

## Entropy generation analysis in a gasket plate heat exchanger using non-spherical shape of alumina boehmite nanoparticles

Élcio NOGUEIRA\*

*Department of Mechanic and Energy, State University of Rio de Janeiro, Brazil*

**Abstract.** The analysis deals with the thermo-hydraulic performance of a Gasket Plate Heat Exchanger used for cooling vegetable oils with a water-ethylene glycol 50% and volume fractions of non-spherical nanoparticles mixture as a refrigerant. The heat exchanger has 75 plates with a chevron angle equal to 30°. The Reynolds number of the refrigerant varies from 80 to 1530. The Reynolds number of the sunflower vegetable oil is fixed and equal to 30. The non-spherical nanoparticles used for analysis are platelet, cylindrical and brick types. Graphical results are presented for global heat transfer coefficient, heat capacity ratio, heat transfer rate, outlet temperatures, thermal and viscous entropy generation rate, and Bejan thermodynamic number. The results obtained allow us to conclude that it is possible to work with low relative flow rates using non-spherical nanoparticles, emphasizing platelet nanoparticles. The entropy generations analysis shows that very high flow rates of the refrigerant dissipate much of the energy in viscous form and do not contribute to oil cooling, with a consequent increase in the heat exchanger operating costs.

**Keywords:** plate heat exchanger; entropy generation; Bejan number; non-spherical nanoparticles; vegetable oil.

\* E-mail address: [elcionogueira@hotmail.com](mailto:elcionogueira@hotmail.com)