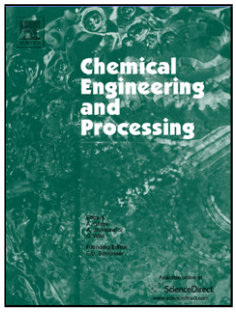

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<AT>Effect of non-uniform magnetic field on heat transfer of swirling ferrofluid flow inside tube with twisted tapes

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<ABS-Head><ABS-HEAD>Graphical abstract
<ABS-P>
<ABS-P><xps:span class="xps_Image">fx1</xps:span>
<ABS-HEAD>Highlights► In this work, the effect of magnetic field on ferrofluid in various flow situations is studied ► The results show an acceptable agreement with experimental data ► Investigations show that twisted tape can significantly increase the heat transfer rate of nanofluids ► Non-uniform magnetic field can increase the Nusselt Number of swirling nanofluid flow.

<ABS-HEAD>Abstract

<ABS-P>In this article, a three-dimensional numerical simulation is performed to investigate the effect of magnetic field on the heat transfer of ferrofluid inside a tube which is equipped with twisted tape. This work comprehensively focused on the flow feature and temperature distribution of ferrofluid in presence of non-uniform magnetic field while ferrofluid swirled inside a tube with twisted tape. In this study, it is assumed that the ferrofluid is single phase and laminar and constant heat flux is applied on the outside of the tube. The magnetic field is established by wire in parallel direction with the axis of the tube. The base fluid is water with 0.86 Vol% Nano particles (Fe_3O_4). The finite volume approach with the SIMPLEC algorithm is used for calculating the flow feature and heat transfer inside the tube. The numerical simulations are validated with experimental data with reasonable discrepancy. Parametric studies are performed to reveal the influence of various factors such as concentration of nanoparticle, intensity of magnetic field, geometric shape of twisted tape and Reynolds number on the heat transfer is investigated. According to obtained results, average Nusselt number of ferrofluid increases more than 200% as it flows inside tube with twisted tapes. Furthermore, our finding shows that magnetic field induced by parallel wire enhances the average heat transfer of the swirling ferrofluid (about 30 %). The results also show that the Nusselt number also rises as the concentration of the nanoparticle is increased. In addition, heat transfer augments in high Reynolds number.