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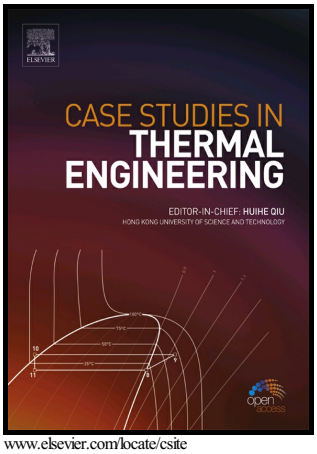

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Heat Transfer Phenomena on Waste Heat Recovery of Combustion Stack Gas with Deionized Water in Helical Coiled Heat Exchanger

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ABSTRACT

Theoretical and experimental studies on waste heat recovery of combustion stack gas and heat transfer phenomena of a fully developed laminar flow of deionized water in vertical helical coils were carried out with coil dimensions: tube diameter to coil diameter, $d_i/D = 0.04 - 0.06$ and pitch to coil diameter, $p/D = 0.1 - 0.25$. The calculation of heat transfer data was based on countercurrent flow LMTD method. The result showed that deionized water (DI-water) possessed better heat transfer than that of normal water. The effect of coil pitch, coil diameter, and coiled tube diameter on heat transfer phenomena of helical coils had been discussed and a new set of correlation of heat transfer data was created and it could be found that the results from the correlation agreed well with the experimental data. In addition, the overall heat transfer coefficient between the hot exhaust gas and the heat transfer fluid in the helical coil was also considered. Smaller tube diameter gave better overall heat transfer coefficient at low water-side Reynolds number and when the Reynolds number was over 3,500 the bigger tube diameter showed the advantage. Smaller coil diameter seemed to get better overall heat transfer coefficient at low water-side Reynolds number.

Keywords: Waste heat recovery, Helical coil, Heat transfer data, Deionized water

Nomenclature

LMTD	log-mean temperature difference
HTF	heat transfer fluid
d	coiled tube diameter
p	coil pitch
D	coil diameter
Re	Reynolds number
Pr	Prandtl number
Dn	Dean number, $Dn = Re(d/D)^{1/2}$
Nu	Nusselt number
R	thermal resistance
T	temperature
C_p	specific heat