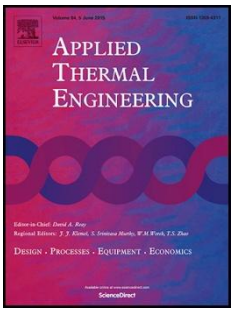
Accepted Manuscript



Title: Heat transfer analysis of a non-newtonian fluid flowing through a plate heat exchanger using CFD

Author: Erika Y. Rios-Iribe, Maritza E. Cervantes-Gaxiola, Eusiel Rubio-Castro, Oscar M. Hernández-Calderón

PII: S1359-4311(16)30237-X
DOI: http://dx.doi.org/doi: 10.1016/j.applthermaleng.2016.02.094
Reference: ATE 7823

To appear in: *Applied Thermal Engineering*

Received date: 16-10-2015
Accepted date: 25-2-2016

Please cite this article as: Erika Y. Rios-Iribe, Maritza E. Cervantes-Gaxiola, Eusiel Rubio-Castro, Oscar M. Hernández-Calderón, Heat transfer analysis of a non-newtonian fluid flowing through a plate heat exchanger using CFD, *Applied Thermal Engineering* (2016), http://dx.doi.org/doi: 10.1016/j.applthermaleng.2016.02.094.

Heat transfer analysis of a non-Newtonian fluid flowing through a Plate Heat Exchanger using CFD

Erika Y. Rios-Iribe[1], Maritza E. Cervantes-Gaxiola[2], Eusiel Rubio-Castro[2], Oscar M. Hernández-Calderón[2*]

[1]Programa de Posgrado en Biotecnología, Facultad de Ciencias Químico Biológicas, Universidad Autónoma de Sinaloa, Av. de las Américas y Blvd. Universitarios, Ciudad Universitaria, CP 80013, Culiacán, Sinaloa, México.

[2]Chemical Engineering Department, Facultad de Ciencias Químico Biológicas, Universidad Autónoma de Sinaloa, Av. de las Américas y Blvd. Universitarios, Ciudad Universitaria, CP 80013, Culiacán, Sinaloa, México.

[*]Corresponding author: Tel.+52 667 713 7860; e-mail: omhc@uas.edu.mx

Highlights

A CFD analysis is applied to a non-Newtonian flow through plate heat exchangers.
The effect of plates number, distance between plates and flow regime is analyzed.
An empirical correlation for the friction factor is proposed.
The relation between Nu and Pe is described by a modified Sieder-Tate equation.
The relation between the heat transfer rate and the pumping power is reported.

Abstract

In this work, the moment and heat transfers of a non-Newtonian fluid flowing in steady laminar regime through a plate heat exchanger at constant wall temperature is studied using CFD. Single-pass U-type plate heat exchangers with multiple flat plates with and without baffles are used. The effect of plates number and distance between plates on the heat transfer and the pressure drop are investigated. An empirical correlation for the friction factor as a function of the generalized Reynolds number and the ratio between the friction characteristic length and the flow trajectory length is developed. It is found that the dependence of the Nusselt number on the Peclet number can be described by the modified Sieder-Tate equation. Although the flow pattern is highly complex, under an adequate definition of the characteristics parameters, it is possible to establish simple correlations between the dimensionless numbers that characterize the thermal-hydraulic behavior of plate heat exchangers.

Keywords: CFD analysis, non-Newtonian flow, plate heat exchanger, baffles, moment and heat transfers.

1. Introduction