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Efficiency enhancement of building multi-layer solar collector with SiO₂-TiO₂ hybrid nanofluids

By [Zawawi, NNM](#) (Zawawi, N. N. M.) ^[1] ; [Azmi, WH](#) (Azmi, W. H.) ^[1] ,
[Majid, ZAA](#) (Majid, Z. A. A.) ^[3] ; [Rahim, RA](#) (Rahim, R. A.) ^[4] ;
[Ali, HM](#) (Ali, H. M.) ^[5] , ^[6]

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Abstract Due to the depletion of conventional energy sources and its limitless resources, solar energy is currently being considered as a viable alternative, especially for water heating systems. The thermal performance of multilayer solar collectors for water heating systems can be improved further by introducing hybrid nanofluids as advanced fluids. This study demonstrates the utilisation of hybrid nanofluids in heating systems by employing a multilayer absorber solar collector. The SiO₂-TiO₂ hybrid nanofluids at volume concentrations up to 2.0% were tested at various flow rates (1.7 to 3.7 LPM) and solar radiation intensities (250 to 1000 W/m²). The thermal performance of the solar collector was assessed by measuring the temperature variation, heat loss, and overall efficiency of the collector. At the optimal volume concentration, the temperature difference for solar collectors employing SiO₂-TiO₂ hybrid nanofluids increased significantly. The optimal volume concentration of 1.5% yields a maximum temperature difference of 9.5 degrees C. In addition, the efficiency and fluid temperature of the solar collector containing hybrid nanofluids have been enhanced by 22% and 37%, respectively. The SiO₂-TiO₂ hybrid nanofluids with the optimal volume concentration of 1.5% were therefore recommended for maximum efficiency in the solar collector.

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**Author
Information** Corresponding Address: Azmi, W. H. (corresponding author)
Lebuhraya Tun Razak, Ctr Res Adv Fluid & Proc, Kuantan 26300,
Pahang, Malaysia
Corresponding Address: Azmi, W. H. (corresponding author)

▼ Univ Malaysia Pahang, Fac Mech & Automot Engr Technol,
Pekan 26600, Pahang, Malaysia
Corresponding Address: Ali, H. M. (corresponding author)

▼ King Fahd Univ Petr & Minerals, Mech Engr Dept, Dhahran
31261, Saudi Arabia
Corresponding Address: Ali, H. M. (corresponding author)

▼ King Fahd Univ Petr & Minerals, Interdisciplinary Res Ctr
Renewable Energy & Power, Dhahran 31261, Saudi Arabia
E-mail Addresses :
wanazmi2010@gmail.com; hafiz.ali@kfupm.edu.sa

Addresses :

¹ Lebuhraya Tun Razak, Ctr Res Adv Fluid & Proc, Kuantan
26300, Pahang, Malaysia

▼ ² Univ Malaysia Pahang, Fac Mech & Automot Engr Technol,
Pekan 26600, Pahang, Malaysia

▼ ³ Int Islamic Univ Malaysia, Kulliyyah Allied Hlth Sci,
Kuantan 25200, Pahang, Malaysia

▼ ⁴ Int Islamic Univ Malaysia, ECE Dept, Kulliyyah Engr, Jalan
Gombak, Kuala Lumpur, Malaysia

▼ ⁵ King Fahd Univ Petr & Minerals, Mech Engr Dept, Dhahran
31261, Saudi Arabia

[...more addresses](#)

E-mail Addresses :

wanazmi2010@gmail.com; hafiz.ali@kfupm.edu.sa

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