

Effect of Full Length Twisted Tape Inserts on Heat Transfer and Friction Factor Enhancement with Fe₃O₄ Magnetic Nanofluid inside a Plain Tube: An Experimental Study

L. Syam Sundar^a, N.T. Ravi Kumar^b, M.T. Naik^b, K.V. Sharma^{a, b}

^a Faculty of Mechanical Engineering, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia

^b Center for Energy Studies, J.N.T.U. College of Engineering, Kukatpally, Hyderabad 500085, India

ABSTRACT

Turbulent convective heat transfer and friction factor characteristics of magnetic Fe₃O₄ nanofluid flowing through a uniformly heated horizontal circular tube with and without twisted tape inserts are estimated experimentally. Experiments are conducted in the particle volume concentration range of $0 < \varphi < 0.6\%$, twisted tape inserts of twist ratio in the range of $0 < H/D < 15$ and Reynolds number range of $3000 < Re < 22000$. Heat transfer and friction factor enhancement of 0.6% volume concentration of Fe₃O₄ nanofluid in a plain tube with twisted tape insert of twist ratio $H/D = 5$ is 51.88% and 1.231 times compared to water flowing in a plain tube under same Reynolds number. Generalized regression equation is presented for the estimation of Nusselt number and friction factor for both water and Fe₃O₄ nanofluid in a plain tube and with twisted tape inserts under turbulent flow condition.

KEYWORDS: Fe₃O₄ nanofluid; Forced convection; Twisted tape insert; Heat transfer enhancement

DOI: [10.1016/j.ijheatmasstransfer.2012.02.040](https://doi.org/10.1016/j.ijheatmasstransfer.2012.02.040)