Consequently, the model of fins-nanoPCM is considered the most efficient technique to achieve the PCM melting shortly (218 min).

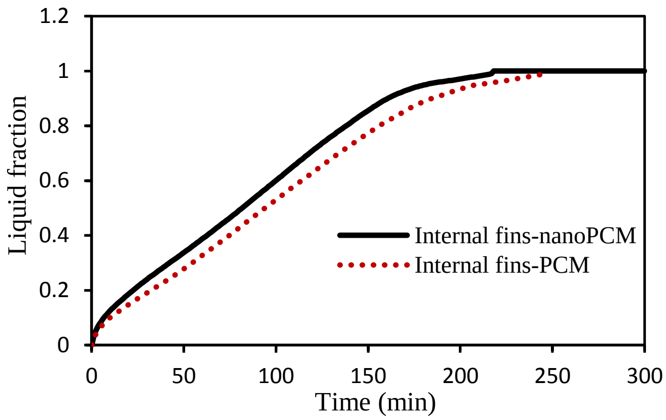

Fig. 8. Liquid fraction vs. melting time for the PCM and nanoPCM in TTHX-internal longitudinal fins.

5. CONCLUSION

Heat transfer enhancement for a large triplex tube heat exchanger (TTHX) has been represented the biggest challenge in LHTES system. The results showed the thermal conductivity of simple PCM (0.2 W/m.K) could be enhanced to 25% by dispersing 10% alumina and the melting time is reduced to 12% as compared with the PCM only. Consequently, the model of fins-nanoPCM has been considered the most efficient technique based on both sides heating method to achieve the PCM melting shortly (218 min). However, the numerical results have validated and showed a good agreement with the PCM and nanoPCM experimentally.

Nomenclature

B	Boltzmann constant (J/K)
C	mushy zone constant (kg/m^3s)
Cp	specific heat (J/kg.K)
gi	gravity acceleration in the i-direction (m/s^2)
H	enthalpy (J/kg)
HTF	heat transfer fluid
L	latent heat fusion (J/kg)
k	thermal conductivity (W/m.K)
p	pressure (Pa)
T_m	melting temperature (°C or K)
u	velocity component (m/s)
S_i	momentum source term in the *i*-direction (Pa/m)
ρ	fluid density (kg/m^3)
γ	liquid fraction
β	thermal expansion coefficient (1/K)
ζ	correction factor

Acknowledgements

The authors gratefully appreciate a financial support that provided by Solar Energy Research Institute(SERI),University Kebangsaan Malaysia (UKM), Malaysia.

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