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Experimental and numerical research of thermal stratification with a novel inlet in a dynamic hot water storage tank

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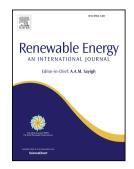
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| 2 | novel inlet in a dynamic hot water storage tank |
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| 7 | Abstract: Heat storage is an important task in the use of solar energy; in particular, the use of water |
| 8 | as the thermal storage medium is one of key technologies in solar thermal energy utilization. With |
| 9 | the purpose of improving the thermal stratification of a heat storage tank, a novel equalizer was |
| 10 | designed in this paper. To investigate the influence factor of thermal stratification in hot water |
| 11 | storage tank, numerical analyses based on the three-dimensional (3D) unsteady Computational Fluid |
| 12 | Dynamics (CFD) model were performed using the commercial software ANSYS. The initial and |
| 13 | inlet temperatures were considered along with various flow rates. The performance parameters, such |
| 14 | as the Richardson number, the MIX number and exergy, were involved in the evaluation. This study |
| 15 | was further extended to explore the fill efficiency as the performance parameters of thermal |
| 16 17 | stratification within a storage tank. The numerical model was validated with the experimental data; the results were determined to be in good agreement. The results demonstrate that with the growth of |
| 17 | the results were determined to be in good agreement. The results demonstrate that with the growth of |
| 18 | flow rate, the Richardson number decreases, fill efficiency and exergy increased first and later |
| 19 | decreased, but the MIX number decreased first and later increased. When the flow rate was 3 L/min, |
| 20 | the equalizer performs best, and the storage tank had a better thermal stratification. The RMS error |
| 21 | increased first and subsequently decreases before increasing again with the growth of the flow rate. |
| 22 | Furthermore, the MIX number reaches a minimum at the dimensionless time of 0.5 in the numerical |
| 23 | results, whereas it is 0.4 in the experimental results. It was also observed that the contribution of the |
| 24 | equalizer on the flow-suppressing of influent results in a decrease of mixing process between the hot |

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