Institute of Chemical Engineering

Experimental and CFD investigation of heat transfer and flow resistance in woven wire gauzes

Publication date:	01.06.2021
Publication title:	Experimental and CFD investigation of heat transfer and flow resistance in woven wire gauzes
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Journal information:	Chemical Engineering and Processing - Process Intensification

In this work, an experimental setup is established to investigate the heat transfer and flow resistance of wire gauzes. Five woven metal sheets of plain-square type differing in wires diameter and mesh size is tested. Based on the measured heat transfer coefficients and pressure drops of wire gauzes, the empirical equations of friction and transfer characteristics of plain-square-type woven sheets are developed. All experimental data lie within 7.16 % and 18.3 % of the empirical equations describing heat transfer and flow resistance, respectively. In order to obtain better agreement between the fitted empirical equation and measured data for flow resistance, three empirical equations respectively for wire gauzes are developed. Experimental measurements are used to supply appropriate boundary conditions for the simulations of the fluid flow and heat transfer within wire gauzes by using computational fluid dynamics (CFD). A good agreement between numerical results and experimental data is found, thus confirming that a simple CFD model can be a powerful and cheap tool, able to efficiently evaluate the pressure drop and heat transfer of woven metal wire gauzes. Finally, the woven metal wire gauzes are compared with packed bed and monolith in terms of flow resistance and heat transfer.

Metryczka

Published by:	Marek Tańczyk
Published at:	08.05.2026 15:01

Number of views:	3