



## ORIGINAL ARTICLE

# Effect of various configurations of swirl generator system on the hydrothermal performance of the flat-plate solar collector



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Received 29 June 2022; revised 18 October 2022; accepted 4 December 2022

Available online 14 December 2022

## KEYWORDS

Nozzle;  
Swirl flow;  
Heat extraction;  
Solar collector

**Abstract** This is a numerical study that analysis the heat extraction potential of solar collector tubes by assembling a couple of nozzles at the sealed end of the pipe to make swirl flow. Swirl flow intensifies the turbulence rate which augments heat transfer by ruffling the boundary layer. To this end, several decisive factors including nozzle angle (A: 30°, 45°, 60°, 90°), tube diameter (D: 20 mm, 50 mm), nozzle edge size (N: 6.25, 12.5, 25 mm (for D50) and N: 2.5, 5, 10 mm (for D20)), and mass flow rate (M: 0.1, 0.5, 1 kg/s (for D50) and M: 0.04, 0.2, 0.4 kg/s (for D20)) were considered. Results demonstrated that all of the models of class "A.../D20/N.../M..." had higher heat extraction potential but lower friction factor compared with "A.../D50/N.../M...". Maximum and minimum values of heat flux extractions are 2113390 W/m<sup>2</sup> and 59239 W/m<sup>2</sup> that were obtained by "A60/D20/N2.5/M0.4" and "A30/D50/N25/M0.1". The created friction factor by class "A.../D50/N

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Peer review under responsibility of Faculty of Engineering, Alexandria University.

<https://doi.org/10.1016/j.aej.2022.12.011>

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