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## Performance characteristics of a novel shell and tube heat exchanger with shell side interstitial twisted tapes for viscous fluids application

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### Abstract

A unique shell and tube heat exchanger with interstitial twisted tapes was tested with propylene glycol/water solution. Propylene glycol concentration was varied between 0 to 40% by volume. Same size conventional shell and tube exchanger with single segmental baffles was also tested under similar temperature and flow conditions. Results from the two exchangers were then compared. The new design heat exchanger showed better thermal enhancement index for the whole range of fluid concentrations. Correlations for Nusselt number and Darcy friction factor were proposed for both heat exchangers.

*Keywords: Shell and tube, twisted tape, segmental baffle, viscous flow*

### Nomenclature

Symbol	Quantity
$A$	surface area, $m^2$
$C$	Constants in Eqs. (13) and (14)
$C_p$	specific heat, $J\ kg^{-1}K^{-1}$
$d$	tube diameter, m
$D_e$	equivalent diameter, m
$f$	friction factor
$H$	$180^\circ$ twist pitch of the twisted tape, m
$h$	convective heat transfer coefficient, $Wm^{-2}K^{-1}$
$k$	thermal conductivity, $Wm^{-1}K^{-1}$
$L$	effective shell length, m
LPM	liter per minute
$\dot{m}$	mass flow rate, $kg\ s^{-1}$
$m$	exponent of Reynolds number
$N$	number of tubes
$n$	exponent of Prandtl number
$Nu$	Nusselt number

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