3, 4 and 5) over a wider range of Reynolds number (3000- 27,000). The obtained results show that mean Nusselt number and mean friction factor in the tube with the

delta-winglet twisted tape increase with decreasing twisted ratio (y/w) and increasingdepth ofwingcutratio(DR) [10]. S.Eiamsa-ard,P. Eiamsa-ard, C. Thianpong (2009) Studied evaluation ofEffects of twin-counter/co-twisted tapes on friction factor (f), heat transfer rate (Nu), and thermal enhancement index (7). The tests are carried out using the co-twisted tapes and co- twisted tapes with four differenttwistratios y/w= 2.5, 3.0, 3.5 & 4.0 for range of Reynolds numbers between 3700 and 21,000. The twin co-twisted tapes are used as coswirl flow generators while twin counter twisted tapes (CTs) are used as counter-swirl flow generators [11]. C. Thianpong, S. Eiamsa- ard, P. Eiamsa-ard (2009) were Studied heat transfer and friction characteristics for water, ethylene glycol, and ISO VG46 turbine oil flowing inside four tubes with three- dimensional internal extended surfaces and copper continuous or segmented twisted-tape inserts. During the experiments, Prandtl numbers ranged from 5.5 to 590 and Reynoldsnumbers from 80 to 50,000. The experimental results showthat this compound enhanced heat transfer technique, a tube with three-dimensional internal extended surfacesandtwisted- tape inserts, is of particular advantage to enhance the convective heat transfer for the laminar tube side flow of highly viscous fluid [12].

IV. CONCLUSION

This paper describes the influence of various type of Twisted tape used to enhances the performance of heat exchanger. A twisted tape insert mixes the flow and efficiently performs better in laminar flow, because in laminar flow the infinite thermal resistant to a thin region. The result also shows twisted tape is better for heat transfer enhancement,Up to certain Reynolds number range, Twisted tape in turbulent flow is enhance heat transfer. It is also shown that twisted tape is ineffective in turbulent flow, because it blocks the flow and so pressure drop has been increases. Hence the thermo hydraulic performance of a twisted tape isdoesn't wellinturbulentflow.For theapplicationofheat transfer enhancement in heat exchanger networks these conclusions are very useful

REFERENCES

[1] Saha, S. K. and Dutta "A Thermo-hydraulic study oflaminar swirl flow through a circular tube fitted withtwisted tapes." Trans. ASME, J. Heat Transfer, **2001**, 123,417-421.

[2] Saha, S. K. and Bhunia,K."Heat transferandpressuredrop characteristics of varying pitch twisted-tape-generated laminar smooth swirl flow." In Proceedings of 4th ISHMTASME Heat and Mass Transfer Conference, India, **2000**, 423-428.

[3] Saha, S. K., Dutta, A. and Dhal, S. K. "Friction and heat transfer characteristics of laminar swirl flow through a circular tube fitted with regularly spaced twisted-tape,"2014

[4] Suresh Kumar, P., Mahanta, P. and Dewan, "A Study of laminar flow in a large diameter annulus with twisted tape inserts."In Proceedings of 2nd InternationalConference on Heat Transfer, Fluid Mechanics, and Thermodynamics, Victoria Falls, Zambia, 2003, paper KP3.

[5] Ray, S. and Date, A. W. Friction and heat transfer characteristics of flow through square duct with twistedtape insert. Int. J. Heat andMass Transfer, 2003, 46, 889— 902

[6] Anil Yadav,"Effect of halflengthtwistedtapeturbulator on heattransfer&pressuredrop characteristicsinsideadouble pipe U-bend heat exchanger." Jordan journal of Mech. & industrial engg. 2009, 3, 1, 17-22.

[7] P. Bharadwaj, A. D. Khondge, A. W. Date, "Heat transfer& pressure drop in spirally grooved tube with twisted tape insert." J. Heat Transfer, 2009,52,5, 1938-1944.

[8] K. N. Sheeba& S. Jaisankar, T. K. Radhakrishanan , "Experimental studies on heat transfer & friction factor characteristics of forced circulation solar water heater system fitted with helical twisted tapes," , Communicatedby Associated Editor Brian Norton, 2009,

[9] K. V. Sharma, L. Syam Sunder, P. K. Sharma, "Estimation of heat transfer coefficient & friction factor in transitation flow with low volume concentration of AI203 Nano fluid flowing in a circular tube & with twisted tape."International Communications in Heat & Mass Transfer.2009, 36, 5, 503-507.

[10] S.Eiamsa-ard, K.Wongcharee, P.Eiamsa-ard, c.Thianpong "Heattransferenhancement usingdeltawinglettwistedtape inserts." Applied Thermal Engg. 2009, 30, 4, 310-3181,

[11] S. Eiamsa-ard, P. Eiamsa-ard, C. Thianpong, "Turbulent heat transfer enhancement bycounter/co-swirling flow in a tube fitted with twin twisted tape." Experimental thermal & fluid science, 2009, 34, 1, 53

[12] C. Thianpong, S. Eiamsa-ard, P. Eiamsa-ard, "Turbulent heat transfer enhancement bycounter/co-swirling flow in a tube fitted with twin twisted tape." Experimental thermal & fluid science, 2009, 34, 1, 53-62.