Unjuk kerja solar kolektor heat pipe ganda = Performance of dual heat pipes solar collector / Kristofer Haliansyah

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Abstrak

[ABSTRAK
Selain tantangan untuk mereduksi penggunaan energi tak terbarukan yang menyebabkan pemanasan global, potensi besar Indonesia dalam menerima panas dari matahari harus dioptimumkan. Pemanfaatan energi panas dari matahari masih rendah, oleh karena itu solar kolektor bertipe tabung vakum merupakan solusi yang bijak untuk memanfaatkan panas tersebut. Dengan menggunakan heat pipe sebagai media penghantar panas yang pasif, solar kolektor dapat bekerja tanpa konsumsi energi tambahan. Karakterisasi dibawah sinar matahari dan dengan menggunakan lampu halogen beserta voltage regulator dilakukan untuk mengetahui panas yang diserap oleh prototipe. Pada eksperimen ini, kotak insulasi yang dibuat dari styrofoam dan kayu digunakan untuk mengetahui kerugian panas.
Untuk meningkatkan jumlah panas yang diserap, plat penyerap panas yang diberi lapisan coating digunakan pada heat pipe. Optimasi performa thermal dilakukan dengan memvariasikan fluida kerja, wick, dan aplikasi sudut kemiringan, dimana air suling, nanofluida Al2O3-air dengan konsentrasi volumetris sebesar 5% dan 0,3% digunakan sebagai fluida kerja, stainless steel screen mesh dengan skala mesh 200, 250, dan 300 digunakan sebagai wick, dan sudut aplikasi divariasikan pada sudut 0o – 60o dengan 15o perubahan sudut kemiringan.
Hasil eksperimen dan analisis lanjutan menunjukan bahwa performa thermal terbaik dari prototipe solar kolektor didapatkan dengan penggunaan nanofluida Al2O3-air dengan konsentrasi volumetris 0,3% dan wick dengan skala mesh 300 dan sudut kemiringan sebesar 60o. Resistansi thermal terbaik diketahui sebesar 0,592 oC/W dengan efisiensi sistem yang mencapai 76,53%.
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ABSTRACT
Beside the challenges to reduce the consumption of nonrenewable energy that causes global warming, Indonesia great potential in receiving heat from the sun must be optimized. Since the utilization of thermal energy from the sun is still low, vacuum tube solar collector will be a well applicable solution to utilize the heat. Using heat pipes as passive heat transfer device, this research was conducted to optimize the thermal performance of solar collector without using extra energy. Characterization under the sun, and using halogen lamp with voltage regulator was done in order to predict the heat absorbed by the designed prototype. In this experiment, insulation box, which made of Styrofoam and wood was made to calculate heat losses.

To increase heat absorbed, coating fin is applied at heat pipe. Optimization of thermal performance of solar collector was done with varied working fluid, wick of heat pipe, and inclination angle of prototype application, where condensed water, Al2O3-water nanofluid with 5% and 0.3% volumetric concentration were used as varied working fluid, stainless steen screen mesh with 200, 250, and 300 mesh scale were used as wick, and inclination angle was varied from 0o – 60o with 15o inclination angle differences.

Experimental result and further analysis shows that the best thermal performance of solar collector prototype by using 0.3% volumetric ratio of Al2O3-water nanofluid as working fluid, stainless steel screen mesh with 300 mesh scale as wick inside heat pipe, and 60o inclination angle for prototype application. The thermal resistance is as high as 0.592 oC/W and the system efficiency is as high as 76.53%., Beside the challenges to reduce the consumption of nonrenewable energy that

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